

1 **Exploring the Disparities in Agricultural Information Networks: Insights**
2 **from Tribal and Coastal Farm Women of Odisha in India**

3
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5 **Abstract**

6 Innovation, productivity, and sustainability in farming communities depend on agricultural
7 information networks. For underprivileged groups like tribal and coastal respondents, these
8 networks' differences sometimes inhibit information sharing. This study seeks to examine and
9 assess the differences between the social networks of respondents living in tribal areas and in
10 coastal areas. 240 respondents from Ganjam and Rayagada, Odisha, were sampled using
11 multiple steps. To map farmers' communication pattern, social network analysis (SNA) was
12 used. Respondents from both the area considers the most educated person in family and village
13 and SHG (Self-help group) as their primary source of information but respondents from coastal
14 area are much smart in networking with other information sources as well like using TV,
15 Training, demonstration, field days, other farmers, agriculture department, input dealers etc.
16 Women farmers are less likely to receive information when betweenness centrality is used in
17 targeting, suggesting there are important gender differences, as in tribal area men are likely to
18 talk to the cosmopolite information sources and respondents are generally engaged in the farm
19 activities more whereas in coastal area respondents are actively involved in both farm activities
20 as well as gathering information from different sources.

21 **Keywords:** centrality measures, information, information network, SNA, SHG (Self-help
22 group).

23
24 **1. Introduction**

25 Information aims to improve user comprehension and reduce uncertainty and confusion.
26 Information must be accurate, timely, and relevant to be effective. A "source of information"
27 might be anything seen or experienced (Bates & Marcia J. 2012). Additionally, information
28 sources help meet the needs of various user groups. Many sources of information exist. Men
29 have more access to mobile phones, radios, and other media than women. Thus, they seek
30 farming advice from men (Mgalamadzi et al. (2024). Farm women rarely benefit from financial
31 services (Taylor & Boubakri, 2013). Timely, relevant information that enhances output,
32 revenue, and sustainability is vital to India's rural economies and farm communities. Farm

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33 women in rural and underdeveloped areas benefit from information networks. Fram women
34 avoid these services due to cultural, economic, legal, and educational hurdles (FAO, 2019).
35 Although their content, size, and structure vary, social networks are universally recognised as
36 a source of social capital (Magnan N et al. 2015). Farmers share and discuss knowledge in their
37 social networks as a resource for production and social engagement. However, information
38 transit within networks depends on both people. Informing aims to reduces confusion and
39 improves comprehension. Effective communication requires accuracy, timeliness, and
40 relevance. Sight or experience can be a "source of information". Information sources benefit
41 different user groups. Many information sources exist. Mobile phones, radios, and other media
42 are more accessible to men. They consult males for farming guidance (Mgalamadzi et al.
43 (2024). Rural women rarely benefit from financial services (Taylor & Boubakri, 2013). Rural
44 India relies on agriculture, and farm communities need timely, relevant information to enhance
45 output, revenue, and sustainability. Information networks assist rural and marginalized farm
46 women improve their lives. Farmers debate knowledge in their social networks for production
47 and socialization. Information transmission in networks depends on social interactions and
48 network structure (Pramila Krishnan MP 2012). Tribal and coastal issues and potential are
49 studied. Tribal and coastal Odisha farmers use different methods and resources. These two
50 regions are appropriate for comparative research because their geography, socioeconomics, and
51 cultures affect farm women's agricultural knowledge utilization. Information networks educate
52 and aid tribal and coastal communities. SHG and agricultural cooperative knowledge, financial
53 inclusion, skill development, and social solidarity benefit women. Policymakers can create
54 region-specific outreach programs that build on strengths and minimize weaknesses by
55 understanding information networks. Agricultural information network research among tribal
56 and coastal respondents in Odisha fills a gap in understanding regional issues and potential for
57 rural women in agriculture. Feminine and male farmer network systems have been hardly
58 studied. No research compares tribal and coastal farming women. Tribal and coastal
59 respondents' information sources, networking habits, and community institutions are examined
60 to inspire future efforts to establish inclusive, effective, and sustainable information systems
61 that empower women to lead rural India's agricultural revolutions.

62 63 **Review of Literature**

64 A social network negotiates and creates possibilities to meet needs and interests. They promote
65 knowledge transfer, eliminate information asymmetries, and fund agricultural innovations

66 (Kassie et al. 2013). Technology spread depends on network size, composition, and structure
 67 (Tesie et al. 2012). Unique social structure patterns show how humans learn from different
 68 sources (Thuo M et al. 2012). Communication and information systems are studied using social
 69 network theories and mapping (Nyambo b et al. 2013). According to De Nooy Mrvar and
 70 Batagelj (2011), social network analysis (SNA) should focus on interactions, not persons.
 71 Centrality measures in social network analysis (SNA) help study social connections' features
 72 for a particular element (Gava O et al. 2017). Complex stakeholder interactions reveal
 73 interconnectedness, networking, and social exchanges while using sophisticated agriculture
 74 technologies (Weyori AE et al. 2017). This phenomenon was explained using social
 75 constructivism and social learning theory. In cognition, social constructivism stresses social
 76 relationships. Research shows farmers prefer learning from peers and exchanging experiences
 77 (Franz N et al. 2010). Communication of knowledge, ideas, and information affects technology
 78 adoption. Social media users share information. More network members and information flow
 79 boost social learning. In person-level networks differ in their innovation information access
 80 and exchange (Reed G et al. 2016). By visualising and assessing relationships between people,
 81 groups, and institutions. Social Network Analysis (SNA) can understand complex systems.
 82 Tabular summary of social networks and agricultural information transmission findings from
 83 sources given below.

Table 1. Summary of literature use in the study.

Year	Title	Author	Publication	Findings	Knowledge Gap
2020	Climate Change and Women Farmers: A Comparative Analysis	S. Panda	Environmental Studies Journal	Coastal women more vulnerable due to their reliance on climate-sensitive livelihoods.	Limited data on how climate-sensitive vulnerabilities impact the information needs and access methods of tribal versus coastal women.
2021	Mobile Technology for Agricultural Extension in Odisha	T. Kumar	Journal of Mobile Technology	Significant benefits but also challenges in technology adoption.	Few studies on specific barriers to mobile technology adoption among women farmers in diverse rural settings.
2023	The Role of Self-Help Groups in Women's Agricultural Development	P. Pritiprada	Development Studies Review	Showing they can enhance access to information and resources, leading to improved agricultural practices.	Lack of analysis on the comparative effectiveness of SHGs in providing agricultural information in tribal vs. coastal regions.
2024	Digital Literacy and Agricultural Information Access	B. Nanda	Journal of Digital Literacy	Finding that increased digital literacy significantly improves information access and agricultural outcomes.	Insufficient focus on how varying levels of digital literacy impact access and quality of agricultural information among tribal and coastal women.

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85 2. Research Approach and Framework

86 To determine how tribal and coastal respondents in Odisha receive and use agricultural
 87 information, this study explores their agricultural information networks. The research area
 88 comprises tribal and coastal areas. Through structured interviews, focus group discussions, and
 89 participant observations, respondents from both regions provided data. The research helps
 90 create targeted strategies to promote knowledge distribution among Odisha women farmers.

91

92 2.1 Study area & sampling:

93 In Odisha, the research focused on the tribal Rayagada district and the coastal Ganjam district,
 94 which have different agricultural settings. Rayagada women farm traditionally with limited
 95 access to modern agricultural technologies and resources. In contrast, greater infrastructure and
 96 agricultural extension services in Ganjam enable women to participate in varied agricultural
 97 enterprises.



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Figure 1. Map of Rayagada District.



Figure 2. Map of Ganjam District.

The study employed a random sampling method (lottery) approach to select districts i.e., Rayagada & Ganjam. A total of 240 respondents were selected following random sampling method. The research design employed for this study was ex-post facto research design.

