**Influence of Intra-Household Gender Dynamics on Household Vulnerability to Climate Change: Empirical Evidence from Tripura State of North-East India**

ABSTRACT

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| --- |
| **Aim:** The study aims to determine how intra-household gender dynamics affect women’s vulnerability to climate change at the household level in the West Tripura district. **Study design:** The study followed an ex-post facto research design, with data collected through a survey and analyzed using descriptive and inferential statistics.**Place and Duration of Study:** The study was conducted in the West Tripura district of Tripura which is the most vulnerable district to climate change. Primary data were collected from April to June 2023. **Methodology:** Through multistage sampling, a total of 60 households were selected for the study of which 49 were male-headed households and 11 female-headed. All male-headed households had both a primary man and a primary woman member; whereas the female-headed households had only a primary woman member. Therefore, a total of 49 primary men and 60 primary women were selected which resulted in a total number of 109 respondents for the present study. For calculating the vulnerability of individual households, the Livelihood Vulnerability Index (LVI) approach was used with necessary modifications to suit local context15. **Results:** There was a greater number of households where only the primary men had adequacy in the selected empowerment variables while there was a comparatively lesser incidence of women achieving adequacy. Variables such as income of primary women, primary women's contribution to household income, and household head had a positive and significant relationship with the LVI of households at a 1 percent level of significance. Women-headed households had significantly higher LVI than men-headed households across all the selected empowerment variables. **Conclusion:** The findings revealed a significant impact of intra-household gender dynamics on households’ vulnerability to climate change, implying that any vulnerability reduction approaches such as gender-inclusive climate action should address this dimension in the future.  |

***Keywords:*** *Climate change, Vulnerability, Gender dynamics, Intra-household*

1. INTRODUCTION

People in every corner of the world are witnessing the harmful consequences of climate change and India is not an exception to this. India is the seventh-most vulnerable nation to climatic extremes worldwide **[1].** Devastating floods, droughts, and cyclones are also occurring more frequently as a result of climate change which causes the migration of millions of people prevents them access to essential amenities, and raises inequality between various categories of people **[2].** The devastating impacts of climate change are also witnessed in the agriculture sector of the country which is the backbone of the Indian economy. With cultivable land of less than one hectare and inadequate coping mechanisms, the majority of the farming households in India are vulnerable to climate change. Climatic extremes have become more frequent in recent years, increasing the risk of significant losses in agricultural production **[3].** The North-east region of India, comprising the states of Assam, Arunachal Pradesh, Tripura, Nagaland, Manipur, Mizoram, Meghalaya, and Sikkim is also facing negative impacts of climate change through substantial alternations in the major climatic variables. Average temperature, summer maximum temperature, winter minimum temperature, and rainfall are projected to rise in the 2030s in nearly all the districts of this region compared to the historical period **[4].** The Tripura state of this region is also not an exception to this as it is suffering from disastrous climate change-induced floods, cyclones, and high temperatures which are causing damage to the houses, infrastructures like power, roads, bridges, and other sectors like agriculture and forestry **[5].**

**1.1 Gender and Climate Change Vulnerability**

Vulnerability is the inclination or potential of any system to suffer adverse impacts from climate change. It is a function of the character, magnitude, and rate of climate variation to which a system is exposed as well as its sensitivity and adaptive capacity **[6].** Men and women are affected by the environmental effects of climate change in various ways. Disasters reinforce, sustain, and raise gender inequality, making bad situations scarier for women **[7].** Women bear a disproportionate share of the burden of preparing food, water, and fuel in many countries and climate change acts as a threat multiplier for them and the effect is more in developing nations where agriculture is the most important job sector for women **[8].** The socially constructed roles, identities, traditions, relationships, responsibilities, and opportunities that come with being a man or woman in a particular society are referred to as gender. As it interacts with socioeconomic, institutional, and environmental factors to produce varying degrees of susceptibility for different groups of men and women, gender is an important factor in determining vulnerability to climate change **[9].** The recent G20 New Delhi Leaders Declaration also highlighted the same fact that women and children are disproportionately affected by the negative consequences of climate change **[10].** At the household level, these socio-cultural factors shape household relations which shape gender-specific vulnerability **[11].** Women’s less access to resources, lower decision-making power, and significant domestic responsibilities also put them in a hazardous situation during vulnerable events **[12].** Vulnerability also differs across household heads; households with female heads are more vulnerable to climate change than households with male heads **[13].** So it is clear that climate change vulnerabilities are gendered, yet most policy approaches fail to recognize this fact. The above information indicates unequivocally that gender is a crucial factor in climate change vulnerability and different household gender dynamics play an important role in shaping a household’s vulnerability to climate change. Hence the following study was conducted in the state of Tripura to understand how the intra-household gender dynamics influence a household’s vulnerability to climate change.

