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# **Inter-collaboration Network among Institutional Actors of Agricultural Knowledge Information System (AKIS): A Comparative Study between Cooch Behar and Jalpaiguri Districts of West Bengal, India**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

Agricultural extension institutions play different roles at village level. There is always a need of inter-collaboration network between different institutions. Information exchange among these organizations is important for technology generation, information dissemination and adoption. So, it is imperative to know the inter collaboration network among the institutional actors which requires proper investigation and analysis. A few works were found in India on inter-collaboration network among the institutional actors of Agricultural Knowledge Information System (AKIS). The objective of the study was to find out the inter-collaboration network among institutional actors of AKIS of two different districts of West Bengal and their comparative evaluation. The data were collected from 84

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respondents from 19 different institutions employing a random sampling technique. The data were analysed through UCINET 6 and Netdraw software. It was found from the study that *Krishi Vigyan Kendra* (KVK), Comprehensive Area Development Corporation (CADC), Agricultural line department through Assistant Director of Agriculture (ADA), Agricultural Technology Management Agency (ATMA) and Farmer Producers' Organisations (FPO) play a pivotal role in this network. It was found also from the study that Cooch Behar district had stronger inter-collaboration network among its institution's actors than Jalpaiguri district.

**Keywords:** *Inter-collaboration network; information exchange; communication network; institutional actors; AKIS.*

## 1. INTRODUCTION

An agricultural knowledge and information system (AKIS) define who contributes which types of knowledge and information to agricultural decision making as well as the relationship among the many actors in the system. AKIS is defined as a set of organisations and/or persons, as well as the connections and interactions that exist between them that are involved in, or manage processes such as the anticipation, generation, transformation, transmission, storage, retrieval, assimilation, diffusion, and utilisation of agricultural knowledge and information, and that can potentially work to support decision-making and problem-solving. Studying this system is useful in order to be able to manage this AKIS in such a way that it contributes as much as possible to generation, dissemination, transformation, utilization, storage and retrieval of knowledge and information which is useful for agricultural development [1]. Hence, the management of AKIS interfaces for institutionalization of incorporated links among research, extension and education as well as among other elements with the farming community is an imperative task. Agricultural research is conducted in colleges and universities, public and private agricultural organizations, extension services, national and local research organizations, and private companies or corporations [2]. A basic assumption in studying an AKIS is that information relevant for decision making is generated by different actors and reaches farmers in many different ways [3].

An AKIS as a network consisted of different actors and multidimensional perspectives which include relations, policies, sources of knowledge, methods of communication, knowledge creating, information sharing, and decision making for development [4]. Information is one of the most significant contributions for employment; and communication networks assume a significant

job in sharing this information in rural society [5]. A social network is seen as a set of linked actors who interrelate continuously, seeking to discuss and make opportunity to complete their requirements and follow their interests. They facilitate flow of information and reduce the information irregularity. Social networks are a widely recognized source of social capital, though they differ in composition, size, and structure. These networks join different stakeholders and agent having different roles in the network. They are either information creator or mediator in the flow of information and sometimes also make use of this information themselves. Flow of information within network is dependent on the social embeddedness of the actors as well as the structural layout of the social network itself. The key actors in the network are linked to each other and thus play many roles to create, transmit and utilize information. The knowledge on linkage between these different institutions; and how they facilitate each other in this network may help extension functionaries to identify critical roles played by central actors in the diffusion process [6]. Agricultural extension organisation of developing countries challenged numerous requirements in their exercises for information generation and use [7]. Adequate extension supports in appropriate combination will develop the service quality, and encourage the farmers to attain the different extension programme [8]. The social network works within and outside the social system and accepts a central activity in the resolution policy of the rural poor [9]. Inter-collaboration network among the institutional actors depends on the networking capability of the actors with the farming community. It was observed that majority of the farming people were networked with the input dealers, farmers club and nearest agriculture department for farm information [10,11]. Rural extension institutions play multiple roles at grassroots level. So there is always need of inter-collaboration relationship with the different institutions or actors.

Information exchange among the institutions or actors is critically important for the successful technology development and information dissemination [12-15]. According to Das and Chowdhury [16] there are many actors in the communication network of AKIS but among them KVK, farmers club and agriculture department play important role. It is seen that the institutions or actors who have better inter-collaboration networks with different actors of AKIS may play a greater role at grass-root level. However, till date, only few studies are found on inter-collaboration network among the institutions of AKIS in different zones or districts. With this backdrop, the present study was undertaken to analyse the inter-collaboration network among institutional actors of AKIS in two Northern districts of West Bengal.

