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Understanding agricultural information networks in the context of rural livelihood: A case of Munising village of Gumma block, Gajapati

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Abstract
Information on agricultural procedures (such as crop management, resource sourcing, finance, marketing, and other relevant topics) is the fundamental input for this coping mechanism to help people make better decisions in farming and associated activities. The various information needs of farmers are met by agricultural extension organisations, extension workers, other farmers, institutions of agricultural research and education, and other farmers through an unnoticed network of interconnected communication channels known as the "Agricultural information Network." A strong, innovative analytical tool is therefore needed in order to manage and improve these complicated information networks. SNA, or Social Network Analysis, is a cutting-edge technique that helps people make better decisions about farming and other related activities. Information about agricultural practises (such as crop management, input sourcing, finance, marketing, and so on) is a crucial part of this coping mechanism. The present study applied SNA methodology to explore the invisible nature of communication networks Gumma block, Gajapati district in Odisha, related to agriculture and allied sectors Farmers' various information needs are met by agricultural extension organisations, fellow farmers, extension agents, agricultural research and education institutions, and other agricultural organisations via an unnoticed network of interconnected communication channels known as the "Agricultural information Network." As a result, a potent, new analytical tool is required in order to effectively monitor and improve these complicated information networks. SNA is an innovative technique for researching social networks.

Keywords: Agriculture, information network, social network analysis

Introduction

For the most majority of Indian farmers, agriculture serves as their main source of income and represents a complicated, nature-based way of life. Farmers frequently need to devise coping mechanisms to deal with such uncertainties because the security of their livelihoods significantly rely on the occupations' unpredictable outcomes. The primary source of information for this coping mechanism is the wide range of knowledge about agricultural practises (such as crop management, input sourcing, finance, marketing, and so on) that aids in making better decisions about farming and associated activities. The agricultural extension organisations, agricultural research and education institutions, extension agents, and other farmers all fill these various information demands. For farmers to get accurate and helpful information, an effective and efficient information distribution system is essential (Demiryurek *et al*., 2008) [14]. The communication network, an unnoticed interconnected channel of communication among farmers, transports this crucial information. A communication network is a social structure in which people are connected via the exchange of information (Rogers &Kincaid 1981; Rogers 1995) [5]. All of the participants in this communication network-farmers, extension agencies, and researchers-play a critical role in both the short- and long-term sustainability of agriculture. In order to effectively manage & improve these communication networks, it is necessary to understand how they work.

Understanding the communication network in a particular agricultural system may help identify the core components, structures, weaknesses, and gaps of the system as well as the many information sources that these various components employ (Demiryurek, 2000) [15]. By properly redesigning the current communication system, this strategy might help lessen these gaps. A powerful, creative analytical tool that may enable farmers and agricultural development organisations to disclose the hidden networking patterns sustaining an agricultural development system is required to comprehend this complex, linked structure of the communication network.

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The new technique known as social network analysis (SNA) focuses on the investigation of a group of actors and a group of relationships between them, as well as the ways in which individuals are connected via various forms of social familiarity, from passing acquaintance to intimate relationships (Wasserman & Faust 1994; Hanneman & Riddle, 2005) [13, 7]. In the current study, social network analysis was used to collect data on five significant forms of information, which were then evaluated to determine their network features. Then, in order to highlight the similarities and contrasts among the attributes of the five separate networks, they were contrasted. Discussion on the relevance of these findings for agricultural extension programmes followed.

Research Methodology
The current study adhered to the social network analysis (SNA) concepts and methodologies. A social network is defined as a group of individuals (or organisations or other social entities) linked by a variety of social connections, such as friendship, co-working, or information sharing (Wasserman & Faust, 1994) [13]. SNA examines these social links as patterns of points and lines in a mathematical space with precisely examined formal features. Comparison of a "rural livelihood system" and "system" features a mechanism a system of subsistence It exists for a cause and brings about some change, or "transformation," therefore it has a purpose (or purposes) (Crossley et al., 2009) [16]. A livelihood system meets the needs of people in a community while preventing adverse externalities in the social and natural systems. Its performance may be assessed, and it can be demonstrated to

