



Research Article

FARMERS MITIGATION AND ADAPTATION OF CLIMATE CHANGE IN MADHYA PRADESH: A STAKEHOLDER ANALYSIS

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Abstract- Countrywide many initiatives on mitigation and adaptation approaches in coping with the climate change for smallholder vulnerable farmers to increase their production through adoption of appropriate techniques fail due to inadequate attention to interests and characteristics of stakeholders. The study had been conducted at Manasa block of Neemuch district and Malhargarh block of Mandsaur district of Madhya Pradesh (MP). Two villages were selected purposively from each of the selected blocks thereby constituting four villages for the study. A total of 60 farmers were selected by way of proportionate random sampling method. As many as 14 and 15 stakeholders were selected from Manasa and Malhargarh blocks respectively by following snowball sampling method. In both the blocks, State Department of Agriculture turned up to be the most active stakeholder and it was revealed that majority (70.00%) of the respondents belonged to category of high level of decision-making followed by 18.33% and 11.67% who belonged to medium and low level category of decision-making on adoption of mitigation and adaptation of climate change practices in agriculture respectively. The study recommends that key stakeholders should be identified by any Government/Private agencies before introducing any new program. On the basis of Power, Interest and Legitimacy stakeholders should be given task related to Climate Change in agriculture.

Keywords- Climate Change, Interest, Legitimacy, Power, Stakeholders.

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Introduction

The impacts of climate change are being felt all over the world and there is almost not any place where there is no impact of climate change. Global temperature is becoming warmer, rainfall is more erratic, the sea level is slowly increasing and extreme weather events are becoming more frequent and intense. The impacts of climate change on agriculture came about through changes in variability, seasonality, the emergence of new pathogens and diseases, and variations in mean rainfall and water availability (Fischlin *et al.*, 2007) [1]. There are a number of stakeholders in the agricultural sector who are sources of climate information and influence the multidirectional flow of information. Rather than getting all of complex climate information from scientists, people often depend on intermediary sources, including mass media (Weber and Stern, 2011) [2]. Some districts of MP are among the highest, in India, in terms of social vulnerability to and exposure to the effects of climate change. The intensity and occurrence of heavy rainfall and droughts events with respect to the current situation is likely to increase further in the state [3].

Stakeholder Analysis is a vital tool for understanding the social and institutional context of any intervention such as policy on mitigation and adaptation of climate change in agriculture. Its findings can provide early and essential information about who will be affected by the intervention, positively or negatively; who could influence the project again, positively or negatively; which individuals, groups, or agencies need to be involved in the project, and how; who is having more power; who are legitimate enough and whose capacity needs to be built to enable them to participate. The present study was conducted with the following objective: To identify stakeholders who are involved in decision-making with respect to adoption

of mitigation and adaptation of climate change practices in agriculture.

Materials and Methods

Research Design

Exploratory research design was adopted in the study to obtain pertinent and precise information with respect to the identified variables of the study.

Study Area

Madhya Pradesh has been selected purposively for the study. The two districts viz., Neemuch and Mandsaur were purposively selected based on the criteria that agriculturally important and climate affected areas felled within a particular zone, as such to represent Moderate and High vulnerable zone of Malwa Plateau Agro-Climatic Zone (ACZ), respectively. The study had been conducted at Manasa block of Neemuch district and Malhargarh block of Mandsaur district of Madhya Pradesh. Two villages were selected purposively from each of the selected blocks thereby constituting four villages for the study.

Sample Size

A total of 60 farmers were selected by way of proportionate random sampling method. As many as 14 and 15 stakeholders were selected from Manasa and Malhargarh blocks respectively by following snowball sampling method.

