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INFORMATION SEEKING BEHAVIOUR OF FARMERS ON ADOPTION OF CLIMATE-SMART AGRICULTURE PRACTICES

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ABSTRACT

There remains hardly any dimension which is unaffected by climate change. Farmer needs ex-ante and ex-post strategies to overcome the adverse effects of climate change. Social Networks enhances in discerning the mechanism of information flow through the agricultural stakeholders and promote such information in adoption of Climate Smart Agricultural Practices (CSAPs). The purpose is to identify different actors and star agents involved in disseminating information and use them as a means to spread agricultural technologies and related information to farmers. Study area includes three adopted villages of CPGS-AS, CAU-I i.e., Lairkhla, Khweng and Palwi of Ri-Bhoi district of Meghalaya. The contemporary study has the following objectives. i) Identifying various climate-smart agricultural practices in adopted villages of CPGS-AS, CAU-I. ii) To map informal social network structures of MGMG beneficiary farmers of adopted villages under CPGS-AS, CAU-I. Fifteen CSA Practices under four domains from three adopted villages of CPGS-AS, CAU-I were identified and documented. Sociograms depict the information disseminating behaviour and network attributes like centrality, cohesiveness, ties and homophily of Khweng, Lairkhla and Palwi are 11,9,11 & 0.444,0.444,0.444 & 90,90,90 & 0.77,0.55,0.86 respectively. Few studies uncovered the role of actors and social networks, but this study uniquely explores and presents the visualizations of networks under CPGS-AS, CAU-I.

Keywords: *climate change, informal social networks, climate-smart agricultural practices.*

INTRODUCTION

Agriculture is indispensable to withstand 9 billion people by 2050 and this will require 70-100 per cent rise in food production (Godfray *et al.,* 2010). According to the Global Climate Risk Index (CRI)–2020, India ranks fifth among the nations which is most susceptible to climate change. It is predicted that by 2050, 9 billion people would have worse living conditions worldwide, with poverty and hunger leading the way and making it far more difficult to put food on the table (FAO, 2013). The adverse effects of climate change are becoming increasingly apparent as a significant hazard to agriculture, food security, and the means of subsistence for millions of people worldwide (IPCC, 2014). Developing nations are particularly susceptible to the adverse effects of climate change because of their limited resources and inadequate ability to recover from the most severe climate shocks (Mekonnen, 2018; Vinaya and Tapan, 2023). Changes in rainfall patterns, temperature increases, and the frequency and severity of extreme events like droughts and floods can all have a substantial influence on agricultural production (Singh *et al.,* 2017).

The CSA addresses transmogrifying and re-orienting agriculture and other allied sectors development under the changing realities of CC (Lipper *et al.,* 2014). The CSA has three interlinked pillars namely, (1) Sustainably increasing agricultural productivity and incomes (2) Adapting and building resilience to CC and (3) Reducing or removing GHGs emissions. In rural areas, agriculture is the primary source of income for around 75% of the world's impoverished. Studies have demonstrated that in nations where a significant portion of the populace is employed in agriculture, expanding the agricultural sector can effectively reduce poverty and boost food security. Some smallholder farmers in developing nations experience "yield gaps," or the discrepancy between the yields they achieve on their farms and the maximum yield that is theoretically possible (Reardon 2009).

It is possible to reduce and even avoid these negative impacts of climate change – but it requires formulating and implementing effective adaptation strategies (Fawzy *et al.,* 2020). A range of potential adaptation measures have already been identified which can provide a good starting point for developing effective adaptation strategies for any particular

site (Fedele *et al.,* 2019). Reducing risk exposure through diversification of production or incomes, and building input supply systems and extension services that support efficient and timely use of inputs, including stress tolerant crop varieties, livestock breeds and fish and forestry species are also examples of adaptation measures that can increase resilience (Lipper *et al.,* 2018). Information seeking behaviour is purposive in nature and is a consequence of a necessity to meet some goals. Face to face or electronically (Kalasariya *et. al.,* 2022). Livestock rearing was the integral component for diversified agriculture and serves an additional source of income generation. That's why farmers need information related to proper nourishment of their animals, veterinary information needed for the safeguard of their animals to health-related issues, knowledge about dairying for milk processing. (Shukla *et.al.,* 2024)