be more or less efficient. Nutrition and food Protection, employment, poverty, etc. A decision-making process serves as a control mechanism. Social links (such as friendships, familial ties, etc.) have an additional impact on social closeness, which results in their characterisation in terms of the flow of farming-related information (Burt, 1987) [17]. This intensity is quantified using the "centrality" notion, which reflects a node's position and power within the network. A node's centrality may also be measured by its "degree" (the total number of connections it has to other nodes), "closeness" (the reciprocal of its geodesic distance from all other nodes in the network), and "betweenness" (the number of times a node appears on the shortest path between two other nodes). Among the attributes of the entire network are the average centrality scores, network size (the number of ties), network density, and network centralization. While "density" measures the total number of links in the network divided by the total number of potential links (Cantner & Graf, 2006) [18].
This study used farm survey data collected from Gumma Block of Gajapati District of Odisha, India during March to May 2023. The research area was purposefully chosen under the presumption that the region's damaged ecosystem may lead to diversity in farmers' coping mechanisms, which would be expressed via varied information networks. People who relied mostly on farming for a living predominated in the region. Further, the tribal demographic feature was expected to pose unique nature of information networks. Moreover, researcher's background and close familiarity with respect to the study area, people, officials, conversance with local dialect also influenced the sampling scheme (Goswami & Basu, 2010) [9].

Table 1: Five information domains and nature of information covered by them

Information domains	Nature of information
Seed/Planting Material	New seed /planting material, their qualities, how to cultivate, where to get, at what price etc.
Fertilizer/Pesticide and Plant Protection	Diagnosis of disease/insects, weeds, type of damage, measure/pesticide to apply, how to apply, classification of fertilizer/pesticide, which fertilizer to apply, at what dose etc.
Irrigation	When, how much, from where to acquire, when available, at what rate, meeting of irrigation committee etc.
Animal Husbandry	Fodder, disease/disorder diagnosis, treatment, artificial insemination, calf management, breed of birds, vaccination, feed, marketing of milk, meat, egg etc.
Market information	Market rate, where to sale, price trend, speculation, form of market produce, market rate of consumable produce, their trends etc.

Table 2: Description of node and network properties used in the study

Node/network property	Description
Centrality	Measure of the number of ties that a node has relative to the total number of ties existing in the network as a whole; centrality measures include degree, closeness, and betweenness.
Degree centrality	Total number of ties a node has to other nodes. A node is central, when it has the higher number of ties adjacent to it
Closeness centrality	Measure of reciprocal of the geodesic distance (the shortest path connecting two nodes) of node to all other nodes in the network. A node is "close" if it lies at short distance from many other nodes
Betweenness centrality	Number of times a node occurs along the shortest path between two others
Network size	Total number of nodes in a network
Network 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
Network Centralization	how central its most central node is in relation to how central all the other nodes are; calculated as sum in differences in centrality between the most central node in a network and all other nodes

Sources: Wasserman & Faust (1994) [13]; Scot & Carrington (2011) [11]; Borgatti et al (2009) [2]; Hanneman and Riddle (2005) [7]; Asres et al. (2012) [19]; Freeman (1979); Misra et al. (2014) [10]

Data Analysis
Conventional Data and Network Data Compared
The data is analysed using a social network analysis approach,

which employs both statistical and visual methods. Before that, let's make a distinction between network data and traditional (survey) data, with which SNA newcomers are

more familiar. Functionaries in Panchayats, development officers, etc. These Panchayats/Blocks are once more located inside networks of district-level stakeholders such as Panchayat Samity, Zilla Parishad, and District Livestock Officers. 'Multi-modal' networks are what these networks are collectively known as. In the aforementioned illustration, district authorities make up the third mode network, followed by individual animal raisers, Panchayat/Blocks, and so on. Then, certain individuals are included in networks that are included in networks that are included in networks. However, only a small number of investigations have tried to focus on more than two modes simultaneously.

Conclusion

Research on social networks has been popular across many academic fields, particularly when it comes to tackling real-world issues. SNA is being used in dynamic systems, including social networking in cyberspace and a system for fisherman to receive weather forecasts, since it is particularly adept at comprehending complicated systems. This is also frequently used to better coordinate and manage the workplace environment. However, before using SNA in the real world, one must have substantial training. For functional reasons, a fundamental knowledge of the analysis is frequently helpful. The complexity of the livelihood system is a result of both its geographical and temporal fluctuations as well as its many interdependent parts and hierarchy of distribution. A livelihood system reacts in the short and long terms to changes in the internal (health of the primary breadwinner in a family) or external (removal of subsidy on agriculture inputs) circumstances of the system. The system is made more complex by the enormous number of institutions connected to a household's or community's livelihood outcomes. For an area to get a meaningful livelihood intervention and for the organisational climate to support innovation, decision-makers must make well-informed decisions. To better comprehend complex systems and apply this knowledge to real-world issues, development professionals will need their capacity built (Goswami and Basu, 2014) [10]. On the methodological front, we advise that SNA training and its implementation be mainstreamed in rural development scholarship and profession.

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