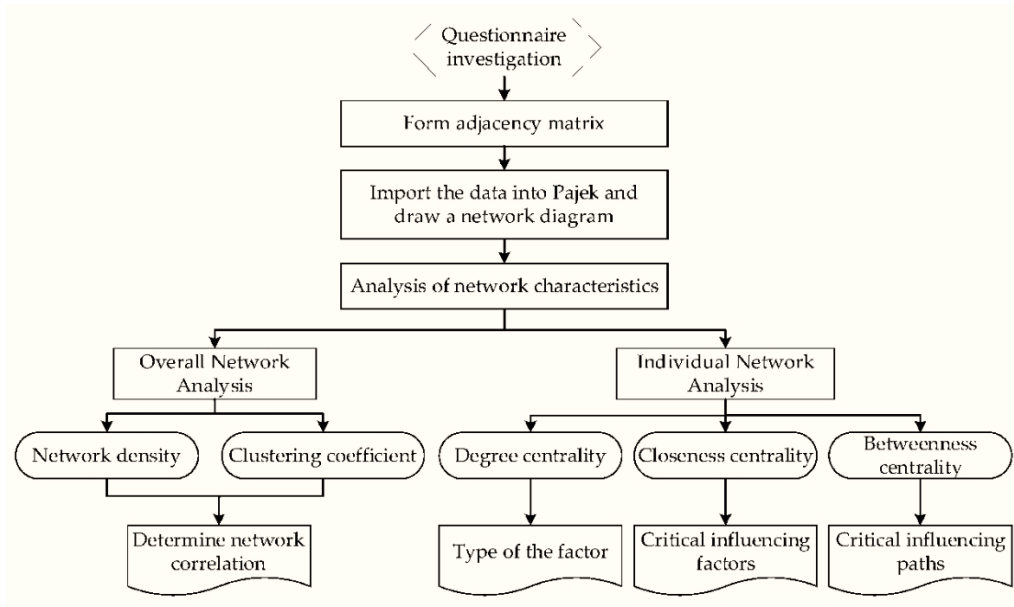
2.2 Data Processing and Analysis

Social networks and graph theory were applied to analyse social structures, mapping respondents information networks. The information network topology was surveyed based on research questions. UCINET, an open-source software, visualized networks and calculated Degree, Betweenness, Closeness centrality, and Density (Borgatti et al., 2009), while Netdraw displayed UCINET's binary network (Kolleck, 2013). Data were organized into an $n \times m$ matrix, with rows and columns representing persons and sources. Thuo (2012) emphasized that affiliation networks should capture multiple information sources for farm women.

2.3 Social Network Analysis (SNA)

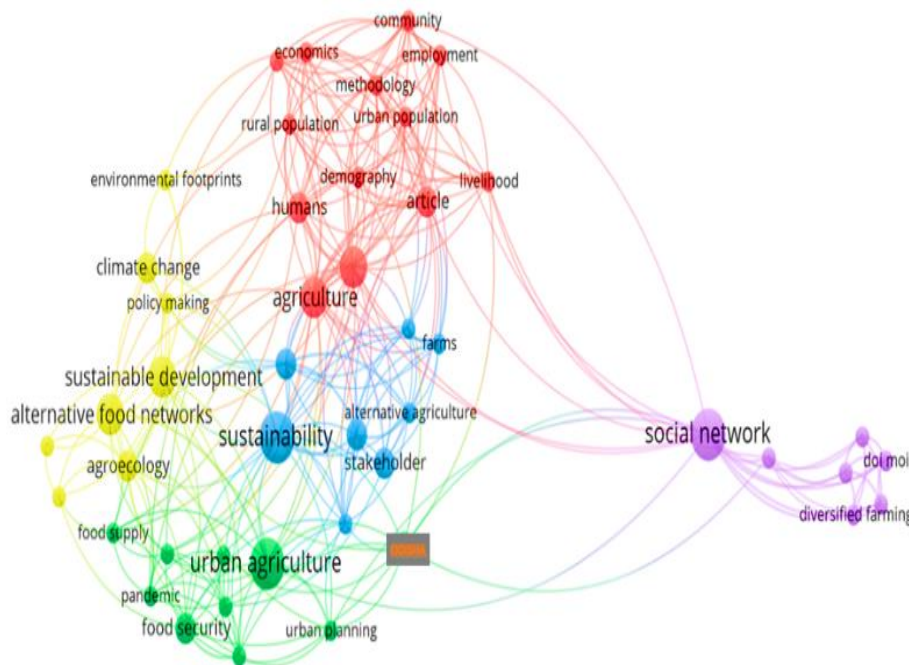
Social Network Analysis (SNA), using graph theory and networks, studies the flow of information, resources, and influence among people, groups, and organizations. It highlights influential actors and nodes within a network. SNA visualizes complex social networks, such

120 as farm women's information exchange. UCINET and Netdraw are used to compute and display
 121 network metrics, including degree (connections), betweenness (information flow control), and
 122 closeness centrality (node proximity). Figures 3 and 4 show SNA flowcharts and Odisha's
 123 agriculture information network. Sample sizes for SNA vary, from 10-50 for small groups to
 124 50-200 for larger community networks, with over 200 people providing structural insights.



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Figure 3. Flowchart for SNA (social networking analysis) using UCINET 6.



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Figure 4. Agriculture Network visualization

132 3. RESULTS

133 3.1 Social network structures among the respondents in various study locales

134 SNA reveals two-mode affiliation networks between farm women and information sources,
 135 highlighting the most important, trusted, and valuable sources. Some respondents rely on only
 136 one source, while others use multiple (Devi, 2024). Actors with many networks' connections
 137 influence others' behaviour. The information networking diagrams for both districts are based
 138 on their betweenness centrality values (Nasiri et al., 2022). Gatekeepers, or information sources
 139 with high betweenness centrality, play a key role. The networking diagram contains 137 nodes,
 140 categorized by information source use, importance, closeness, and value to respondents (Table
 141 2).

Table 2. Information exchange and actors of TRIBAL district respondents (n₁= 120).

S. No	Information source	EXTENT OF USE		IMPORTANCE		CLOSENESS		VALUE	
		Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
1	Most educated person in family	1.60	2	1.68	1	1.68	1	1.65	2
2	Most educated person in village	1.44	4	1.55	4	1.55	3	1.45	3
3	Neighbors or friends	1.20	6	1.14	6	1.42	4	1.18	5
4	Other farmers (progressive, relative)	1.30	5	1.33	5	1.30	6	1.20	4
5	Input dealers	0.24	11	0.57	3	0.22	14	0.23	17
6	Agriculture department	0.50	7	1.08	7	0.60	9	1.03	6
7	Farmers Call Centre	0	14	0.30	15	0	16	0.35	15
8	Radio	0	15	0.77	12	0.35	11	0.93	9
9	TV	0.27	9	0.94	8	0.37	10	1.00	8
10	News paper	0	17	0.23	17	0	17	0.50	13
11	Training, demonstration & field days	1.63	1	0.91	9	1.37	5	1.02	7
12	Cooperatives society	0	16	0.81	10	0.81	7	0.65	12
13	SHG	1.52	3	1.59	2	1.59	2	1.87	1
14	NGO	0.41	8	0.75	13	0.75	8	0.88	11
15	Leaflets, Folder	0.12	13	0.32	14	0.32	12	0.42	14
16	Internet	0.26	10	0.80	11	0.26	13	0.93	10
17	Others (Micro finance organisation, Bank)	0.16	12	0.24	16	0.10	15	0.30	16

142 Table 2 shows that most tribal respondents rely primarily on their family's most educated
 143 member for information, their second most-used source (Bankapur & Naik, 2018). They attend
 144 training, demonstrations, and field days for up-to-date knowledge (Oktarina et al., 2020). The
 145 government supports these efforts to enhance food security and livelihoods. Respondents prefer
 146 SHGs, which align well with commodity groups, and consult other farmers over publications
 147 due to limited formal education. Newspapers are the least used. Key knowledge sources include
 148 the family's educated member, SHGs, village contacts, friends, neighbors, and the agricultural
 149 department, consistent with Das et al. (2020).
 150

Table 3. Information exchange and actors of COASTAL district respondents (n₂= 120).