Agriculture, including land-use change, is a major source of greenhouse gas emissions, responsible for around a quarter of total anthropogenic GHG emissions (Rock *et al.,* 2020). Agriculture is also a major part of the climate problem, currently generating 19–29% of total GHG emissions. (World Bank Report, 2018). CSA as a transformative and sustainable form of agriculture that aims to improve productivity in food security and production systems, based on coupling the key pillars of climate change (e.g., adaptation, resilience, and mitigation) in addition to smart and advanced technological knowledge, thereby increasing profit, and to minimize vulnerability through reducing greenhouse gas emissions (Adesipo *et al.* (2020); Thakor and Joshi (2024); Ghasura *et al.* (2024); Vinaya *et al.* (2022).

Social network analysis

Understanding the dynamics of SNA improves comprehension of the information flow among agriculture stakeholders and the elements that facilitate or impede the acceptance of such information and its application in technology adoption for CC mitigation and adaptation (Dympep, 2018; Anusha et al., 2023). Informal Social Network Analysis (ISNA) is a methodology used in SNA (Valente *et al.,* 2015) to study how people behave in social groups and organizations as well as the informal social ties among network members (Clifton and Webster, 2017). Modelling, visualizing, and analyzing interactions between and within groups or organizations can be done with the use of software (Springer and De Steiguer, 2011). These ISNA provide data on the degree of similarity between individuals in the group, their centrality, cohesiveness, links between nodes, and their degree of similarity, which may be used to formulate a better intervention plan and carry it out to accomplish the desired outcome.

The identified research gap is, despite providing timely and numerous awareness programs, improving the knowledge, supplying of agricultural inputs and incentive, enabling access to capital & investments and helping farmers by niche institutions of agriculture and allied disciplines in the state to endorse the CSAPs, only a few farmers effectively adopt CSAPs. Therefore, this study is noteworthy in mapping Informal Social Networks (ISNs) of farmers in adopting CSAPs in adopted villages of CPGS-AS, CAU-I.

OBJECTIVES

(1) To identify various climate-smart agricultural practices in adopted villages of CPGS-AS, CAU-I

(2) To map informal social network structures of MGMG beneficiary farmers of adopted villages under CPGS-AS, CAU-I

METHODOLOGY

Central institute, CPGS-AS [CAU, Imphal] at Umiam, Ri-bhoi district of the state Meghalaya, the adduced state and district, were purposefully chosen for the scientific investigation. Within the 21 villages that the CPGS-AS adopted as part of Umsning C&RDB under MGMG Scheme, three of the most agriculturally significant villages—Khweng, Lairkhla, and Palwi had been purposefully chosen for the scientific interrogatory. The study used purposive sampling and a diagnostic research approach. The respondents were chosen using the snowball sampling approach. The main tool used for collecting data from the respondent in the present study was a structured interview schedule which was prepared in the light of the objectives of the study. The interview schedule focussed on general information of the respondents, their innovative farming practices to adapt to the climate changes was designed to collect information about the independent variables. And the second part was structured to collect information on informal social networks of respondents

Social network attributes such as (i) Centrality, measures the respondent's critical positions in the network. (ii) Degree Centrality, measures the position of a given node as a mediator for geodesic paths between other nodes in the graph. two measures of 'Degree Centrality' used in the study were, namely (1) In-degree and (2) Out-degree. In-degree is the number of actors/edges pointing to a given node. Out-degree is the number of ties that a node directs to others within the network. A value of zero for both in-degree and out-degree shows that a node is isolated and without interaction. (iii) Cohesiveness, is the degree to which actors are connected directly to each other by cohesive bond.