Data Collection

The data were collected through structured interview schedule. The collected data were analyzed by using various statistical techniques and tools like frequency,

mean, percentage, standard deviation, K-means clustering, Adjusted Relative Ranking, and Cumulative Dimension Score. The Adjusted Relative Ranking was determined as per the following formula, (Sova *et al.*, 2013) [4]:

$$\frac{R}{n} = \frac{Ra}{amr}$$

Where, R = Relative ranking (unadjusted), n = Total number of ranked levels identified by the respondent, Ra = Adjusted Ranking, amr = Average Maximum Ranking.

Results and Discussion

Decision-Making on Adoption of Mitigation and Adaptation Practices of Climate Change in Agriculture:

Table-1 Categorization of respondents on the basis of their decision-making on adoption of mitigation and adaptation practices of climate change practices in agriculture (N=60).

Category	Frequency	%
Low	7	11.67
Medium	11	18.33
High	42	70.00

On perusal of the data in [Table-1] and [Fig-1], it revealed that in respect of decision-making on adoption of mitigation and adaptation practices of climate change practices in agriculture, majority of the respondents *i.e.* 70.00% belonged to category of high level of Decision-making followed by 18.33% and 11.67% who belonged to categories of medium and low level of Decision-Making on adoption of mitigation and adaptation practices of climate change practices in agriculture respectively.

These findings were in consonance with the results of Ugwoke *et al.* (2012), Tologbonse *et al.* (2010), Hellin *et al.* (2014) and Varadan & Kumar (2014) [5-8].

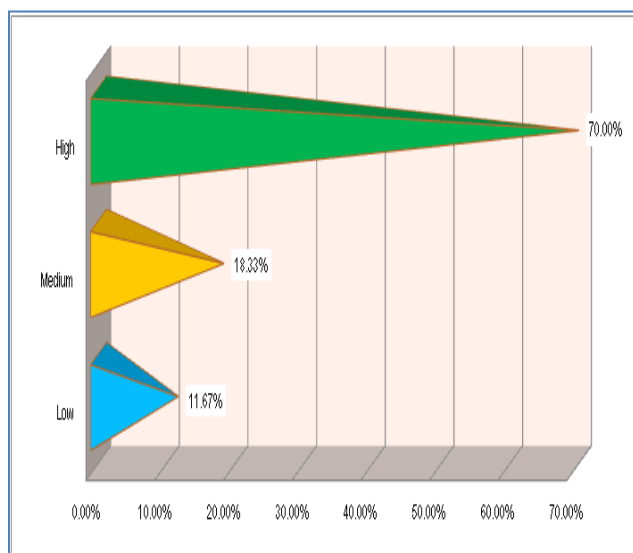


Fig-1 Overall distribution of respondents according to their Decision-Making on Adoption of Mitigation and Adaptation Practices of Climate Change Practices in Agriculture.

Identified stakeholders in Malhargarh and Manasa blocks of Malwa Plateau ACZ of MP: Following Delphi technique with five iterations in both Malhargarh and Manasa blocks, the following stakeholders had been identified interestingly, stakeholders namely Agricultural Produce Market Committee (APMC), Agricultural Technology Management Agency (ATMA), College of Horticulture (CoH), Co-operative Societies, Department of Animal Science and Dairy Science (ASDS), Farmers, Financial Institutions, Input Dealers, Irrigation Department, Krishi Vigyan

Kendra (KVK), Non-Government Organizations (NGOs), Panchayat, Political Leaders, State Department of Agriculture (SDA) and State Department of Horticulture (SDH) had come up in Malhargarh Block. However, in Manasa Block all the above stakeholders had been identified similarly except College of Horticulture (CoH).

Average adjusted ranking of identified stakeholders with respect to Power, Interest and Legitimacy in Malhargarh Block:

Table-2 Average adjusted ranking scores of identified stakeholders with respect to Power, Interest and Legitimacy in Malhargarh block.