S. No	Information source	EXTENT OF USE		IMPORTANCE		CLOSENESS		VALUE	
		Mean Score	Rank	Mean Score	Rank	Mean Score	Rank	Mean Score	Rank
1	Most educated person in family	1.43	3	1.42	4	1.62	3	1.76	1
2	Most educated person in village	1.30	4	1.03	12	1.13	11	1.50	3
3	Neighbors or friends	1.29	5	1.25	8	1.61	4	1.25	8
4	Other farmers (progressive, relative)	1.15	6	1.38	6	1.39	6	1.22	10
5	Input dealers	1.17	7	1.05	11	1.27	8	1.17	11
6	Agriculture department	1.10	9	1.10	10	1.25	9	1.30	7
7	Farmers Call Centre	0.55	16	0.76	15	0.35	15	0.86	14
8	Radio	0.28	17	0.70	17	0.19	17	0.65	17
9	TV	1.58	2	1.58	1	1.77	2	1.60	2
10	News paper	0.71	13	0.71	16	0.35	16	1.14	13
11	Training, demonstration & field days	1.09	10	1.47	3	1.24	10	1.45	4
12	Cooperatives society	0.99	11	1.21	9	1.54	5	1.15	12
13	SHG	1.60	1	1.41	5	1.79	1	1.40	5
14	NGO	0.80	12	0.77	13	0.73	13	0.75	15
15	Leaflets, Folder	0.64	14	1.55	2	0.37	7	0.66	16
16	Internet	1.16	8	0.75	14	1.13	12	1.35	6
17	Others (Micro finance organisation, Bank)	0.56	15	1.33	7	0.52	14	1.23	9

151

152 Table 3 shows that coastal respondents trust SHGs over the most educated family member.
 153 SHG memberships foster essential partnerships. The agriculture department supports those
 154 with primary education, using booklets, training, and online resources. TV, rather than radio,
 155 is now the main information and entertainment source. Key information sources include the
 156 most educated family member, SHGs, village contacts, neighbours, other farmers, and the
 157 agriculture department.

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159 3.2 Centrality measures of various information sources across the study locales

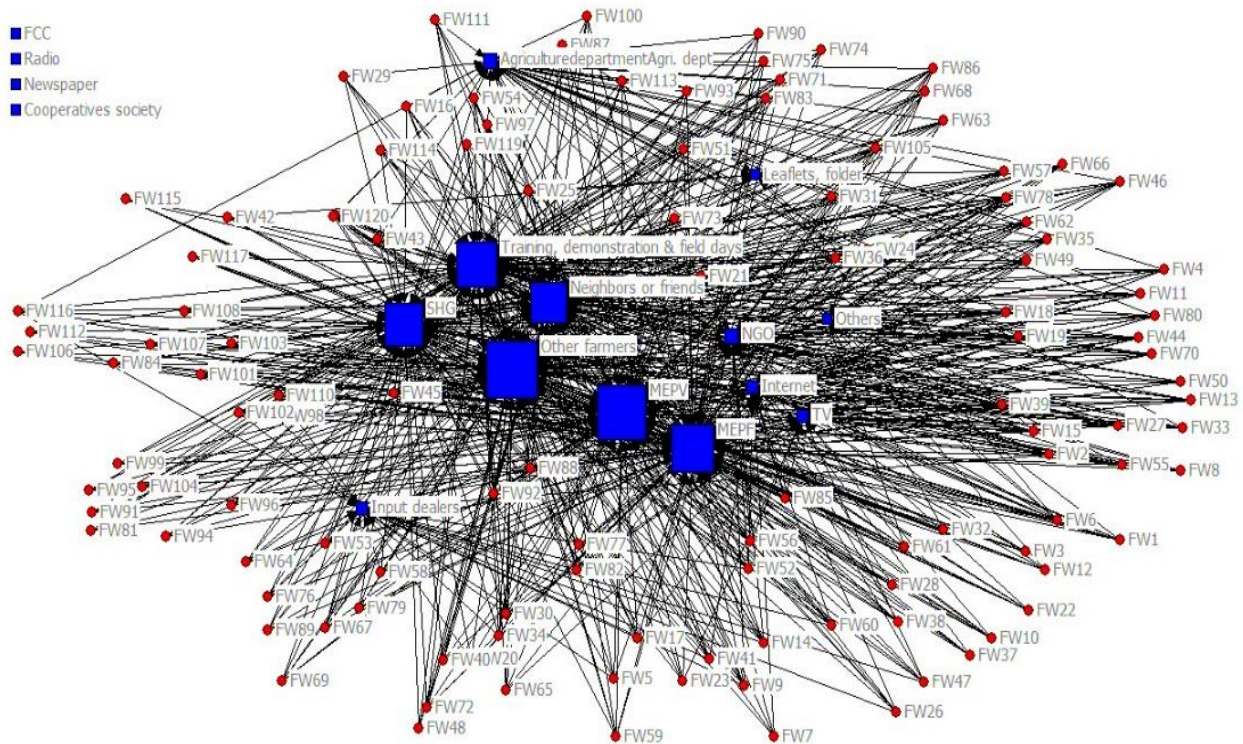
160 Centrality measurements for information sources in different networks are used to evaluate
 161 their influence. Centrality measures a network node's importance. Degree centrality-network
 162 node significance. It depends on node connections. Closeness Centrality—assessing each
 163 network node's importance. Betweenness Centrality measures the shortest pathways between
 164 nodes and which gets frequented most.

165

166 3.2.1 Information source and its extent of use by the respondents

167 Information usage patterns show that tribal respondents prefer trusted sources within their
 168 community. Figure 5 illustrates that their network is less dense, with highest reliance on other

169 farmers (progressive or relatives), followed by the village's most educated person, family's
 170 most educated member, training events, SHGs, and neighbors (Table 3).

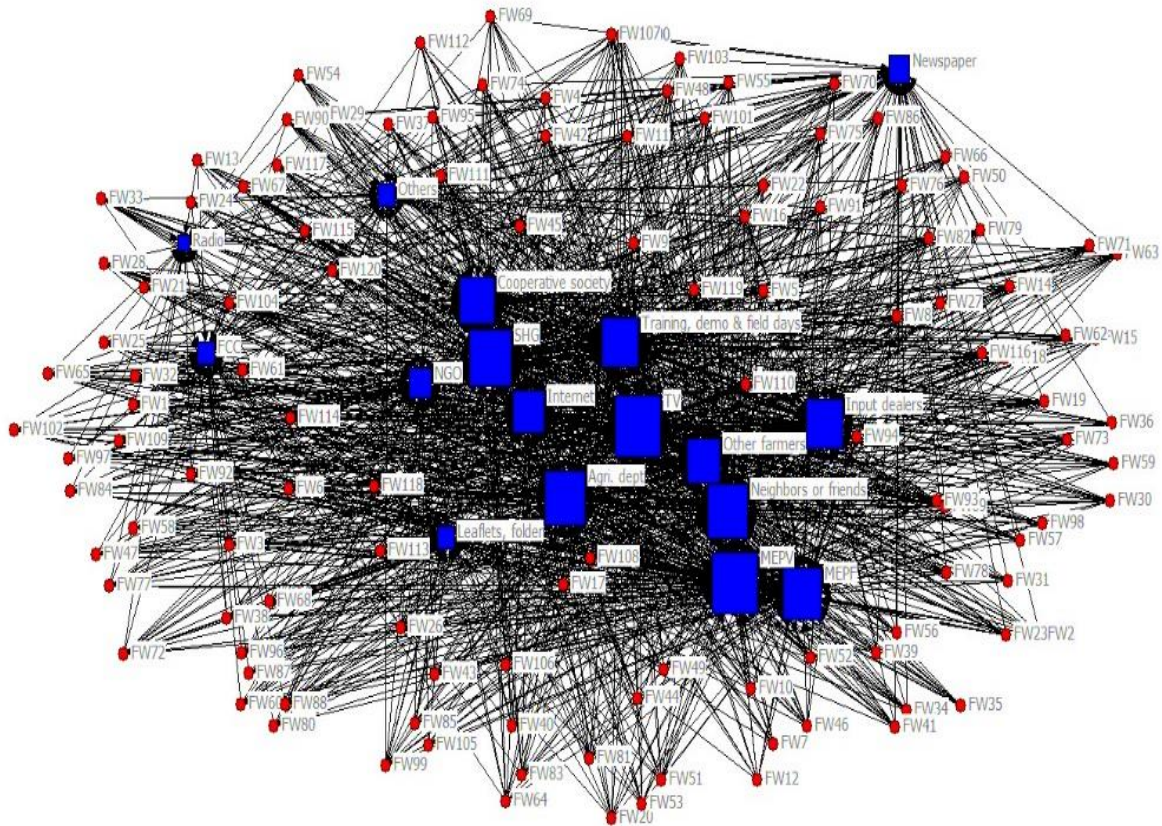


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 172 **Figure 5.** Information network of information source and its extent of use by the TRIBAL
 173 respondents.