(iv) **Ties,** is a connection of a pair of actors by one or more relations. it is mathematically expressed as '*N (N-1)/2',* where N = Number of nodes in a network**.** (v) **Homophily,** measures the tendency of individuals to associate with those similar to themselves. The value ranges from -1 to +1, the value of -1 shows 'Homophily' and a value of +1 shows 'Heterophily'.

RESULTS AND DISCUSSION

1 Identifying various climate-smart agricultural practices in selected villages of Ri-Bhoi district

Table 1: Identified CSAP's under four domains

Sr. No.	Domains	Identified CSAPs
I	**Crop Production**	1 Cultivation of Stress Tolerant Varieties 2 Maize-French bean Integrated Farming System *3* *Aji* System of Cultivation (Cultivation of Rice and Millets alongside rearing of Fish in knee-deep water)
II	**Natural Resource Management**	1 Soil Testing and use of Soil Health Card. 2 Enriched compost prepared on local biomass 3 Furrow application of lime on acid soils 4 Rainwater harvesting structures (e.g. *Jalkund*) 5 Raised and Sunken Bed technology
III	**Plant Protection**	1 Biological Pest/disease management 2 Usage of pest/disease resistant varieties 3 Usage of organic pesticides and poison baits
IV	**Agro-Advisory Services**	1. Information to farmers on scientific crop management practices 2. Personal field visits to the adopted villages in regular period 3. Information on market intelligence 4. Linkage of farmers to 1917iTEAMS

A total of fifteen climate smart agricultural Practices in four domains have been completely enumerated. Pertaining to the domain of I. 'Crop Production', the following three CSAPs had been identified, namely (1) Cultivation of Stress Tolerant Varieties, (2) Maize-French bean Integrated Farming Systems, and (3) *Aji* System of Cultivation. Concerning the domain of II. 'Natural Resource Management', the entailing CSAPs had been identified, namely (II). Soil Testing and use of Soil Health Card, (2) Enriched compost prepared on local biomass, (3) Furrow application of lime on acid soils, (4) Rainwater harvesting structures, and (5) Raised and Sunken Bed technology. Dealing with the domain of III. Plant Protection, the following three CSAPs had been identified as: (1). Biological Pest/disease management, (2) Usage of pest/disease resistant varieties, and (3) Usage of organic pesticides and poison baits. Apropos of the domain IV. Agro-Advisory Services, the entailing CSAPs had been specified as: (1) Information to farmers on scientific crop management practices, (2) Personal field visits to the adopted villages in regular period, and (3) Information on market intelligence, and (4) Linkage of farmers to 1917Iteams.

2 To map informal social network structures of MGMG beneficiary farmers of adopted villages under CPGS-AS, CAU-I

Archetypical sociogram of MGMG beneficiary farmers of three adopted villages of CPGS-AS, CAU-I can be described as:

2.1 ISN of MGMG beneficiary farmers of Khweng Village under CPGS-AS on information seeking and dissemination of CSAPs

When Centrality is scrutinized by inferring Figure 1, it is evident that the respondent– PK had highest 'Indegree' value of 7, indicating that PK sought CSAP information pertaining to (i) CI from PT & HS; (ii) AAS from TM, PM & BB; and (iii) PP from IL & BD. The same respondent-PD had Outdegree of 4, hinting that PD disseminated information on CI to BD, PM, HS and TM. Further, the Figure 2, revealed that the respondents BM, HS, IL, PM, PT & TM had Indegree and Outdegree of 4. Subsequently, the respondents BB, BD & BM2 had Indegree and of 3 and Outdegree of 4, respectively.

On examining the intricacies of sociogram, it could be stated that the most reputed and prestigious farmers amongst the identified respondents on seeking and disseminating information on CSAPs was the respondent PK.

With the Cohesiveness value of 0.444, it could be inferred that the ISN of MGMG beneficiary farmers of Khweng village has moderate 'knittedness' in seeking and sharing of CSAPs. The Tie value of 90 in ISN revealed that the respondents formulated an arc relationships pertaining to passionate attachment & reciprocity in seeking and sharing CSAPs and curbing social distance that is minimizing the difference in socio-economic status, education level and gender, whilst performing CSAPs. Having the Homophily values of 0.778 hinted that the ISN had moderately high (> 0.50) level of within-group connectedness. Hence, diffusion of innovations apropos of CSAPs within the personnel network would be good enough and fast.

