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# Determinants of farmers' adaptation measures to climate variability in Tribal block of district Jabalpur, Madhya Pradesh

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**Abstract**
The study was conducted in the Kundam block of district Jabalpur to investigate the determinants of adaptation measures towards climate variability. Five villages of Kundam block were selected on the basis maximum area under Rice – Wheat cropping system. Total 100 farmers' were selected by the proportionate random sampling method. The study reveals that higher per cent (61%) of farmers had medium level of adaptation and mean value of adaptation level was 68.11 and a standard deviation 4.36 of data. The results of regression analysis indicated that all the 20 variables fitted in a regression equation accounted for 76.30 per cent ($R^2$ = .763) variation in adapted adaptation measures. The results of regression analysis further revealed that credit access, mass media exposure, information seeking behaviour, scientific orientation and perception towards climate variability were the main determinants of adaptation measure in Jabalpur district. Planners and development workers should formulate policies to improve these factors to improve farmers' adaptation to climate variability in the region.

**Keywords:** Adaptation measures, climate change, tribal area, factors

## Introduction
Agriculture is most vulnerable sector to climate change and plays important role in social and economic life of people in India, where 65% of the cropped area is rain-fed. It is projected that by the end of 21st century the mean annual temperature will increase by 3-4 $^{o}$ C and rainfall by 15-40% in India (NATCOM, 2004) [4]. Increasing climatic variability with global warming has seasonal/annual fluctuations in food production. Droughts, floods, tropical cyclones, heavy precipitation events, hot extremes, and heat waves have negative impact on agricultural production and farmer's livelihood. An increase in $CO_2$ to 550 ppm increases yield of rice, wheat, pulses and oilseeds by 10-20%. A 1$^{o}$ C increase in temperature may reduce yield of wheat, soybean and mustard by 3-7%. Losses will be more with increase in temperature. The productivity of most crops decreases only marginally by 2020 but by 2100 it will be 10-40 per cent due to increase in temperature and rainfall as well as decrease in irrigation water (Shrivastava, 2016) [7].

Madhya Pradesh has sub-tropical climate with hot-dry summer (April-June) followed by the monsoon season (June-September). Winter in Madhya Pradesh is cool and dry. Average annual rainfall in Madhya Pradesh is about 1300mm. About 75% of the total population of Madhya Pradesh is living in rural areas which are directly or indirectly engaged in agriculture related activities, thus, agriculture is most important sector in Madhya Pradesh (Mishra *et al.* 2016) [3]. Rice-Wheat is the main cropping system of district Jabalpur, where rice crop is suffering from drought condition, while Wheat crop is exposed to the higher temperature during grain filling stage, which ultimately causes low production and reduces the quality of grain. The climate factors like temperature and precipitation are expected to shift production seasons, pest and diseases patterns and modify the set of feasible crops affecting production, prices, income and ultimately, livelihood and lives. To reduce the impact of climate change and vulnerability, measures known as adaptation measures are used. However, there is limited information on types of adaptation strategies used by farmers in Rice-Wheat cropping system of Tribal area. Furthermore, the determinants of appropriate climate change adaptation measure used by farmers in Rice-Wheat cropping system have not been fully investigated.

This study, therefore, identifies determinants of appropriate climate change adaptation measures used by the farmers in Rice- Wheat cropping system of tribal block of Jabalpur district.

## Materials and Methods

The present study was carried out in the district Jabalpur, which comprises of seven block, out of which namely Kundam block was selected purposively, as the block is a tribal dominated and has minimum irrigated area. Five villages namely Sahajpuri, Sunawal, Dabrakala, Murjhor and Tikariya were selected for the study on the basis of Maximum area under Rice – Wheat cropping system. Proportionate random sampling was followed to select 100 respondents from the selected villages of the block. A structured schedule was used to collect data from the farmers, to find out the characteristics of farmers influencing their adaptation measures towards the climate change to reduce impact of climate variability. The results of correlation analysis were fitted in a regression equation and regression analysis was run in IBM SPSS statistics 23.

## Results and Discussion

**Table 1:** Distribution of farmers' according to overall level of adaptation measures towards climate variability

| S. No | Categories | Frequency | Percentage |
|---|---|---|---|
| 1. | Low (< 63.75) | 13 | 13.00 |
| 2. | Medium (63.75 – 72.47) | 70 | 61.00 |
| 3. | High (> 72.47) | 17 | 17.00 |
| | Total | 100 | 100.00 |
| | Mean | 68.11 | |
| | Standard deviation | 4.36 | |

### Adaptation measures adapted by the farmers'

Adaptation is a process by which strategies to moderate, cope with and take advantage of the consequences of climate events are enhanced, developed and implemented. In this study adaptation is some adjustments or alterations which are introduced by farmers in their farming. The pursual of data presented in the Table 1 shows that mean value of adaptation measures was 68.11 and a standard deviation 4.36 of data. The result also revealed that the higher per cent of farmers (61.00%) had medium level initiation for adaptation measures, followed by high (17 %) and low (13 %). The result is supported with the previous findings (Muttanna, 2013) [2].