2. methodology

The study was conducted in the West Tripura district of Tripura state which is the most vulnerable district to climate change according to CRIDA (Central Research Institute for Dryland Agriculture) and it is also India’s seventh most flood-exposed district **[14].** Based on SAPCC (State Action Plan on Climate Change) and Flood Management Plan data, two blocks viz., Jirania and Old Agartala were purposively selected from the said district. From each block, 2 villages were selected randomly followed by selecting 15 households randomly from each village. A conscious effort was made to include at least a few female-headed households in the sample, though the number of female-headed households in the study area was negligible. Thus, a total of 60 households were selected for the study of which 49 were male-headed households and 11 female-headed. The primary men (head of male-headed household) and primary women (wife of primary men in case of male-headed household or female head in case of female-headed household) members of the households were selected as respondents of the study. All male-headed households had both a primary man and a primary woman member; whereas the female-headed households had only a primary woman member. Therefore, a total of 49 primary men and 60 primary women were selected which resulted in a total number of 109 respondents for the present study.

For calculating the vulnerability to climate change, the Livelihood Vulnerability Index (LVI) approach **[15]** was adopted.The LVI uses multiple indicators to assess exposure to natural disasters and climate variability, social and economic characteristics of households that affect their adaptive capacity, and current health, food, and water resource characteristics that determine their sensitivity to climate change impacts at the community level. The instrument consists of 7 major components: natural disasters and climate variability; socio-demographic profile; livelihood strategies; social networks; health; food and water. Necessary modifications were made to the instrument to suit the local context and fit to measure household-level vulnerability**.** The Content Validity of the modified instrument was established by 7 experts. The evaluation of the items done was through the item-level content validity index (I-CVI) **[16].**

The scoring of the subcomponent items was done in binary ordinal score. For sub-components where scoring was done in interval or ratio level in the original LVI, the score was converted into binary ordinal by employing appropriate measures of central tendency.Considering that all the sub-components in the instrument have equal weights, the arithmetic mean of all the subcomponents was taken for calculating the vulnerability score of each major component of individual households. The arithmetic mean of the sum of the mean score of all the seven components was taken as the household vulnerability to climate change score. This score was used to categorize the households into three categories viz. highly vulnerable, moderately vulnerable, and less vulnerable according to the mean ± standard deviation of the household vulnerability score.

The selected intra-household gender dynamics variables *viz*. participation in decision-making, access and control over productive resources, and contribution and control over household income and workload were measured by adopting a similar methodology mentioned in the Women Empowerment in Agricultural Index **[17].** Here “adequacy” which is a measure of empowerment was measured for both primary men and women. Adequacy or sufficiency is the state to meet the needs of a particular area satisfactorily. An individual is said to be adequate or sufficient in a particular indicator of domain based on the criteria of each indicator Adequacy cut-off of the indicators **[16]**. A score of “1” is given to respondents with adequacy, and in no adequacy, a score of “0” is given. A description of the variables and their adequacy evaluation is provided in Table 1.

**Table 1:** Description of the variables and their adequacy evaluation

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Variable** | **Indicators** | **Decision on Adequacy** |
| 1 | Participation in decision-making | Participation in activity | Adequacy in any of the 2 indicators is considered as **adequate=1**, if not then **non-adequate=0** |
| Input in decision-making |
| Input on the use of generated income |
| 2 | Access and control over productive resources | Ownership of assets | Adequacy in all the indicators is considered as **adequate=1**, if not then **non-adequate=0** |
| Access to assets |
| Decision-making over the sale and purchase of assets |
| 3 | Contribution and control over household income  | Decision on expenditure | Adequacy in all the indicators is considered as **adequate=1**, if not then **non-adequate=0** |
| Contribution to income |
| 4 | Workload | - | If the number of hours worked per day was less than the time poverty line of 10.5 hours in the previous 24 hours, then it is considered as **adequate=1**, if not then **non-adequate=0** |

According to the adequacy of the primary man and primary women in a household, the households were divided into 3 categories of intra-household gender dynamics. The 3 categories are presented in Table 2.