Note FW: Farm Women; MEPF: Most educated person in family; MEPV: Most educated person in village; Other farmers: (progressive or relative); Agri. Dept: Agriculture department; FCC: Farmers Call Centre

174
 175 The main dependable information sources for respondents include the agricultural department,
 176 TV, input dealers, and the Internet, with NGOs having lower centrality due to limited

177 infrastructure and materials. Leaflets are least used due to literacy limitations (Mago, 2012).



178

179 **Figure 6.** Information network of information source and its extent of use by the COASTAL
180 respondents.

Note FW: Farm Women; MEPF: Most educated person in family; MEPV: Most educated person in village; Other farmers: (progressive or relative); Agri. Dept: Agriculture department; FCC: Farmers Call Centre

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182 The FCC, radio, newspaper, and cooperative society are disconnected from respondents.
183 With 120 connections, progressive and relative farmers are the most central sources, while only
184 12 rural women use leaflets due to their high closeness centrality. In Figure 6, the coastal district
185 shows a dense network, with TV as a reliable, timely source, followed by SHG, friends, the
186 agriculture department, the most educated family member, training events, input dealers,
187 cooperative society, farmers, and the Internet (Table 4). NGO has lower betweenness centrality
188 than newspapers, leaflets, FCC, and financial sources. The most educated villager has 117
189 connections, while radio, with high closeness centrality, is used by only 30 women.

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Table 4. A comparative table of centrality measures of information source and its extent of use by the respondents (n= 240).

S.No	Information source	Tribal			Coastal		
		Degree	Betweenness	Closeness	Degree	Betweenness	Closeness
1	Most educated person in family	108	1201.558	716.000	108	616.027	176.000
2	Most educated person in village	118	1458.864	696.000	117	741.141	158.000
3	Neighbors or friends	100	972.899	732.000	111	658.683	170.000
4	Other farmers (progressive, relative)	120	1523.575	692.000	96	481.869	200.000
5	Input dealers	23	43.933	890.000	104	570.300	184.000
6	Agriculture department	43	152.875	846.000	108	623.888	176.000
7	Farmers Call Centre	-	-	-	56	152.928	280.000
8	Radio	-	-	-	30	41.747	332.000
9	TV	26	55.755	880.000	118	754.120	156.000
10	News paper	-	-	-	66	213.843	260.000
11	Training, demonstration & field days	108	1174.793	716.000	105	583.758	182.000
12	Cooperatives society	-	-	-	101	534.098	190.000
13	SHG	102	1053.938	728.000	112	674.278	168.000
14	NGO	42	155.190	848.000	73	266.380	246.000
15	Leaflets, Folder	12	10.751	910.000	55	153.540	282.000
16	Internet	22	41.231	888.000	93	450.758	206.000
17	Others (Micro finance organisation, Bank)	15	17.636	904.000	57	152.641	278.000

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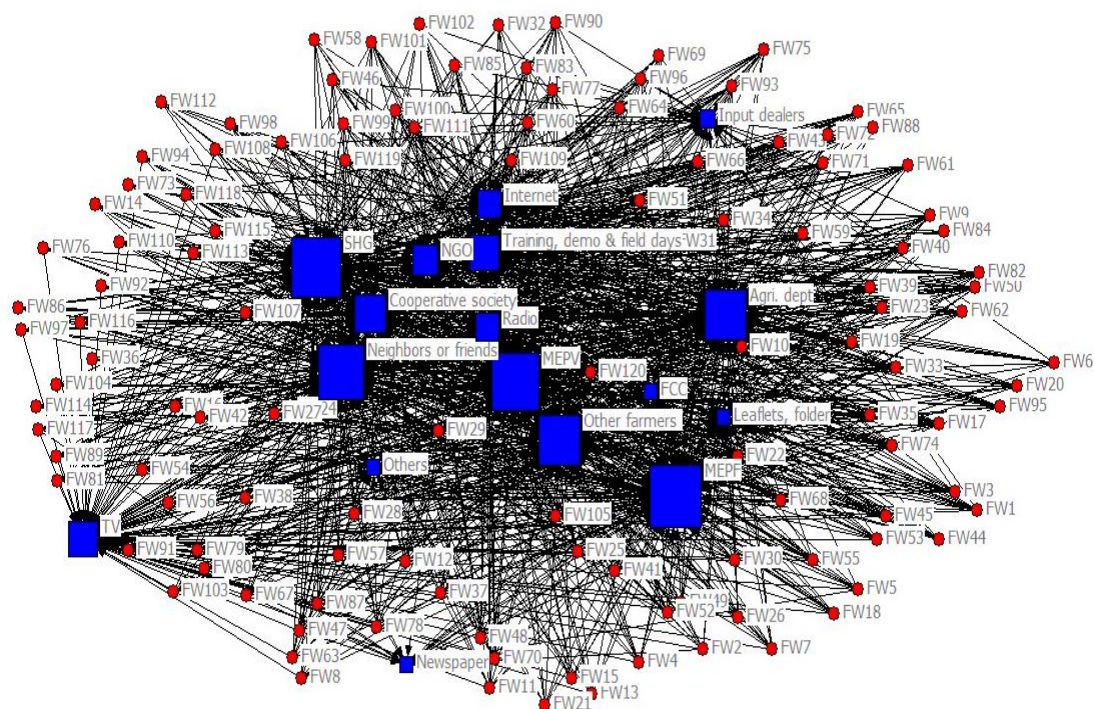
195 3.2.2 Importance of information sources as perceived by the respondents

196 The value of information sources depends on their role in agricultural decision-making. Figure
 197 7 indicates that tribal respondents' networks are less dense, with central connections primarily
 198 to the most educated family member, SHG, village, friends, progressive farmers, agriculture
 199 department, training events, and TV.

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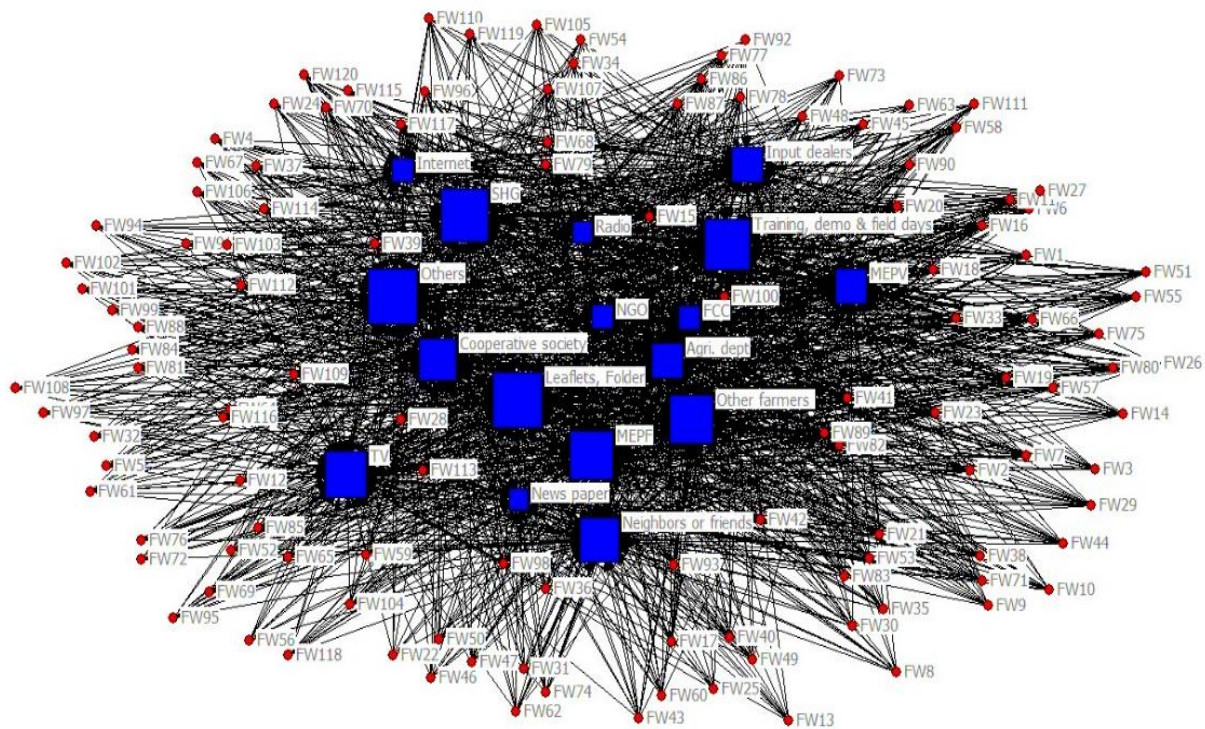
204 **Figure 7.** Information network of Importance of information sources perceived by the TRIBAL
 205 respondents.