## 2. METHODOLOGY

### 2.1 Study Area, Respondents and Data

Cooch Behar and Jalpaiguri district have 12 and 7 blocks respectively. Present study undertook 3 blocks each from Cooch Behar (Cooch Behar-I, Cooch Behar-II and Mathabhanga-II) and Jalpaiguri (Jalpaiguri sadar, Maynaguri and Dhupguri) randomly for this study. 25 institutions acting under AKIS in West Bengal were primarily selected for this study and a careful pilot survey, 19 institutions were sustained for final study. These were *Krishi Vigyan Kendra* (KVK), ICAR-Institutes (ICAR), Agricultural Technology Management Agency (ATMA), National Bank for Agriculture and Rural Development (NABARD), Farmer Producers' Organisations (FPO), State

Agricultural University (SAU), Farmers Club (FC), Agricultural line department through Assistant Director of Agriculture (ADA), Horticulture line department through Assistant Director of Horticulture (ADH), Private Company (PC), Nationalise Bank (NBANK), Cooperative (COOP), Input dealer (INDE), Fishery department (FD), Animal Resource Department (ARD), Sericulture department (SERI), Comprehensive Area Development Corporation (CADC), Soil conservation department (SCD) and Microfinance institution (MICROF). Random sampling methods were used for selection of the blocks. Descriptive research design was used in the present study. Data were collected from 84 respondents working under these institutions (43 from Cooch Behar district and 41 from Jalpaiguri district) from 19 different institutions of AKIS.

### 2.2 Analytical Tools

Social Network Analysis (SNA) tools were utilized to extract the character and strength of inter-correlation networks of the study districts. Social network analysis [SNA] is the mapping and measuring of relationships and flows between people, groups, organizations, and other connected information/knowledge entities (accessed from <http://www.orgnet.com/sna.html> on 27.06.2021). The nodes in the network are the people and groups while the links show relationships or flows between the nodes. SNA provides both a visual and a mathematical analysis of human relationships. The tools are explained in Table 1. Data were analysed with social networking analytical software like UCINET 6 and Netdraw.

**Table 1. Brief description about different network analysis tools\***

Tools	Definition
Nodes	An individual, a household, an organisation, or other entity of interest within a network
Ties	Interconnections between actors, may be directed or non-directed.
Average Degree	Average number of links per node
In-degree H-Index	Nodes which are most important
K-core index	Coreness is a measure that can help identify tightly interlinked groups within a network. A k-core is a maximal group of entities, all of which are connected to at least k other entities in the group
Degree	Degree centrality is defined as the number of connections incident to the node of interest. The nodes with higher degree is more central.
Centralization	The number of ties originating from an actor to other actors, e.g. the number of social interactions that an actor approaches to other actors. The nodes with higher outdegree is more central
Out-Centralization	
In-Centralization	The number of ties directed towards an actor from other actors, e.g. the number of social interactions that an actor receives from other actors. The nodes with higher indegree is more prestigious

Tools	Definition
Degree Correlation	Degree correlations capture the relationship between the degrees of nodes that link to each other
Density	Number of ties, expressed as percentage of the number of ordered/unordered pairs. When density is close to 1.0, the network is said to be dense, otherwise it is sparse
Components	Component subgraphs (or simply components) are portions of the network that are disconnected from each other
Connectedness	The extent to which individuals are connected to others
Fragmentation	Fragmentation is the proportion of pairs of nodes that cannot reach each other
Network Closure	A measure of the completeness of relational triads
Avg Distance	The Average of distance between all pairs of nodes

\*Adopted from: Wasserman and Faust [17], Hannemann and Riddle, [18]; Borgatti et al. [19] and Scott and Carrington [20]

### 3. RESULTS AND DISCUSSION

#### 3.1 Comparative Picture of Inter-collaboration Network among Institutional Actors

Inter-collaboration network among institutional actors of Cooch Behar and Jalpaiguri district is depicted in table-2. It is found from the table that there were 19 nodes (institutions) present in both the districts. Total numbers of ties found were 160 and 112 which produces an *average degree* of 8.421 and 5.859 for Cooch Behar and Jalpaiguri districts respectively. Actors of Cooch Behar district had stronger relationship than Jalpaiguri district. It is also found that both indegree H-index and K-core index was more in Cooch Behar district; and 9 nodes were most important here, whereas in Jalpaiguri district 7 nodes were most important. Eight nodes in Cooch Behar and 7 nodes in Jalpaiguri were closely interlinked with each other.