Stakeholders	Malhargarh Block		
	Power	Interest	Legitimacy
APMC	1.33 (14 th)	9.83 (10 th)	5.10 (11 th)
ATMA	2.55 (12 th)	13.75 (7 th)	13.10 (6 th)
CoH	10.55 (6 th)	15.25 (6 th)	14.10 (5 th)
Co-operative Societies	14.77 (5 th)	21.66 (4 th)	16.30 (4 th)
ASDS	4.33 (9 th)	5.50 (12 th)	6.50 (10 th)
Farmers	6.00 (8 th)	17.66 (5 th)	4.50 (12 th)
Financial Institutions	3.00 (11 th)	6.91 (11 th)	1.60 (15 th)
Input Dealers	0.77 (15 th)	13.5 (8 th)	6.60 (9 th)
Irrigation Department	1.66 (13 th)	3.41 (13 th)	4.30 (13 th)
KVK	21.11 (3 rd)	24.83 (2 nd)	21.90 (3 rd)
NGOs	3.22 (10 th)	3.08 (14 th)	7.70 (8 th)
Panchayat	16.22 (4 th)	11.75 (9 th)	10.40 (7 th)
Political Leaders	6.44 (7 th)	2.00 (15 th)	3.10 (14 th)
SDA	26.66 (1 st)	24.91 (1 st)	28.30 (1 st)
SDH	23.44 (2 nd)	22.66 (3 rd)	25.60 (2 nd)

Perusal of [Table-2] and [Fig-2] unveiled the intricacies of 'Power' amongst different stakeholders on decision-making on adoption of mitigation and adaptation practices for Climate Change in agriculture. Most powerful amongst the stakeholders was 'State Deptt. of Agriculture' with the score of 26.66 and least being 'Input Dealers' with the score of 0.77. When 'Interest' of stakeholders on decision-making on adoption of mitigation and adaptation practices for Climate Change in agriculture was concerned, it could be stated, as shown in same table, that 'State Deptt. of Agriculture' with the score of 24.91 and 'Political Leader' with the score of '2.00' were the most interested and least interested respectively. Similarly, when 'Legitimacy' of stakeholders on decision-making on adoption of mitigation and adaptation practices for Climate Change in agriculture was determined, as the same table depicted, the 'State Deptt. of Agriculture' and the 'Financial Institutions' with the scores of 28.30 and 1.60 were found to be most legitimate and least legitimate respectively.

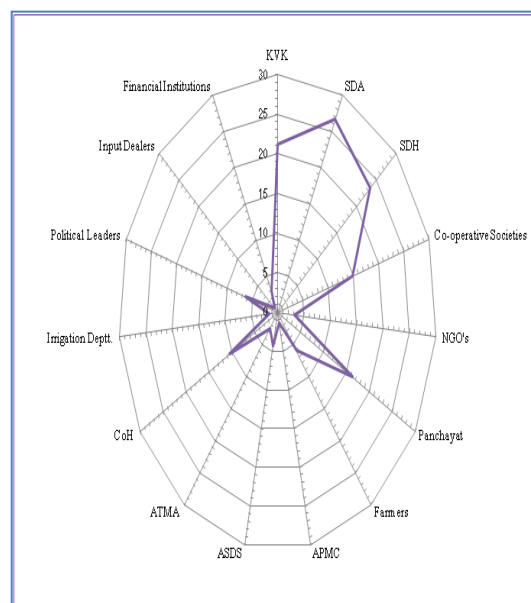


Fig-2 Radar Chart on Power of Stakeholders in Malhargarh Block.

Average adjusted ranking of identified stakeholders with respect to Power, Interest and Legitimacy in Manasa Block:

Table-3 Average adjusted ranking scores of identified stakeholders with respect to Power, Interest and Legitimacy in Manasa block.