Note FW: Farm Women; MEPF: Most educated person in family; MEPV: Most educated person in village; Other farmers: (progressive or relative); Agri. Dept: Agriculture department; FCC: Farmers Call Centre

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207 Farmer call centers are less central than NGOs, radio, the Internet, input dealers, leaflets, FCC,
 208 and other financial sources, while newspapers are the least-used source (Table 5). The family's
 209 most educated person has 117 edges, thus 117 respondents get information from them.
 210 Newspapers' closeness centrality discourages respondents (20) from using them for agri allied
 211 information.

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213

214 **Figure 8.** Information network of Importance of information sources perceived by the COASTAL
 215 respondents.

Note FW: Farm Women; MEPT: Most educated person in family; MEPTV: Most educated person in village; Other farmers: (progressive or relative); Agri. Dept: Agriculture department; FCC: Farmers Call Centre

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217 In Figure 8, coastal district respondents network mainly through leaflets, folders, SHGs,
 218 training events, educated family members, progressive farmers, TV, friends, neighbors,
 219 cooperative societies, village's most educated, and the agriculture department. FCC has lower
 220 betweenness centrality than NGOs, the Internet, and newspapers, with radio being used the
 221 least. Leaflets and folders have the highest centrality with 120 connections, while only 61
 222 respondents use newspapers for agri-related information due to its high centrality.

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Table 5. A comparative table of centrality measures of importance of information sources perceived by the respondents (n= 240).

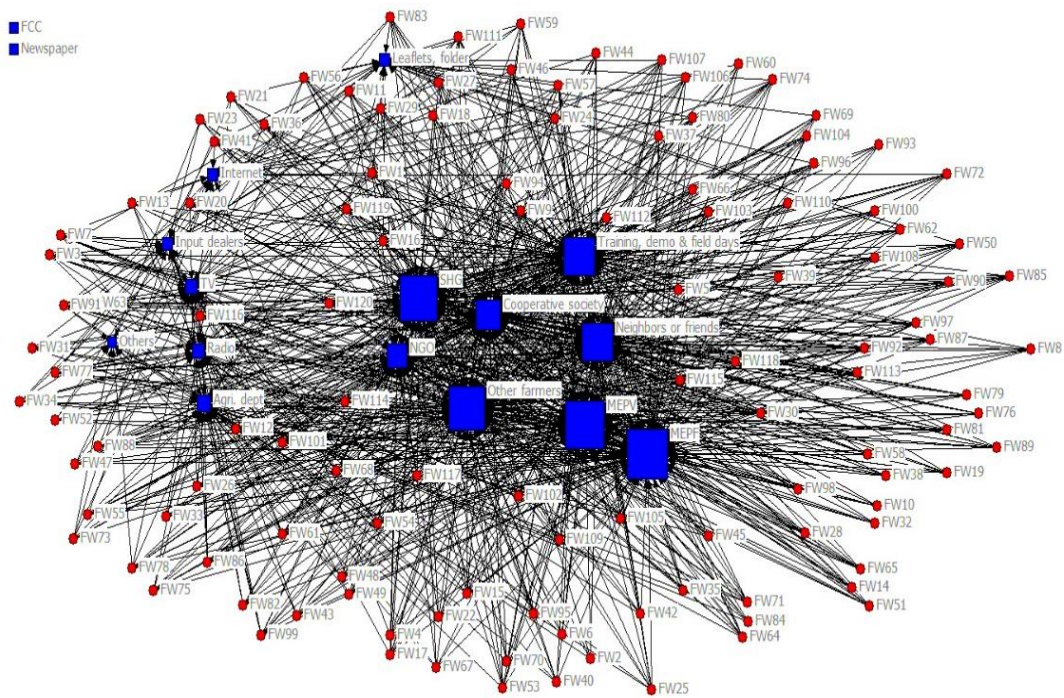
S.No	Information source	Tribal			Coastal		
		Degree	Betweenness	Closeness	Degree	Betweenness	Closeness
1	Most educated person in family	117	1014.094	158.000	112	592.986	168.000
2	Most educated person in village	113	921.292	166.000	94	391.687	204.000
3	Neighbors or friends	108	842.484	176.000	106	515.753	180.000
4	Other farmers (progressive, relative)	105	776.194	182.000	112	580.551	168.000
5	Input dealers	42	112.903	308.000	93	380.564	206.000
6	Agriculture department	103	757.499	186.000	92	387.836	208.000
7	Farmers Call Centre	28	46.031	336.000	70	219.510	252.000
8	Radio	70	323.299	252.000	62	164.788	268.000
9	TV	79	435.363	234.000	109	573.963	174.000
10	News paper	20	26.341	352.000	61	165.552	270.000
11	Training, demonstration & field days	84	466.559	224.000	114	630.652	164.000
12	Cooperatives society	85	503.657	222.000	100	478.923	192.000
13	SHG	113	943.894	166.000	117	665.101	158.000
14	NGO	74	347.941	244.000	70	212.043	252.000
15	Leaflets, Folder	32	59.069	328.000	120	700.723	152.000
16	Internet	70	305.986	252.000	66	200.646	260.000
17	Others (Micro finance organization, Bank)	22	32.396	348.000	120	700.723	152.000

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234 3.2.3 Information sources and its closeness in relation to the respondent

235 Information closeness familiarity and belonging from several knowledge sources is
 236 examined in this study. Closeness to the respondent" usually means emotional or psychological
 237 intimacy in a relationship or contact. It can include trust, empathy, understanding, and
 238 affection.

239 As shown in Figure 9, tribal respondents information networks are less dense and
 240 closely connected to the most educated person in the family or village, Self-Help Groups
 241 (SHGs), progressive and relative farmers, training and demonstration events, friends, and
 242 cooperative societies (Table 6; Jeeva et al., 2020). Centrality is low for NGOs, agriculture
 243 departments, TV, radio, leaflets, input dealers, and the Internet. Microfinance organizations
 244 and banks are the least-used information sources.



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246 **Figure 9.** Information network of Information sources and its closeness in relation to the
 247 TRIBAL respondents.