It was observed that *Degree Centralization* in Cooch Behar was less than Jalpaiguri which means Jalpaiguri had more central node than Cooch Behar district. It was also found that *Out-Centralization* and *in-Centralization* of Cooch Behar district is more than Jalpaiguri district which reveals that Cooch Behar district had more influential nodes than Jalpaiguri district and nodes of Cooch Behar district received more request on different services than Jalpaiguri district. *Indegree* and *outdegree correlation* of the nodes of Cooch Behar district was assortative in nature whereas it was disassortative in Jalpaiguri district. Network *Density* among the nodes of Cooch Behar district was more than Jalpaiguri district. It is due to higher connections among the nodes in Cooch Behar District. It is also depicted in the table that

number of *Component*, *Component Ratio*, and *Fragmentation* was less in case of Cooch Behar district; and Cooch Behar district had less subgroup nodes and more *Connectedness* than Jalpaiguri district. It is due to the fact that Cooch Behar district is having larger numbers of connections among the nodes; and so, average distance among the nodes was also less in Cooch Behar district than Jalpaiguri district.

#### 3.2 Diagrammatic Representation of the Inter-collaboration Network among the Institutional Actors of Cooch Behar District

The distribution of the actors of the Cooch Behar district on the basis of Inter-collaboration network is depicted in the Diagram 1.

It is found from the diagram 1 that majority of the nodes were networking with the KVK followed by CADC, FPO, ADA, DDH, ATMA and FC. From this diagram it is revealed that KVK play a major role in inter-collaboration network among the institutional actors followed by CADC, FPO, ADA, DDH, ATMA and FC. It is also observed that inter-collaboration network of SAU in Cooch Behar district was more than Jalpaiguri district (Diagram 2). It is due to presence of one SAU in Cooch Behar district. It is found that ICAR play an important role of networking with the SAU, SERI, KVK, CADC, and NABARD. It is seen that NABARD plays an import role in AKIS through inter collaboration networking with the KVK, CADC, ICAR, FC, FPO, PC, FD, NBANK, DDH, ATMA and ADA. ATMA also plays an important role of networking with the ADA, DDH, FPO, KVK, FC, CADC, FD, SCD, ARD, INDE, PC, NABARD, SERI, and COOP. It is also observed that FPO is an important actor in AKIS of Cooch Behar district through networking with ADA,

CADC, KVK, NABARD, FC, MICROF, SERI, NBANK, FD, DDH, ARD, SCD, ATMA, PC and INDE.

### 3.3 Diagrammatic Representation of the Inter-collaboration Network among the Institutional Actors of Jalpaiguri District

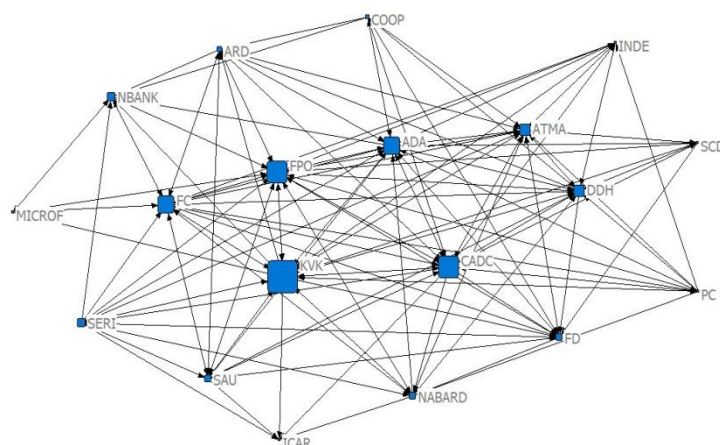
The distribution of the actors of the Jalpaiguri district on the basis of inter-collaboration network is depicted in the Diagram 2.