**Table 2: Classification of Households according to their Intra-household Gender Dynamics**

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Categories** | **Code** |
| 1 | Households where only primary men have adequacy in the particular variable  | HH\_M |
| 2 | Households where only primary women have adequacy in the particular variable  | HH\_W |
| 3 | Households where both primary men and women have adequacy in the particular variable  | HH\_M&W  |

For finding the influence of intra-household gender dynamics on household vulnerability to climate change Pearson correlation coefficient, One-way ANOVA and Independent sample t-Test are used.

3. results and discussion

**3.1 Profile of the respondents and their household’s gender dynamics**

 The description of the profile of respondents of the study is presented in Table 3. It can be seen from the table that among the respondents, the majority of the primary men fall under the old age category (53.06 %) followed by the middle age category (44.90 %) whereas in the case of primary women majority fall under middle age category (83.33 %) followed by old age (10.00 %) and young age category (6.67 %). In level of education, it can be observed that the majority of the primary men had a high school level (40.81 %) of education whereas the majority of primary women possessed a primary level of education (48.33 %). Noteworthy is the fact that none of the primary men and primary women fall under the illiterate category of education level because the district where the study is conducted i.e. West Tripura district having a literacy of 97.43 %, is one of the highest educated districts in the country **[18].** There were few graduates (10.20 %) among the primary men but none among the primary women. The notable primary occupation of the primary men was agriculture (65.31 %) and for primary women, it was a homemaker (81.66 %). The secondary occupation of the majority of the primary men was agriculture (34.70 %), whereas for primary women it was agro-based subsidiary enterprises like dairy, piggery, poultry, and sheep/goat rearing (78.33 %). It is because most of the primary women respondents of the male-headed farm-households in their free time from homemaking work raise livestock like ducks, chickens, and pigs which gave them some amount of income. It was reported that women dominate the labor force in the livestock sector of India **[19]**. There was a stark difference between the mean annual income of the male-headed and female-headed households at Rs. 98326.53/- and Rs. 68454.55/- respectively. In the male-headed households, the contribution of the primary women in the annual income was meager at an average of 9.65 %. The total percentage of women’s contribution to household income in Bangladesh was calculated to be 43.52 % **[20]** and20.5 % in Uttar Pradesh **[21]** which was comparatively much higher than that recorded in this study.

**Table 3: Description of the respondents according to selected socio-economic variables**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Variables** | **Categories** | **Primary Men****(n=49)** | **Primary Women****(n=60)** |
| **Frequency** | **%** | **Frequency** | **%** |
| 1. | Age (in years) | Young (<35) | 1 | 2.04 | 4 | 6.67 |
| Middle age (35-50) | 22 | 44.90 | 50 | 83.33 |
| Old (>50) | 26 | 53.06 | 6 | 10.00 |
| Mean | 49.84 | 43.28 |
| 2. | Level of education | Illiterate | 0 | 0.00 | 0 | 0.00 |
| Primary | 10 | 20.41 | 29 | 48.33 |
| Middle school | 2 | 4.09 | 26 | 43.33 |
| High school | 20 | 40.81 | 4 | 6.67 |
| Higher Secondary | 12 | 24.49 | 1 | 1.67 |
| Graduate and above | 5 | 10.20 | 0 | 0.00 |
| 3. | Primary occupation | Agriculture | 32 | 65.31 | 7 | 11.67 |
| Horticulture | 2 | 4.08 | 0 | 0.00 |
| Fishery | 4 | 8.16 | 0 | 0.00 |
| Agro-based subsidiary enterprise  | 6 | 12.25 | 4 | 6.67 |
| Business | 5 | 10.20 | 0 | 0.00 |
| Salaried Service | 0 | 0.00 | 0 | 0.00 |
| Homemaker | 0 | 0.00 | 49 | 81.66 |
| Other | 0 | 0.00 | 0 | 0.00 |
| 4. | Secondary occupation | Agriculture | 17 | 34.70 | 4 | 6.67 |
| Horticulture | 5 | 10.20 | 7 | 11.67 |
| Fishery | 5 | 10.20 | 0 | 0.00 |
| Agro-based subsidiary enterprise  | 14 | 28.58 | 47 | 78.33 |
| Business | 8 | 16.32 | 2 | 3.33 |
| Salaried Service | 0 | 0.00 | 0 | 0.00 |
| Homemaker | 0 | 0.00 | 0 | 0.00 |
| Other | 0 | 0.00 | 0 | 0.00 |
| 5. | Annual income (in Rupees) | Mean Income in female-headed households (n=11) | 0 | 68454.55 |
| Mean income in male-headed households (n=49) | 88877.55 | 9448.98 |
| 6 | Primary women's contribution to household income (in percentage) | Mean contribution in female-headed households (n=11) | 0 | 100 |
| Mean income in male-headed households (n=49) | 90.35 | 9.65 |