Stakeholders	Manasa Block		
	Power	Interest	Legitimacy
APMC	3.50 (11 th)	8.72 (10 th)	8.30 (7 th)
ATMA	4.87 (9 th)	11.18 (7 th)	13.60 (6 th)
Co-operative Societies	14.87 (4 th)	17.54 (4 th)	15.70 (5 th)
ASDS	5.62 (7 th)	7.27 (11 th)	7.80 (8 th)
Farmers	5.87 (6 th)	15.00 (6 th)	4.40 (10 th)
Financial Institutions	2.37 (12 th)	9.54 (9 th)	3.60 (12 th)
Input Dealers	0.37 (14 th)	9.90 (8 th)	5.50 (9 th)
Irrigation Department	2.25 (13 th)	3.54 (14 th)	2.90 (14 th)
KVK	28.50 (1 st)	23.45 (3 rd)	20.9 (3 rd)
NGOs	5.37 (8 th)	5.45 (12 th)	3.30 (13 th)
Panchayat	14.50 (5 th)	16.54 (5 th)	15.70 (5 th)
Political Leaders	3.87 (10 th)	5.27 (13 th)	4.10 (11 th)
SDA	26.25 (2 nd)	26.63 (1 st)	27.70 (1 st)
SDH	22.25 (3 rd)	23.81 (2 nd)	26.40 (2 nd)

Perusal of [Table-3] and [Fig-3] unveiled the intricacies of 'Power' amongst different stakeholders on decision-making on adoption of mitigation and adaptation practices for Climate Change in agriculture. Most powerful amongst the stakeholders was 'Krishi Vigyan Kendra' with the score of 28.50 and least being 'Input Dealers' with the score of 0.37. When 'Interest' of stakeholders on decision-making on adoption of mitigation and adaptation practices for Climate Change in agriculture was concerned, it could be stated, as shown in same table, that 'State Deptt. of Agriculture' with the score of 26.63 and 'Irrigation Department' with the

score of 3.54 were the most interested and least interested respectively. Similarly, when 'Legitimacy' of stakeholders on decision-making on adoption of mitigation and adaptation practices for Climate Change in agriculture was determined, as the same table depicted, the 'State Dept. of Agriculture' and the 'Irrigation Department' with the scores of 27.70 and 2.90 were found to be most legitimate and least legitimate respectively.

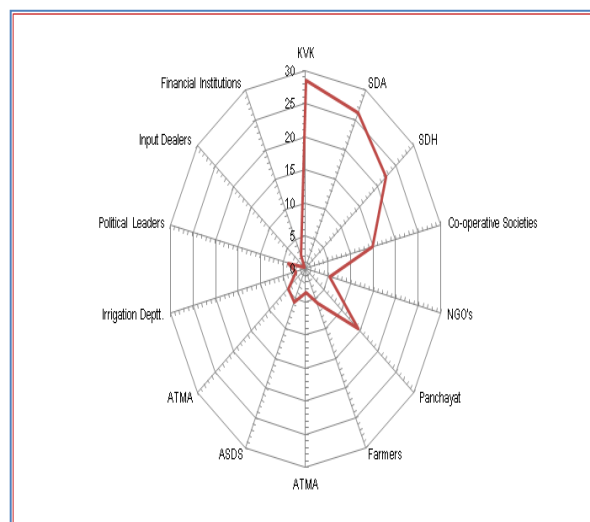


Fig-3 Radar Chart on Power of Stakeholders in Manasa Block.

Percent Composite Scores of Identified stakeholders in Malhargarh Block:

Table-4 Percent Composite Scores of stakeholders in Malhargarh Block.

Rank	Stakeholders	Transformed Score of Power, Interest and Legitimacy (Min = 0.00 to Max = 1.00)			Effect Size of Factor ANOVA	Composite Score(%)
		Power	Interest	Legitimacy		
1.	SDA	1.00	1.00	1.00	1.000	100.00
2.	SDH	0.87	0.90	0.90	0.890	89.00
3.	KVK	0.78	1.00	0.76	0.847	84.70
4.	Co-operative Societies	0.54	0.86	0.55	0.650	65.00
5.	CoH	0.38	0.58	0.47	0.477	47.70
6.	Panchayat	0.60	0.42	0.33	0.450	45.00
7.	ATMA	0.07	0.51	0.43	0.337	33.70
8.	Farmers	0.20	0.68	0.11	0.330	33.00
9.	Input Dealers	0.00	0.50	0.19	0.230	23.00
10.	APMC	0.02	0.34	0.13	0.163	16.30
11.	ASDS	0.14	0.15	0.18	0.157	15.70
12.	NGOs	0.09	0.05	0.23	0.123	12.30
13.	Financial Institutions	0.09	0.21	0.00	0.100	10.00
14.	Political Leaders	0.22	0.00	0.06	0.093	9.30
15.	Irrigation Department	0.03	0.06	0.10	0.063	6.30