More or less similar pattern was found in case of Jalpaiguri district as was found in Cooch Behar district. It is found that majority of the nodes were in network with the KVK and ADA followed by

ATMA, FPO and FC. From this Diagram it is revealed that KVK and ADA play a major role in AKIS by creating inter-collaboration with majority of the institutional actors. They are followed by ATMA, FPO and FC. It is also observed that CADC and SERI department were isolated in Jalpaiguri district as there was no center of these institutions in Jalpaiguri district. Both SAU and ICAR also play vital in collaboration with KVK, ADA, ATMA and NABARD. On the other hand, NABARD itself made network with KVK, ICAR, FC, FPO, PC, FD, DDH, ATMA and ADA, whereas ATMA collaborated with ADA, KVK, DDH, FPO, FC, FD, SCD, ARD and COOP. It is also observed that FPO is in network with ADA, KVK, NABARD, FC, MICROF, NBANK, FD, DDH, ARD, SCD, ATMA, PC and INDE.

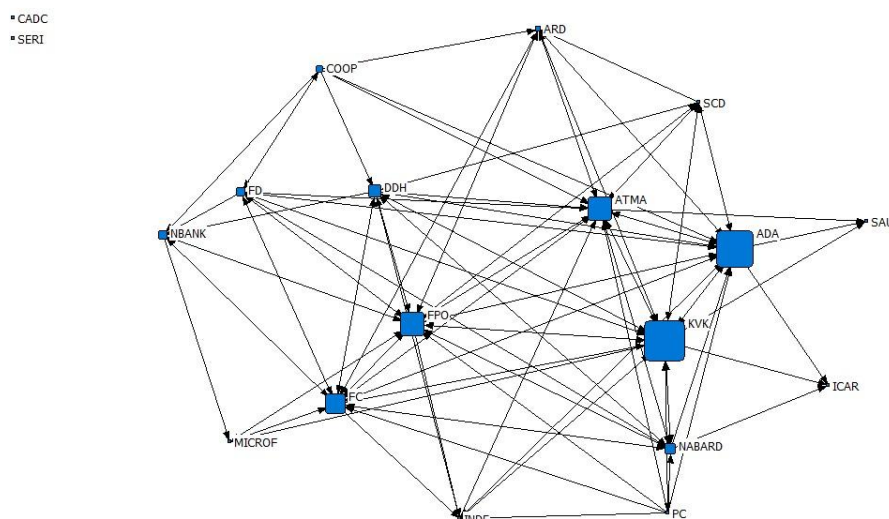
**Table 2. Comparative analysis of inter-collaboration network among institutional actors of Cooch Behar and Jalpaiguri district**

Sl. No.	Network Analysis	Cooch Behar District	Jalpaiguri District
1.	Number of nodes	19	19
2.	Number of ties	160	112
3.	Avg Degree	8.421	5.895
4.	Indeg H-Index	9	7
5.	K-core index	8	7
6.	Deg Centralization	0.369	0.405
7.	Out-Centralization	0.503	0.475
8.	In-Centralization	0.386	0.358
9.	Indeg Corr	0.059	-0.039
10.	Outdeg Corr	0.021	-0.054
11.	Density	0.468	0.327
12.	Components	2	5
13.	Component Ratio	0.056	0.222
14.	Connectedness	0.947	0.702
15.	Fragmentation	0.053	0.298
16.	Network Closure	0.647	0.614
17.	Avg Distance	1.540	1.596



**Diagram 1. Inter-collaboration network among the institutional actors of Cooch Behar district**





**Diagram 2. Inter-collaboration network among institutional actors of Jalpaiguri district**

#### 4. CONCLUSION

From this analysis it is concluded that the inter-collaboration networks of both the districts are strong through network building among themselves. Although, Cooch Behar district is slight ahead of Jalpaiguri due to the presence of more number of institutions, but in respect of quantitative indicators they are more or less similar in status. The present extension service approach demands a pluralistic approach of service delivery which may satisfactorily fulfilled by both the districts. Inter-collaboration and convergence is the backbone of pluralistic extension approach and both the districts can utilize the strength of their network and deliver the extension services more effectively. Among 19 actors KVK, CADDC, ADA, DDH, ATMA, FPO, FC, FD and SERI in Cooch Behar and KVK, ADA, ATMA, FPO, FC, DDH and NABARD emerged as the most important actors in AKIS of these districts. Planners and policy makers should utilize these actors and their strong network support for implantation of development interventions in these districts.

#### 5. FUTURE SCOPE OF THE STUDY

The study helps the researchers and policy makers to analysis the network strength of the different actors or institutions in AKIS. There is further research work may develop from the above study by identifying the different factors influencing the inter-collaboration networks and a holistic analysis may be done on inter-

collaboration networks among the institutional and non- institutional actors for agricultural information and communication networks developments.

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The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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