2.2 ISN of MGMG beneficiary farmers of Lairkhla Village under CPGS-AS on information seeking and dissemination of CSAPs

When Centrality is scrutinized by inferring Figure 2, it is evident that the respondents–SPS, RM, PS, KS had highest 'Indegree' value of 5, indicating that SPS sought CSAP information pertaining to (i) CI from KL, MR & PS; (ii) AAS from KS; and (iii) PP from ER. The same respondent-SPS had Outdegree of 4, hinting that SPS disseminated information on (i) CI to RM; (ii) AAS to SR; (iii) NRM to KS; and (iv)PP to PS. Respondent RM sought CSAP information pertaining to (i) CI from ER & SPS; (ii) AAS from MR; (iii) NRM from MM; and (iv)PP from SR2.The same respondent-RM had Outdegree of 4, hinting that RM disseminated information on CI to SR2; AAS to MM; NRM to MR; PP to PS. Respondent PS sought CSAP information pertaining to (i) AAS from SR; (iii) NRM from KL & MR; and (iii)PP from RM & SPS. The same respondent-PS had Outdegree of 4, hinting that PS disseminated information on CI to SPS; AAS to MR; NRM to KL; PP to SR. Respondent KS sought CSAP information pertaining to (i) AAS from KL & SPS; (ii) NRM from SPS; and (iii)PP from MR & SR. The same respondent-KS had Outdegree of 4, hinting that KS disseminated information on CI to MR; AAS to SPS; NRM to SR; and PP to ER. Further, sociogram revealed that the respondents MM, MR & SR had Indegree and Outdegree of 4. Subsequently, the respondents ER & SR2 had Indegree of 3 and Outdegree of 4, respectively. On examining the intricacies of sociogram in Figure 2, it could be stated that the most reputed and prestigious farmers amongst the identified respondents on seeking and disseminating information on CSAPs was the respondent SPS, RM, PS & KS.

Having the Cohesiveness value of 0.444, it could be inferred that the ISN of MGMG beneficiary farmers of Liarkhla village has moderate 'crochetedness' in seeking and sharing of CSAPs. The Tie value of 90 in ISN revealed that the respondents formulated an arc relationships pertaining to passionate attachment & reciprocity in seeking and sharing CSAPs and curbing social distance that is minimizing the difference in socio-economic status, education level and gender, whilst performing CSAPs. Having the Homophily values of 0.556 hinted that the ISN had medium (≈0.50) level of inward-group connectedness. Hence, diffusion of innovations suitably of CSAPs within the personnel network would be good enough and agile.

2.3 ISN of MGMG beneficiary farmers of Palwi Village under CPGS-AS on information seeking and dissemination of CSAPs

When Centrality is scrutinized by inferring Figure 3, it is evident that the respondent–NS had highest 'Indegree' value of 7, indicating that NS sought CSAP information pertaining to (i) CI from KM, KLM & SL; (ii) AAS from EL, DLM & PN; and (iii) PP from YP. The same respondent-NS had Outdegree of 4, hinting that NS disseminated information on CI to SL; AAS to KM; NRM to DLM; and PP to YP. Further, the sociogram revealed that the respondents PN had Indegree and Outdegree of 6 and 4. SL & KM had Indegree of 5 and Outdegree of 4. YP & PP had Indegree of 4 and Outdegree of 4. DLM & KLM2 had Indegree and Outdegree of 3 and 4. EL had Indegree of 2 and Outdegree of 4. KLM had an Indegree of 1 and Outdegree of 4 respectively. On examining the intricacies of sociogram in Figure 3, it could be stated that the most reputed and prestigious farmer amongst the identified respondents on seeking and disseminating information on CSAPs was the respondent NS.