The percent composite score which was a derivative of 'Effect Size' of factor ANOVA out of transformed score by applying 'Max and Min' (where Maximum Value = 1 and Minimum Value = 0) by taking into consideration Power, Interest and Legitimacy of each of the identified stakeholder in Malhargarh block, as shown in [Table-4] and [Fig-4], signified that 'State Deptt. of Agriculture' with the

score of 100% was the most important stakeholder in the district, it took a lead role in decision making on agricultural innovation systems as that of mitigation and adaptation practices for Climate Change in agriculture. This stakeholder should be the king-pin in further interventions of agricultural innovations apropos of climate change in agriculture and allied activities. It could be further elaborated that main

stakeholders who took key roles in the similar direction as above in order of importance were 'State Deptt. of Horticulture', 'Krishi Vigyan Kendra' and 'Co-operative Societies' which had the composite scores of 89.00%, 84.70% and 65.00% respectively. Rest of the stakeholders, as depicted in same table and figure, did not augur well on decision making, policy and programme formulation for mitigation and adaptation practices for Climate Change in agriculture by farmers.

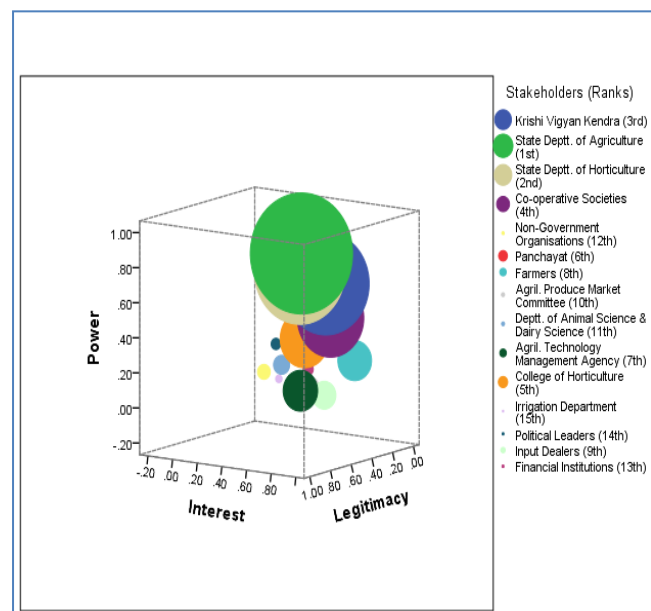


Fig-4 A 3-D Bubble Graph of Stakeholders of Malhargarh Block with respect to consolidated ranks on Interest, Power and Legitimacy.

Percent Composite Scores of Identified stakeholders in Manasa Block:

Table-5 Percent Composite Scores of Stakeholders in Manasa Block

Rank	Stakeholders	Transformed Score of Power, Interest and Legitimacy (Min = 0.00 to Max = 1.00)			Effect Size of Factor ANOVA	Composite Score (%)
		Power	Interest	Legitimacy		
1.	SDA	0.92	1.00	1.00	0.973	97.30
2.	KVK	1.00	0.88	0.75	0.877	87.70
3.	SDH	0.78	0.89	0.95	0.873	87.30
4.	Co-operative Societies	0.52	0.66	0.57	0.583	58.30
5.	Panchayat	0.51	0.62	0.57	0.567	56.70
6.	ATMA	0.17	0.42	0.49	0.360	36.00
7.	Farmers	0.21	0.56	0.16	0.310	31.00
8.5	APMC	0.12	0.33	0.30	0.250	25.00
8.5	ASDS	0.20	0.27	0.28	0.250	25.00
10.	Input Dealers	0.01	0.37	0.20	0.193	19.30
11.	Financial Institutions	0.08	0.36	0.13	0.190	19.00
12.	NGOs	0.19	0.21	0.12	0.173	17.30
13.	Political Leaders	0.13	0.20	0.15	0.160	16.00
14.	Irrigation Department	0.08	0.13	0.10	0.103	10.30

Perusal of [Table-5] and [Fig-5] unveiled that, in Manasa block, the composite score of 'State Deptt. of Agriculture' having 97.30% was the highest which implied that this stakeholder was most important in the district, therefore it took a lead role in decision making on agricultural innovation systems of mitigation and adaptation practices for Climate Change in agriculture. This stakeholder should be the vibrating agent in further interventions of agricultural innovations apropos of climate change in agriculture and allied activities in the block. It could be further elaborated that main stakeholders who took key roles in the similar direction as above in order of importance were, 'Krishi Vigyan Kendra', 'State Deptt. of

Horticulture', 'Co-operative Societies' and 'Panchayat' which had the composite scores of 87.70%, 87.30%, 58.30% and 56.70% respectively. Rest of the stakeholders, as depicted in same table and figure, did not augur well on decision-making, policy and programme formulation for mitigation and adaptation practices for Climate Change in agriculture by farmers.

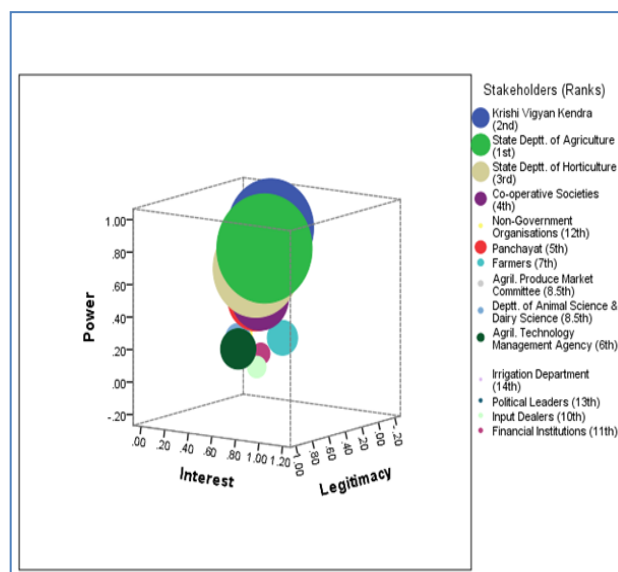


Fig-5 A 3-D Bubble Graph of Stakeholders of Manasa Block with respect to consolidated rank on Interest, Power and Legitimacy.

Conclusions

Based on the findings of the study, it may be concluded that majority of the respondents i.e. 70.00% belonged to category of high level of decision-making on adoption of mitigation and adaptation practices of climate change practices in agriculture. In both the blocks, State Department of Agriculture turned up to be the most active stakeholder.

Recommendations: The key stakeholders should be identified by any Government/Private agencies before introducing any new program and on the basis of Power, Interest and Legitimacy, stakeholders should be given task related to Climate Change in agriculture.

Suggestions for future research: There is a scope to study the integrated decision-making between stakeholders with respect to reducing mal-adaptation of climate change in agriculture. There remains a scope to study social network of stakeholders for spreading of consequences of climate change in agriculture in the social system fastly.

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Author Contributions

Pankaj Kumar Meghwal is main researcher of the present study for whole research work and Dr. Rajkumar Josmee Singh is my Major Advisor and Chairperson of the Advisory Committee and he guided me till publication of this research paper.

Conflict of Interest: None declared

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