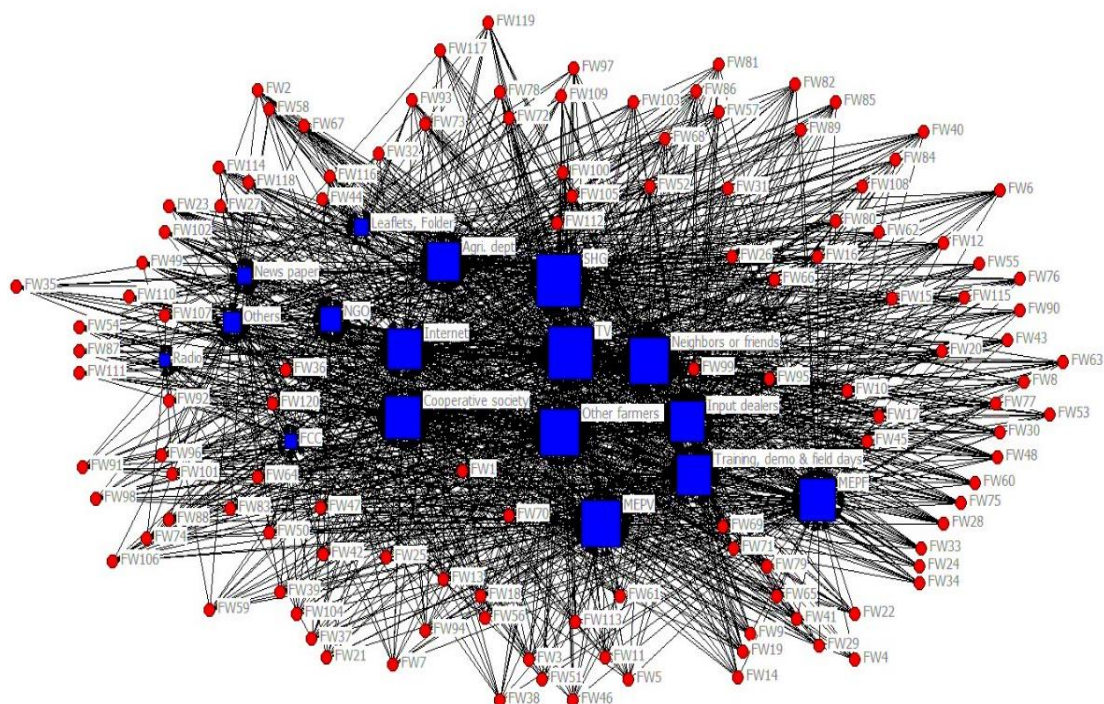
Note FW: Farm Women; MEPF: Most educated person in family; MEPV: Most educated person in village; Other farmers: (progressive or relative); Agri. Dept: Agriculture department; FCC: Farmers Call Centre

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249 The Farmer Call Center (FCC) and newspapers are isolated nodes, indicating no connection
 250 with respondents. The most educated family member is the most central information source,
 251 with 117 connections. The FCC, newspapers, and other financial sources have high closeness
 252 centrality due to their lack of engagement with respondents for Agri-allied information.

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256 **Figure 10.** Information network of Information sources and its closeness in relation to the
 257 COASTAL respondents.

Note FW: Farm Women; MEPPF: Most educated person in family; MEPV: Most educated person in village; Other farmers: (progressive or relative); Agri. Dept: Agriculture department; FCC: Farmers Call Centre

258

259 Coastal respondents have close access to various information sources (Figure 10), forming a
 260 complex farm knowledge communication network. The closest sources include Self-Help
 261 Groups (SHGs) and TV, followed by neighbors or friends, the most educated individuals in
 262 their village or family, cooperative societies, and training events (Table 6). Input merchants are
 263 less central compared to agriculture departments, NGOs, and other sources. Folders, leaflets,
 264 and Farmer Communication Centers (FCC) rank below newspapers in betweenness centrality,
 265 while radio is used the least. SHG and TV are the most central sources, each connecting 120
 266 respondents, while fewer than 18 women rely on radio for agri-allied information (Kekulandala
 267 et al., 2023).

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Table 6. A comparative table of centrality measures of Information sources and its closeness in relation to the respondent (n= 240).

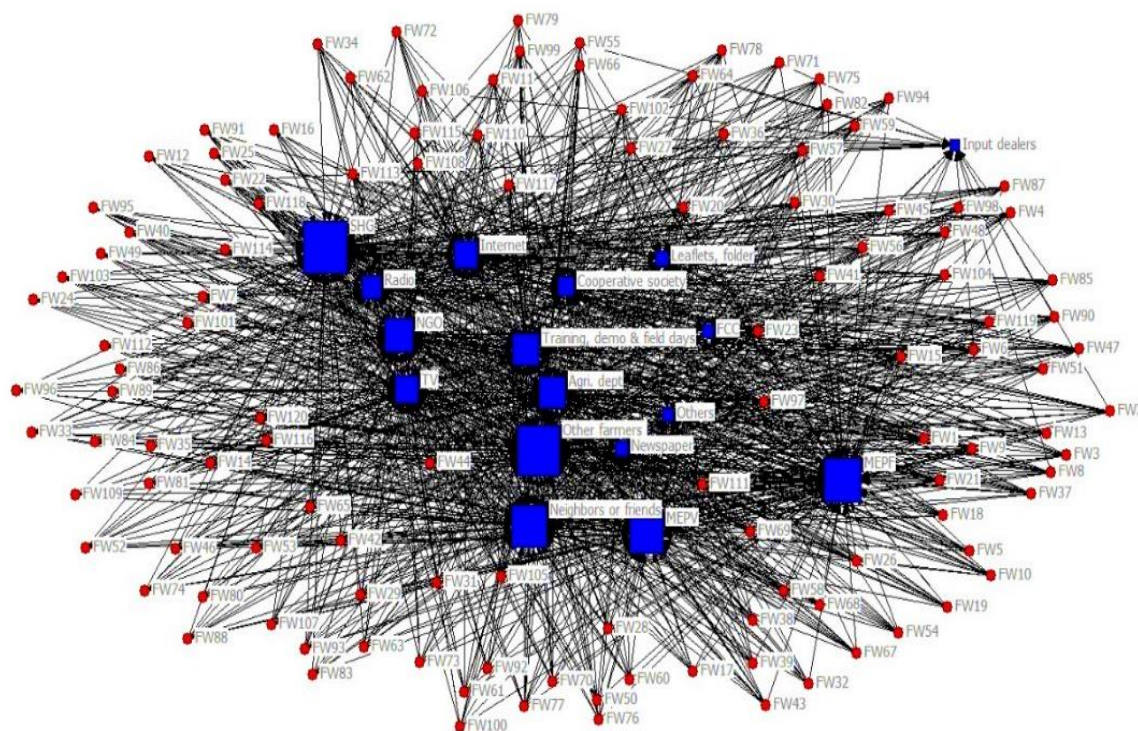
S.No	Information source	Tribal			Coastal		
		Degree	Betweenness	Closeness	Degree	Betweenness	Closeness
1	Most educated person in family	117	1244.782	428.000	105	619.682	182.000
2	Most educated person in village	113	1156.704	436.000	111	672.502	170.000
3	Neighbors or friends	99	840.245	464.000	111	680.058	170.000
4	Other farmers (progressive, relative)	108	1048.649	446.000	112	702.494	168.000
5	Input dealers	24	43.676	614.000	103	556.272	186.000
6	Agriculture department	48	174.587	566.000	102	543.915	188.000
7	Farmers Call Centre	-	-	-	27	36.441	338.000
8	Radio	36	96.754	590.000	18	15.098	356.000
9	TV	36	98.850	590.000	120	813.493	152.000
10	News paper	-	-	-	42	89.988	308.000
11	Training, demonstration & field days	101	901.239	460.000	103	577.439	186.000
12	Cooperatives society	85	612.409	492.000	104	595.203	184.000
13	SHG	113	1146.634	436.000	120	813.493	152.000
14	NGO	74	431.311	514.000	67	225.730	258.000
15	Leaflets, Folder	31	73.775	600.000	39	78.944	314.000
16	Internet	22	39.331	618.000	102	568.116	188.000
17	Others (Micro finance organization, Bank)	12	12.055	638.000	55	150.133	282.000

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275 **3.2.4 Information sources and its value as perceived by the respondent**

276 The information value is based on the respondent's judgment of its potential benefit in uncertain
 277 times. As shown in Figure 11, tribal respondents information networks are less dense and more
 278 prominent within Self-Help Groups (SHGs), followed by other farmers, educated family
 279 members, friends, educated villagers, NGOs, the Agriculture department, and training or
 280 demonstration events (Table 7). TV is less central than the Internet, radio, cooperative societies,
 281 printed materials, newspapers, and financing organizations (Das and Chowdhury 2024),. Input
 282 dealers are the least-used information source. SHGs have the highest centrality as information

283 sources (Mahato, 2023), connecting 120 respondents, while only 20 women access Agri-allied
 284 information through input dealers due to their high closeness centrality.

