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Social Capital of Rice Farmers in Andhra Pradesh and Kerala: A Social Network Analysis

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HIGHLIGHTS

- Rice farmers of Kerala had higher social capital than those of Andhra Pradesh, specifically in bridging and linking capital
- Bonding capital across both regions was low, indicating a lack of peer-to-peer interactions
- Andhra Pradesh farmers sourced information heavily from input dealers, while Kerala farmers relied on government institutional sources

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ABSTRACT

The study explored the social capital among the rice farming communities, which is crucial in the context of climate change for building their resilience. The study was conducted in the South Indian states of Andhra Pradesh (AP) and Kerala during 2023. Primary data were collected from 120 farmers using a pretested schedule. Three social capital measures, viz., bonding capital, bridging capital, and linking capital, were analysed using social network analysis of the information sourcing and support networks of farmers. The results revealed relatively higher social capital among the farmers of Kerala than those of AP. Networks of both states had lower bonding capital, explained by lower density, moderate closeness centrality, and moderate modularity values. In the case of bridging and linking capital, Kerala regions had relatively higher levels than AP, explained by their in-degree centrality and betweenness centrality. The network maps also revealed greater reliance on input dealers for information in AP regions, whereas Kerala farmers relied on institutional sources. The results call for improving the bonding capital of all regions and the bridging and linking capital of AP farmers to expand their overall resilience.

INTRODUCTION

Agri-food systems involve complex interactions throughout the series of activities such as production, processing, retailing, and consuming, along with environmental and societal contexts under which all the activities occur (Ingram, 2011). All such interactions involve and lead to the building of social capital of the communities, which is defined as the "features of social organisation, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions" (Putnam, 2000). With climate change affecting agri-food systems all over the world, the concept of enhancing resilience has gained prominence as a policy tool both at national and international levels (European Commission, 2020). Enhancing the resilience of farming systems is featured in six out of the seventeen Sustainable Development Goals of the United Nations that are targeted to be achieved by 2030.

In the context of enhancing resilience, the sustainable livelihood framework emphasises the pentagon of assets, natural, human, physical, social, and financial (DFID, 1999). Social capital, however, plays a higher role as it influences the circulation and accumulation of all the other assets. Social networks, which constitute social capital, play varied positive roles in enhancing and building the

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resilience of communities (Aldrich, 2012; Jordan, 2015; Cui & Li, 2020; Chaudhuri et al., 2021). Social networks among farmers were found to be beneficial in developing countries where rural education and extension services have yet to reach the last mile (Ma et al., 2014). They increased farmers' access to information on sustainable agricultural practices (Niranjan et al., 2023) and helped the extension agents to transfer the information to the entire network. Social networks of the farming communities enable knowledge diffusion and resource sharing, facilitate collective action, and improve social support, which altogether strengthen the capacity to cope with any challenges (Esparcia, 2014; Henry & Vollan, 2014; Rockenbauch & Sakdapolrak, 2017; Chapman et al., 2018; Nain et al., 2019).

In India, rice is the single largest crop grown with around 46 million hectares (GoI, 2023), underlining the importance of ensuring resilience among rice farming communities. India also occupies a vital role in the global rice supply chain by contributing around 40 per cent to the global rice exports. While existing research evidence highlights the important role of social capital in agriculture, gaps prevail in mapping the underlying structures and understanding the flow of resources among the farming communities. Informal social connections and their interplay with formal connections are vital in agriculture for technology dissemination, adoption and diffusion. Thereby, this study attempts to address these gaps by mapping the structure of rice farmer social networks and understanding its dynamics to leverage the networks to improve the resilience of farmers.

METHODOLOGY

The research was conducted in the South Indian states of Kerala and Andhra Pradesh (AP) during 2023. Within the selected states, districts were chosen based on the criteria of natural disaster proneness and area under rice cultivation (Rao et al., 2019). Accordingly, districts with a high risk of flooding (East Godavari, Thrissur) and drought (Kurnool, Palakkad) were purposively selected for the study. Villages with the highest area under rice in all four districts were taken for the study. As these villages are majorly dependent on rice farming, they have established information and support networks and study of such villages allows for scaling and replicating of interventions in other rice growing regions. Random sampling was used in selection of 30 farmers from each village and they were surveyed using a semi-structured interview schedule, making a total sample of 120 farmers. Also, given the relatively homogenous farming communities, the sample of 30 farmers per village gives a statistically representative cross-section of the village networks while also allowing for gaining comprehensive qualitative insights. The schedule included questions related to information sourcing networks and emotional support networks of farmers. The data was generated through the name generator technique, where each farmer can recall and list down the individuals they approached for accessing information and the persons from whom they seek emotional support without any limit of number of names since the preceding two cropping seasons. (Hampton, 2011). GEPHI software with version 0.10.1 202301172018 was used for the analysis and mapping of the data collected. Maps were developed using the ForceAtlas 2 layout format in the software.