Possessing the Cohesiveness value of 0.444, it could be inferred that the ISN of MGMG beneficiary farmers of Palwi village has moderate 'binding' in seeking and sharing of CSAPs. The Tie value of 90 in ISN revealed that the respondents formulated an arc relationships pertaining to passionate attachment & reciprocity in seeking and sharing CSAPs. Having the Homophily values of 0.867 hinted that the ISN had very high (>0.50) level of inward-group connectedness. Hence, diffusion of innovations with respect to CSAPs within the personnel network would be brisked.

These findings have worth in research locale and also supported by some other studies by Shukla, (2024); Kalasariya, (2022); Dympep, A. (2018); Fawzy *et.al.,* (2020); Parikh *et al.* (2024); Fazely *et al.* (2024); Bhabhor *et al.* (2024); Pokiya *et al.* (2024); Tiwari *et al.* (2024).

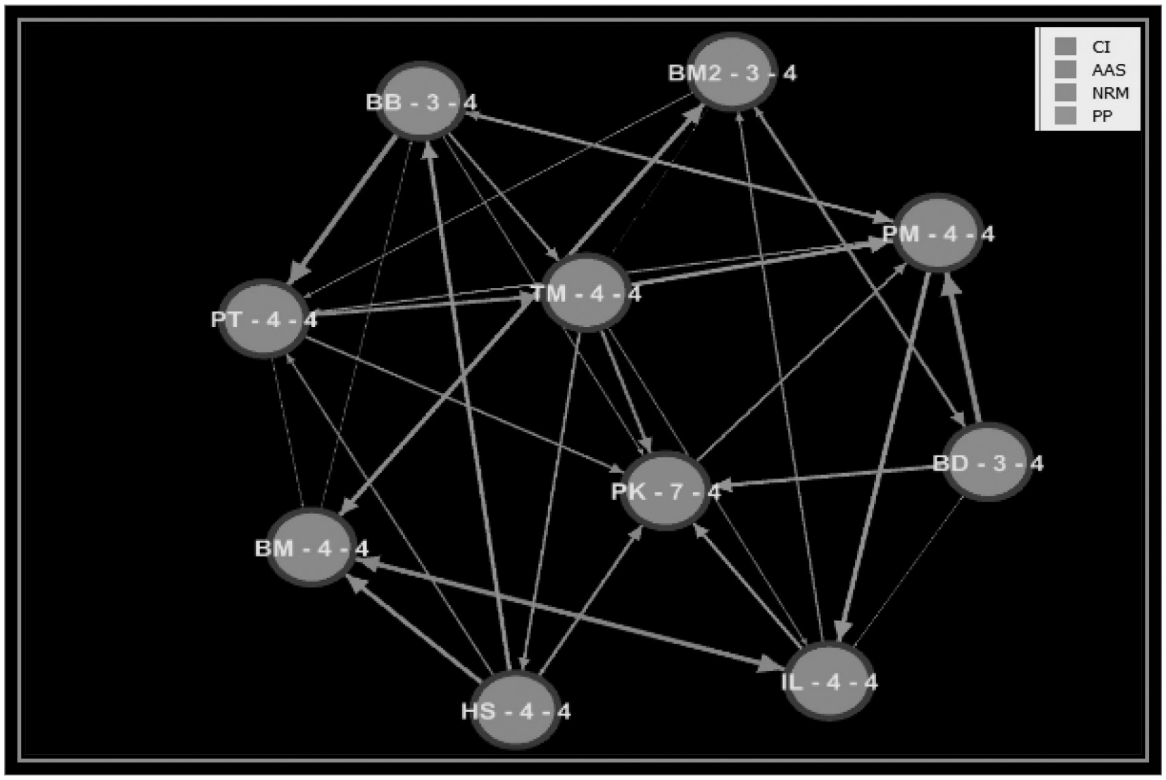

Fig.1: Sociogram of MGMG beneficiary farmers of Khweng village

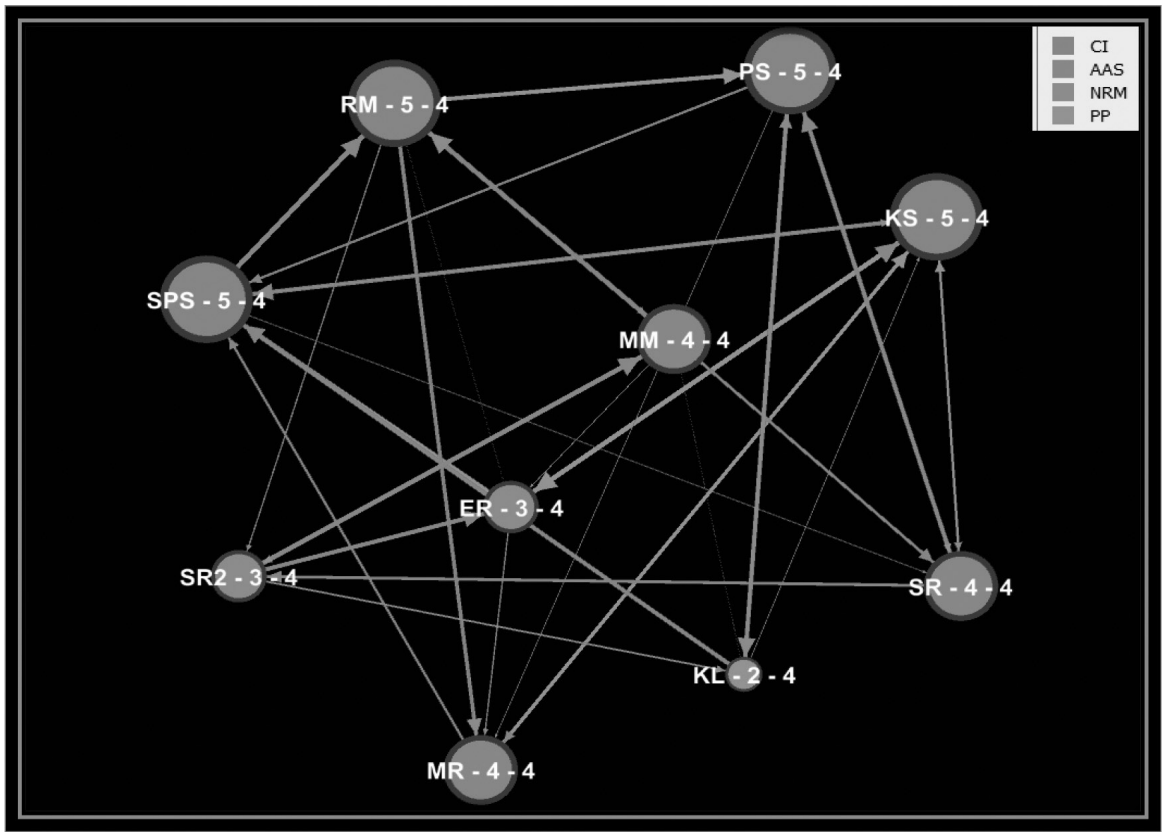

Fig.2: Sociogram of MGMG beneficiary farmers of Lairkhla village