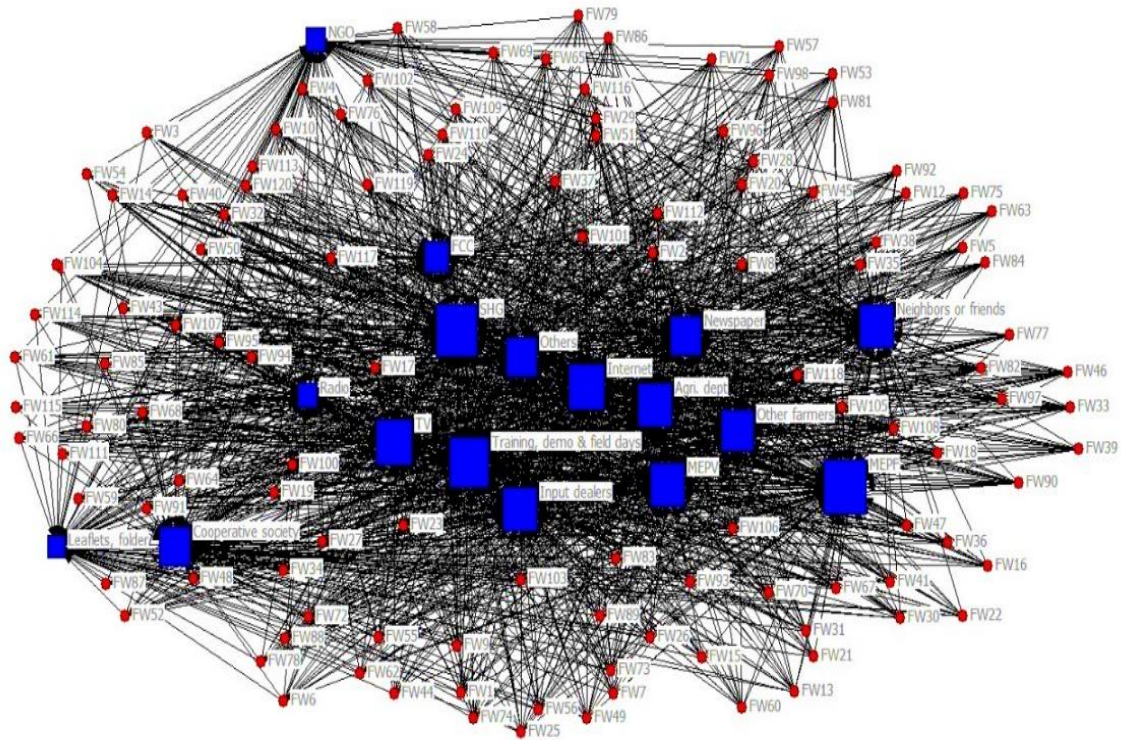


285
 286 **Figure 11.** Information network of Information sources and its value in relation to the TRIBAL
 287 respondents.

Note FW: Farm Women; MEPF: Most educated person in family; MEPV: Most educated person in village; Other farmers: (progressive or relative); Agri. Dept: Agriculture department; FCC: Farmers Call Centre

288
 289
 290 As shown in table 7, respondents in the coastal district networked the importance of
 291 information sources most densely in the case of the most educational person in the family,
 292 followed by SHG, Training, demonstration & field days, Internet, and TV. (Basak &
 293 Chowdhury, 2024). Agriculture department, most educated villager, neighbors or friends, input
 294 dealers, other farmers (progressive/relative), other information sources, newspaper,
 295 cooperative society, FCC, radio, and NGO have relatively low betweenness centrality.

296



297

298 **Figure 12.** Information network of Information sources and its value in relation to the COASTAL
 299 respondents.

Note FW: Farm Women; MEPF: Most educated person in family; MEPV: Most educated person in village; Other farmers: (progressive or relative); Agri. Dept: Agriculture department; FCC: Farmers Call Centre

300

301 Respondents utilize leaflets and folders least. The most educated member in the family is the
 302 most central information source, with 120 edges, meaning 120 respondents obtain knowledge
 303 from it. Leaflets, Folder has the highest closest centrality, thus only 63% of respondents use it
 304 for agri-allied information.

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Table 7. A comparative table of centrality measures of Information sources and its value in relation to the respondents (n= 240).

S.No	Information source	Tribal			Coastal		
		Degree	Betweenness	Closeness	Degree	Betweenness	Closeness
1	Most educated person in family	110	868.261	172.000	120	655.280	152.000
2	Most educated person in village	101	730.284	190.000	105	492.690	182.000
3	Neighbors or friends	106	806.080	180.000	106	485.250	180.000
4	Other farmers (progressive, relative)	117	1017.181	158.000	105	474.439	182.000
5	Input dealers	20	26.879	352.000	104	482.689	184.000
6	Agriculture department	87	536.987	218.000	106	499.325	180.000
7	Farmers Call Centre	28	53.309	336.000	82	288.100	228.000
8	Radio	69	319.433	254.000	66	186.751	260.000
9	TV	80	454.580	232.000	110	532.674	172.000
10	News paper	42	110.266	308.000	101	442.246	190.000
11	Training, demonstration & field days	86	525.064	220.000	114	585.606	164.000
12	Cooperatives society	56	208.727	280.000	100	430.886	192.000
13	SHG	120	1076.639	152.000	117	615.946	158.000
14	NGO	91	577.909	210.000	65	184.600	262.000
15	Leaflets, Folder	42	117.108	308.000	63	167.232	266.000
16	Internet	80	447.764	232.000	110	539.873	172.000
17	Others (Micro finance organization, Bank)	26	42.528	340.000	100	442.411	192.000

315

316 CONCLUSIONS

317 In Odisha, India, coastal and tribal agricultural women share information through their social
 318 networks. The study uses social network analysis to map networks and identify key sources. A
 319 trustworthy and efficient respondents information system can be created using the findings.
 320 Results suggest that coastal respondents use SHGs and tribal respondents consult the most
 321 educated family member. The study also reveals how social networks affect respondents'
 322 knowledge transfer. Using SHGs for collective participation, improving women's information
 323 networks, minimizing mobile phone use to reach women farmers owing to ownership and
 324 phone literacy concerns, and developing community information centers can bridge the gender
 325 gap in information transmission (Mahato, 2023). SNA enhances agricultural extension, gender
 326 equity, and rural sustainable development.

327 This study's focus on Odisha may limit its applicability to other cultural, socioeconomic, and
 328 agricultural situations. The study also uses Social Network Analysis (SNA) to understand
 329 network structure and key participants, however it may not fully capture qualitative
 330 components of information exchange, such as knowledge depth or source credibility.

331 Similar research and activities in other countries can use Self-Help Groups (SHGs), improve
 332 women's information networks, reduce mobile phone use, and create community information
 333 centers. This research affects countries and areas confronting similar issues in agricultural

334 information transmission, gender equality, Comparative Analysis in Different Cultural
335 Contexts, Policy Formation and Extension Services, and Gender Equality.

336

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340

341 References

342 1. Aral, S., & Dhillon, P. S. 2023. What (exactly) is novelty in networks? Unpacking the
343 vision advantages of brokers, bridges, and weak ties. *Management Science*, **69(2)**, 1092-1115.

344 2. Basak, D., & Chowdhury, I. R. 2024. Role of self-help groups on socioeconomic
345 development and the achievement of Sustainable Development Goals (SDGs) among rural
346 women in Cooch Behar District, India. *Regional Sustainability*, **5(2)**, 100140.

347 3. Bates, Marcia J. 2012. "Fundamental Forms of Information." *Journal of the American*
348 *Society for Information Science and Technology*, **57 (8)**: 1033–45.
349 <https://doi.org/10.1002/asi.20369>.

350 4. Borgatti SP, Everett MG, Freeman LC. 2009. "Ucinet for Windows: Software for Social
351 Network Analysis". *Harvard Anal Technol.*, 10.1111/j.1439-0310.

352 5. Correa, M. 2017. Report on workshop on enhancing capacities of women fish workers
353 in India for the implementation of the SSF Guidelines, 21–23 November 2016, Ashoka Hall,
354 Asha Nivas Social Service Centre, Chennai, India.

355 6. Das, A., Hota, A., Midya, D. K., & Samanta, R. K. 2020. Empowerment of women
356 through Self Help Group (SHG): An anthropological study. *Antrocom: Online Journal of*
357 *Anthropology*, **16(1)**.

358 7. Das, G., & Chowdhury, S. 2024. Information Network Assessment of Farm Women in
359 Sub-Himalayan Terai Region of India and the Role of KVK. *Journal of Experimental*
360 *Agriculture International*, **46(8)**, 63-94.