### Determinants of adaptation measures towards climate vulnerability using multiple regression analysis

This section examines the farmers' characteristics that influence their adaptation towards climate variability. A look at the Table 2 indicated that $R^2$ was significant as F was significant. The F- ratio tests whether the overall regression model was a good fit for the data. The values shows that the independent variables significantly predicted the dependent variable, (F= 12.868, $P< 0.0001$). The $R^2$ value, which is the proportion of variance in the dependent variable, that can be explained by the independent variables. It was seen from the value of 0.763 that 20 independent variables selected for this research jointly explained 76.3% variation in the dependent variable adaptation. Besides, the coefficient of determination of these variables were found to be highly significant ($R^2$ = 0.763). Multiple regression analysis showed that out of 20 variables selected, 5 variables namely credit access, Mass media exposure, information seeking behaviour, scientific orientation and perception towards climate variability contributed significantly to the prediction of the dependent variable i.e. adaptation. The partial b value indicated the amount of change which shall be brought in the dependent variable, other things remaining constant that change in one unit of credit access shall bring about change 1.646 units in the adaptation while other remaining constant. The result is consistent with previous findings that access to credit is an important variable which commonly has a positive effect on adaptation measures (Ndamani and Watanabe, 2016) [5]. A change in one unit of mass media exposure shall bring about change of 0.291 units in the dependent variable adaptation while other things remaining constant. The mass media has a wide reach and can communicate climate information in short time. The result shows that change in one unit of information seeking behaviour shall bring about a change of 0.162 units in the adaptation remaining other constant. This implies that farmers with exposure of the farmers to different sources to obtain climate information are more likely to adapt measures towards climate variability. The change in one unit of scientific orientation shall bring about a change of 0.276 units in the adaptation remaining other things constant. This implies that farmers with scientific orientation are more likely to adapt to climate variability. A change in one unit of the perception towards climate variability shall bring about a change of 0.061 units in the adaptation remaining other things constant. The result is confirmed with the previous findings (Nzeadibe and Ajaero 2010, Kosthi and Mankar 2016) [6, 1]. The farmers' who have awareness about climate change and perceives climate change in a better way, have higher chances of taking adaptive measure in response to observed change.

**Table 2:** Multiple Regression analysis showing determinants of climate variability adaptation measures by the farmers

| Independent variables | b Value | Standard error | t value |
|---|---|---|---|
| Age | -0.047 | 0.122 | -0.381 |
| Gender | 0.471 | 0.980 | 0.481 |
| Education | 0.324 | 0.249 | 1.301 |
| Operational Land holding | 0.112 | 0.432 | 0.259 |
| Annual Income | 0.000 | 0.000 | -0.278 |
| Social participation | -0.404 | 0.473 | -0.853 |
| Occupation | 0.178 | 0.317 | 0.562 |
| Farm Power and implements | 0.027 | 0.050 | 0.542 |
| Farming Experience | 0.122 | 0.123 | 0.985 |
| Credit access | 1.646* | 0.627 | 2.626 |
| Irrigation potential | -0.068 | 0.081 | -0.839 |
| Cropping pattern | 0.127 | 0.214 | 0.592 |
| Extension contact | 0.104 | 0.066 | 1.587 |
| Mass media exposure | 0.291* | 0.092 | 3.180 |
| Information seeking behaviour | 0.162** | 0.087 | 1.848 |
| Innovative proneness | 0.149 | 0.119 | 1.253 |
| Scientific orientation | 0.276* | 0.109 | 2.531 |
| Decision making ability | -0.009 | 0.067 | -0.133 |
| Risk preference | -0.019 | 0.084 | -0.227 |
| Perception towards the climate variability | 0.061* | 0.026 | 2.361 |
| **Significant at 0.01 level of probability<br>*Significant at 0.05 level of probability | | $R^2$ | 0.763 |
| | | Adjusted $R^2$ | 0.702 |
| | | F | 12.868 |

## Conclusion

It is concluded that higher per cent (61%) of farmers had initiated adaptation measures. The variables credit access, mass media exposure, information seeking behaviour,

scientific orientation and perception towards the climate vulnerability statistically significant predicted adaptation measures to mitigate the impact of climate change and vulnerability F = 12.868, $P<0.0001$, $R^2$ = 0763 . Use of different adaptation measures significantly increases the adaptation measure in the tribal area. Government and development partners should design policies related to climate change to mainstream the determining factors of adaptation. So farmers' can significantly increase adaptation measure towards climate variability.

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