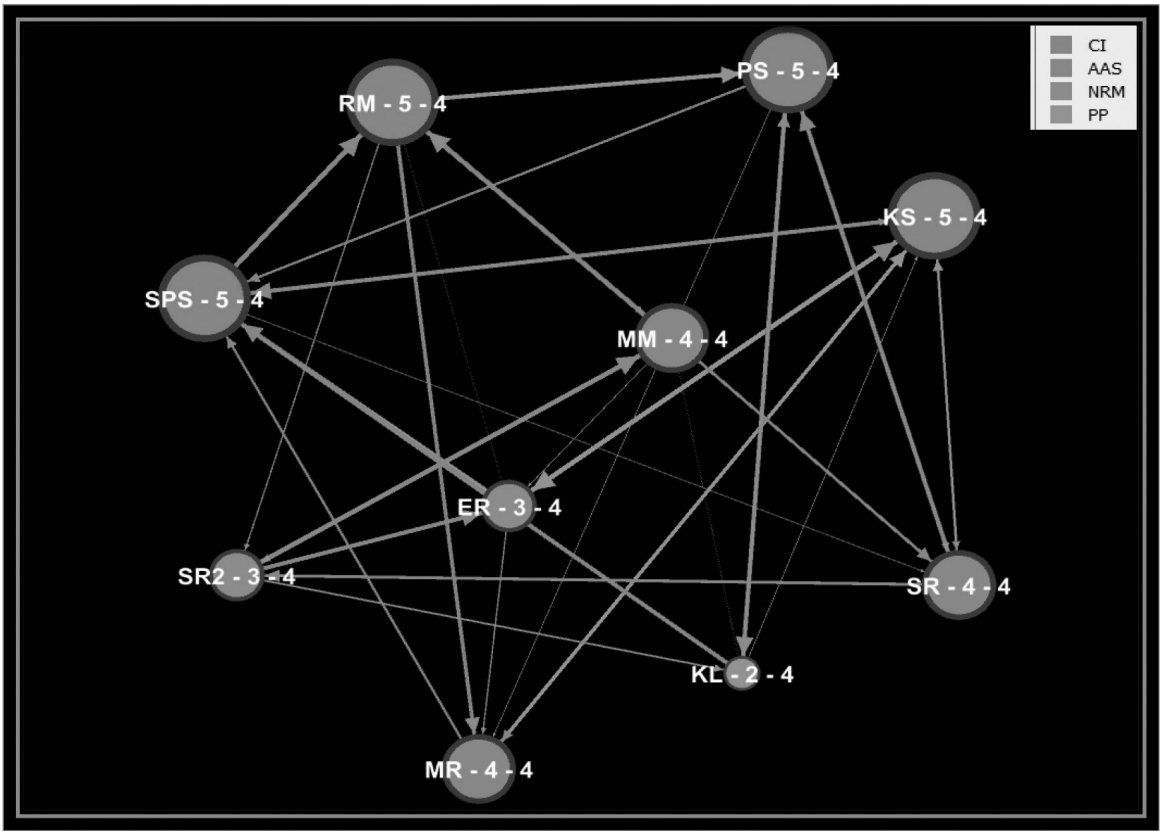

Fig.3: Sociogram of MGMG beneficiary farmers of Palwi village

Table.2 : Attributes of ISNs of MGMG beneficiary farmers of CPGS-AS, CAU-I

Sr. No.	Network Attributes	MGMG Adopted Village of CPGS-AS, CAU-I		
		Khweng	Lairkhla	Palwi
1	**Centrality (Degree Centrality)**	11	9	11
2	**Cohesiveness**	0.444	0.444	0.444
3	**Ties**	90	90	90
4	**Homophily**	0.778	0.556	0.867

CONCLUSION

The Ri-Bhoi district's Climate-smart Agricultural Practices revealed that farmers were forced to adapt to and minimize the effects of climate change on undulating terrain due to the use of sophisticated agricultural techniques. Farmers need to incorporate both ex-ante and ex-post methods into their farming systems in order to endure the unpredictable fluctuations in climate. A homophilous ISN of farmers did not experience a nimble dissemination of CSAP innovation.

In the current study, three villages in the Ri-bhoi district's typical sociograms show the respondents' in- and out-of-degree information seeking and dissemination behaviours. Acting as a liaison between extension agents and other farmers within the network, the respondent with the highest in-degree and out-degree serves as a contact farmer inside the ISN. In order to evaluate the efficacy and adaptability of climate smart technology during climate extreme events, case studies must be prepared. Lastly, the researcher provided a reliable and practical sociogram to pinpoint the information-seeking and information-dissemination behaviours of the farmers in Ri-bhoi who responded to the ISN survey.

RECOMMENDATIONS

(1) Understanding which group have limited access to CSA knowledge can shape targeted outreach strategies.

(2) This study can guide information investment in rural ICT infrastructure to ensure timely and accessible CSA information for farmers.

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CONFLICT OF INTEREST

I hereby state that there are no conflicts of interest within the research team.

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