The description of the intra-household gender dynamics variables of the sampled households is presented in Table 4. From the observations of Table 4, it can be seen that among the selected households, in participation in the decision-making variable majority of the households reported only primary men having adequacy (46.67 %), followed by both primary men and primary women having adequacy (35.00 %). Only primary women having adequacy was less among all three categories. As we know, adequacy is a measure of empowerment; it is clear that in participation in decision making household’s primary women adequacy solely is lower which indicates that primary women of the household are less empowered comparatively than primary women. In access and control over productive resources majority of the households reported only primary men having adequacy (75.00 %), followed by only primary women having adequacy (18.33 %) and both primary men and primary women having adequacy (6.67%). This reflects that most of the productive resources of the households in the study area are controlled by primary men which makes them comparatively more empowered. The findings are similar to the results of a study conducted in Tripura where the access and control over productive resources of male head respondent was higher which indicates their higher adequacy in the variable **[22].** Similar results were also found in the case of contribution and control over household income that in the majority of the household only primary men had adequacy (63.34 %) in the variable. This indicates that in contribution and control over household income variables also primary men of households are more empowered than the primary women. The workload variable also highlights the same scenario. Negligible male-headed households were found where the primary women have adequacy in all the variables. Households, where only the primary women had adequacy in all the four variables, were female-headed households because, in the absence of the primary man who by convention is the prime breadwinner and decision maker of the household, the primary women of the household had to take up these roles along with her usual reproductive and household roles. The majority of the selected households reported having a male head (81.67 %) which means they are male-headed households. The numbers of female-headed households are comparatively very less (18.33 %). The findings are similar to National Family Health Survey Report- 5 where female-headed households are found less in the West Tripura district **[23].**

**Table 4: Distribution of the sampled households according to selected intra-household gender dynamics variables (n=60)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Variables** | **Categories** | **Frequency** | **%** |
|  | Participation in decision-making | HH\_M | 28 | 46.67 |
| HH\_W | 11 | 18.33 |
| HH\_M&W | 21 | 35.00 |
|  | Access and control over productive resources | HH\_M | 45 | 75.00 |
| HH\_W | 11 | 18.33 |
| HH\_M&W | 4 | 6.67 |
|  | Contribution and control over household income | HH\_M | 38 | 63.34 |
| HH\_W | 11 | 18.33 |
| HH\_M&W | 11 | 18.33 |
|  | Workload | HH\_M | 34 | 56.67 |
| HH\_W | 13 | 21.66 |
| HH\_M&W | 13 | 21.66 |
|  | Household head | Male  | 49 | 81.67 |
| Female  | 11 | 18.33 |

**3.2. Household vulnerability to climate change:**

The households were categorized into three categories viz. highly vulnerable, moderately vulnerable, and less vulnerable according to the mean ± standard deviation of the household vulnerability score, and the results are presented in Table 5. It can be observed that 20.00 % of the households fall under the highly vulnerable category, while a large majority of 61.67 % are moderately vulnerable while the remaining 18.33 % are less vulnerable. A study in Kenya **[24]** developed a household vulnerability index (HVI) and found that 27% of households were highly vulnerable, 44% were moderately vulnerable and 29% of households were less vulnerable to climate-induced stresses.

**Table 5:** Distribution of the households according to their household vulnerability score

|  |  |  |
| --- | --- | --- |
| Categories | Frequency  | Percentage |
| Less vulnerable (<6.85) | 11 | 18.33 |
| Moderately vulnerable (6.85 to 7.46) | 37 | 61.67 |
| Highly vulnerable (>7.46) | 12 | 20.00 |

**3.3 Relationship between independent variables and Household Vulnerability to climate change**

For determining the relationship between independent variables and household vulnerability to climate change, the Pearson correlation coefficient test was utilized, the results of which are presented in Table 6.The observations of Table 6 demonstrate that variables such as income of primary women, primary women's contribution to household income, and household head had a positive and significant relationship with the vulnerability of households at a 1 percent level of significance. The income of primary women and primary women's contribution to household income has a positive significant relation with the LVI of households. It is because in the study area income of primary women and their contribution is more in the household only when the household is female-headed. Usually in male-headed households’ primary women's contribution is much less. So, a positive significant correlation indicates that where primary women's income is high their vulnerability value is also high which denotes that female-headed households are comparatively more vulnerable to the impacts of climate change than male-headed households. A positive significant correlation with the type of households also confirms the fact that female-headed households are more vulnerable to climate change since it was assigned a higher nominal value i.e. 2, during analysis. The findings are similar to a study conducted in Ghana which highlighted that female-headed households are more vulnerable to climate change than male-headed households **[25].** The remaining variables namely age of primary women, access and control over productive resources, and contribution and control over household income and workload were positive but non-significantly correlated with LVI of households whereas variables namely education level of primary women, participation in decision making are negative but non-significantly correlated with the LVI of households.