361 8. De Nooy, Wouter, Andrej Mrvar, and Vladimir Batagelj. 2011. "Exploratory Social
362 Network Analysis with Pajek". doi:10.1017/cbo9780511996368.

363 9. FAO, 2019. "Women's access to rural finance: challenges and opportunities, *Food and*
364 *Agriculture Organization of the United Nations, Rome, Italy.*," License: CC BY-NC-SA 3.0
365 IGO."

- 366 10. Figeac, J., & Favre, G. 2023. How behavioral homophily on social media influences
367 the perception of tie-strengthening within young adults' personal networks. *New Media &*
368 *Society*, **25(8)**, 1971-1990.
- 369 11. Franz N, Piercy F, Donaldson J, Richard R, Westbrook J. 2010. "How farmers learn:
370 implications for agricultural educators." *J Rural Soc Sci.*, **25(1)**: 37–59.
- 371 12. Gava O, Favilli E, Bartolini F, Brunori G. 2017. "Knowledge networks and their role
372 in shaping the relations within the Agricultural Knowledge and Innovation System in the agro
373 energy sector. The case of biogas in Tuscany (Italy)". *J Rural Stud.*, **56**:100–13.
- 374 13. Hartwich F, Halgin D, Monge M. 2008. "How change agents and social capital
375 influence the adoption of innovations among small farmers. Evidence from Social Networks in
376 Rural Bolivia." IFPRI Discussion Paper; No.761. 10.5367/ 000000008784648889 ET- 00761.
- 377 14. Jagriti, R., Nirmala, G., Beevi, A., Shankar, K. R., Nagasree, K., Pankaj, P. K., ... &
378 Singh, V. K. 2021. Structural analysis of social network among farmers for information
379 acquisition in rainfed areas: A study on farmers' information acquisition dynamics. *Indian*
380 *Journal of Extension Education*, **57(1)**, 1-6.
- 381 15. Jeeva, J. C., Moharana, G., & Joshi, K. 2020. Gender differences in information needs
382 and communication behaviour among the tribal farm families in Odisha, India. *Journal of*
383 *Global Communication*, **13(1)**, 1-9.
- 384 16. Kassie, Menale, Moti Jaleta, Bekele Shiferaw, Frank Mmbando, and Mulugetta
385 Mekuria. 2013. "Adoption of Interrelated Sustainable Agricultural Practices in Smallholder
386 Systems: Evidence from Rural Tanzania." *Technological Forecasting and Social*
387 *Change*, **80(3)**:525–40. <https://doi.org/10.1016/j.techfore>.
- 388 17. Kekulandala, B., Cunningham, R., & Jacobs, B. 2023. Exploring social networks in a
389 small tank cascade system in Northcentral Sri Lanka: First steps to establishing adaptive
390 governance. *Environmental Development*, **46**, 100847.
- 391 18. Kumar, T. 2021. Mobile technology for agricultural extension in Odisha. *Journal of*
392 *Mobile Technology*.
- 393 19. Kolleck N. 2013. "Social network analysis in innovation research: using a mixed
394 methods approach to analyze social innovations." *Eur J Futur Res*; **1(1)**:25.
- 395 20. Magnan N, Spielman DJ, Gulati K, Lybbert TJ. 2015. "Information networks among
396 women and men and the demand for an agricultural technology in India." In: IFPRI Discussion
397 Paper; No. 01411.

- 398 21. Mago, S. 2012. The Impact of Information and Communication Technologies (ICTs) on
399 Rural Livelihood: The Case of Smallholder Farming in Zimbabwe (Doctoral dissertation,
400 University of Fort Hare).
- 401 22. Mahato, T., Jha, M. K., Nayak, A. K., & Kaushal, N. 2023. Empowerment of women
402 through participation in self-help groups: a bibliometric analysis and systematic
403 review. *Journal of Enterprising Communities: People and Places in the Global*
404 *Economy*, **17(6)**, 1511-1538.
- 405 23. Msofi Mgalamadzi, L., Matita, M., & Chimombo, M. 2024. The gendered nature of
406 household decision making and expenditure choices in the context of smallholder agricultural
407 commercialization in Malawi. *CABI Agriculture and Bioscience*.
408 <https://doi.org/10.1186/s43170-024-00270-x>
- 409 24. Nasiri, E., Berahmand, K., Samei, Z., & Li, Y. 2022. Impact of Centrality Measures on
410 the Common Neighbors in Link Prediction for Multiplex Networks Big Data.
411 <https://www.semanticscholar.org/paper/44fe2f790b84376817b7d710b34444366f9e9870>
- 412 25. Nyambo B, Ligate E. 2013. "Smallholder Information Sources and Communication
413 Pathways for Cashew Production and Marketing in Tanzania: An Ex-post Study in Tandahimba
414 and Lindi Rural Districts, Southern Tanzania." *J Agric Edu Ext.*, **19**:73–92.
- 415 26. Oktarina, S., Sumardjo, S., Purnaningsih, N., & Hapsari, D. R. 2020. Activities of
416 farmer women groups in utilizing digital communication media in urban farming activities in
417 Bogor City. *International Journal of Progressive Sciences and Technologies (IJPSAT)*, **19(1)**,
418 241-249.
- 419 27. Panda, S. 2020. Climate change and women farmers: A comparative analysis.
420 *Environmental Studies Journal*, **12(4)**, 45-60.
- 421 28. Pramila Krishnan MP. 2012. "Neighbours and extension agents in Ethiopia who matters
422 more for technology diffusion? International Growth Centre." Working paper; No. DP9539.
- 423 29. Pritiprada, P., Satpathy, I., Patnaik, B. C. M., Patnaik, A., & Khang, A. 2023. Role of
424 the Internet of Things (IoT) in Enhancing the Effectiveness of the Self-Help Groups (SHGs) in
425 Smart City. In *Smart Cities*, **183-203**.
- 426 30. Ramirez A. 2013. "The Influence of Social Networks on Agricultural Technology
427 Adoption." *Procedia- Soc Behav Sci*; **79**:101–16. <https://doi.org/10.1016/j.sbspro>.
- 428 31. Reed G, Hickey GM. 2016. "Contrasting innovation networks in smallholder
429 agricultural producer cooperatives: Insights from the Niayes Region of Senegal." *J Co-Op*
430 *Organ Manage*; **4(2)**: 97–107.

- 431 32. Thuo, M., Bell, A. A., Bravo-Ureta, B. E., Okello, D. K., Okoko, E. N., Kidula, N. L.
432 Puppala, N. 2013. "Social Network Structures among Groundnut Farmers." *The Journal of*
433 *Agricultural Education and Extension*, **19(4)**, 339–359.
434 <https://doi.org/10.1080/1389224X.2012>.
- 435 33. Taylor, S. and Boubakri, N. 2013. "Women and finance: unlocking Africa's hidden
436 growth reserve." In *Financial Inclusion in Africa* (eds Triki, T. and Faye, I.), *African*
437 *Development Bank Group, Tunis, Tunisia*, pp. 75–83.
- 438 34. U. Devi. 2024. [PDF] Farm Women Preferences of Communication Sources for Farm
439 Information | *Semantic Scholar*. [semanticscholar.org](https://www.semanticscholar.org).
- 440 35. V.M.Bankapur, & Bhavanishankar Naik, B. 2018. Information needs and seeking
441 behaviour of farmers in bhutaramanahatti village of belagavi district in karnataka state: a study.
442 *Journal of Emerging Technologies and Innovative Research*.
443 <https://www.semanticscholar.org/paper/789df2f1d4731c529a7115593b1715e04aba00fb>
- 444 36. Weyori AE, Amare M, Garming H, Waibel H. 2017. "Agricultural innovation systems
445 and farm technology adoption: findings from a study of the Ghanaian plantain sector." *J Agric*
446 *Educ Ext*:1–23.
- 447 37. Young HP. 2009. "Innovation diffusion in heterogeneous populations: Contagion,
448 social influence, and social learning." *Am Econ Rev*; **99**:1899–924.
- 449 38. Yu, Q., & Gambrah, P. P. 2024. Information Network Among Farmers: A Case Study
450 in Ghana. *SAGE Open*, **14(1)**, 21582440241228696.

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