**Table 6: Relation between independent variables and LVI of households**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Variable** | **Pearson correlation coefficient (r)** | **p-value** |
| 1 | Age of primary women | 0.248 | .06 |
| 2 | Education level of primary women | -0.192 | .14 |
| 3 | Income of primary women | **0.433\*\*** | .001 |
| 4 | Primary Women's contribution to household Income | **0.485\*\*** | .000 |
| 5 | Participation in decision-making | -0.016 | .9 |
| 6 | Access and control over productive resources | 0.212 | .1 |
| 7 | Contribution and control over household income | 0.019 | .41 |
| 8 | Workload | 0.017 | 0.90 |
| 9 | Household head (1-male headed; 2-female-headed) | **0.484\*\*** | 0.000 |

***\*\**** *Correlation is significant at the 0.01 level (2- 2-tailed),* ***\**** *Correlation is significant at the 0.05level (2-tailed)*

**3.4 Comparing the means of LVI values of different groups present in the intra-household variables**

For comparing the means of LVI values of different groups present in the intra-household variables, one-way ANOVA was performed with the null hypothesis that there are no significant differences among the mean LVI scores of the different categories of households across the selected intra-household variables. The results of which are shown in table 7.

The observation of Table 7 demonstrates a significant difference among the means of LVI of different groups at a 1 percent level of significance in all the selected intra-household variables. In participation in decision-making, access and control over productive resources, contribution and control over household income and workload variable significant difference was found between the means of LVI of different groups at a 1 percent level of significance. The mean score of primary women having adequacy was found to be higher than other groups. The above observations of the intra-household variables highlight that Vulnerability is more for the households where only primary women have adequacy in the variables because of their higher mean score. Significant differences between the groups indicate that vulnerability varies significantly at different levels of empowerment in the household. These observations indicate that in the majority of the farm households, there is an existence of a gender gap in the empowerment level of primary men and primary women of the household. The primary men in the household are the ones having adequacy in most of the variables which signifies that primary women in the farm-households of the study area are less empowered than primary men. Similar findings were found in a study conducted in Manipur where the primary male members of households were found to have a high empowerment level compared to primary women of farm households **[26].**

**Table 7: Group differences of different intra-household variables with LVI value**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl. No.** | **Variables** | **Group Means****(Mean LVI score of the different categories of households)** | **F** |  **P-value** |
| **HH\_M** | **HH\_W** | **HH\_M&W** |
|  | Participation in decision-making | 7.101 | 7.462 | 7.069 | **8.844\*\*** | .000 |
|  | Access and control over productive resources | 7.094 | 7.463 | 7.016 | **8.939\*\*** | .000 |
|  | Contribution and control over household income | 7.091 | 7.462 | 7.073 | **8.767\*\*** | .000 |
|  | Workload | 7.104 | 7.412 | 7.038 | **7.508\*\*** | .001 |

***\*\**** *Differences among group mean are significant at the 0.01 level (2- 2-tailed),****\**** *Differences among group mean are significant at the 0.05 level (2-tailed)*

4. Conclusion

The findings of the study reflect that farm-households vulnerability to climate change varies across genders. From the intra-household gender dynamics information it can be observed that in the majority of households, the access, control, and decision-making regarding various resources are confined only to the primary man. As a result, primary men of the household gain more empowerment comparatively than the primary women of the household which increases the vulnerability of primary women towards negative climate change consequences. The results indicate that there is a need for gender transformative strategies that can empower women as well as reduce their drudgery from the significant impacts of climate change. Moreover, few initiatives can address the vulnerability of climate change from a gender viewpoint. The significant impact of gender dynamics on households’ vulnerability to climate change from the findings implies that any vulnerability reduction strategy should address this dimension. A suitable ‘gender-inclusive climate action strategy’ can also aid in easing the burdensome effects of women from the negative impacts of climate change, which includes productive involvement of women and girls in the decision-making process, as well as their greater consultation during policy formulation to mitigate the negative effects of climate change. This type of strategy was advocated by various international bodies such as the G20, because they not only help in managing climate change-induced adverse effects but also help in empowering women to achieve gender equality.

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