Social capital was assessed using the framework developed by Aldrich (2012) that measures resilience in terms of bonding, bridging, and linking social capital. Bonding social capital represents close-knit ties between people similar in terms of socio-economic characteristics, attitudes, and resources living in close proximity (family, friends) (Putnam, 2000). Weak formal connections that link different communities or groups, providing access to external resources and knowledge beyond the immediate community, relate to the bridging social capital (Cofré-Bravo et al., 2019). Linking social capital provides access to resources and information unavailable through inside channels through formal connections with powerful institutions or individuals. It is often seen as a vertical link between a network and some form of authority or influence in the social context (Szreter, 2004; Aldrich, 2012). Communities with higher levels of bonding, bridging, and linking social capital are assumed to be more resilient than those with only one type of social capital or none (Woolcock & Narayan, 2000; Elliott et al., 2010; Aldrich, 2012).

In measuring the social capital, various SNA metrics were used. Density is the ratio between the total number of actual ties and potential ties in a network. High density in the network was found increase the chances of collaboration among the actors of community (Olsson et al., 2004; Luthe et al., 2012), increase the access to information sources and its spread and has a positive influence on social support and strengthens the trust among the actors in the network (Granovetter, 1973; Pretty & Ward, 2001). Closeness centrality is the reciprocal of the geodesic distance of a node to other nodes in the network (Golbeck, 2013). Closeness in a network influences the speed of information spread and also the efficiency in the spread of information (Elkady et al., 2023). Modularity is the strength of network division into different clusters (Prokhorenkova et al., 2016). Clusters, when present, can hinder the aspects of collaboration, dividing the network into many subgroups (Granovetter, 1973; Bodin et al., 2006). All three measures, density, closeness centrality, and modularity, are widely used in assessing the bonding capital of networks (Putnam, 2000; Woolcock & Narayan, 2000).

Betweenness centrality is the frequency with which a node lies in the geodesic path between two other nodes in a network (Perez & Germon, 2016). It is used in the identification of important actors and actors that may hinder the capacities of the network (Green et al., 2012). It also indicates bridges whose absence can disrupt the whole network and maintains heterogeneity in communities to avoid redundancy (Borgatti, 2003; Elkady et al., 2023). In-degree centrality is the total number of all the inward ties linked to an actor from other actors in the network (Guzman et al., 2014). In-degree value reveals the influential actors in the network (Srinivas & Velusamy, 2015), also facilitates coordinated action among central actors. However, it can also result in uneven distribution and influence on the network (Luthe et al., 2012). Granovetter (1973) and Lin (2002) describe betweenness centrality and in-degree centrality as measures for assessing the bridging capital in networks.

Linking capital was assessed by using the presence of various vertically linking actors such as formal institutions, political leaders, and other formal organisations (Woolcock & Narayan, 2000)

RESULTS

Information networks of rice farming systems

Figure 1 reveals the information networks of rice farmers in selected study locations. The maps were created using the in-degree centrality metric, and the size of the circles was scaled proportionally to their respective in-degree values.

In the information networks of Kerala regions, the panchayat-level government agricultural office, Krishi Bhavan, emerged as the primary information source with the highest in-degree values of 50. Other institutional actors that played significant roles are Kerala Agricultural University (KAU) with an in-degree of 23 and Krishi Vigyan Kendra (KVK) with an in-degree of 17. Along with these institutional actors, input dealers with an in-degree of 16 and a few farmers were the other critical actors in the network. Farmers with anonymized ID numbers 133, 105, 101, 10, and 47 emerged as influential actors with in-degree values more than 5. In-degree threshold of 5 was chosen as it allows for isolating the most sought-after actors from the average actors. Silva (2023) also emphasised the presence and importance of such opinion leaders in farmers networks for information sourcing.

In the regions of AP, input dealers emerged as the primary information source with an in-degree value of 27. Following input dealers, Rythu Bharosa Khendra (RBK), a government agricultural office, had a higher in-degree value of 16. Other prominent actors in the AP region are the National Disaster Management Authority (NDMA) with value 11 and the Reliance Group with value 5 provided information to farmers through mass media, specifically SMS and direct farmer calls respectively. Farmer with ID number 105 was found as an opinion leader with an in-degree value of 5.

Emotional support networks of rice farming systems

Figure 2 shows the emotional support networks of both states, which play a critical role in the farmers' community resilience, especially during natural hazards. It could be observed from the figure that in both regions, family followed by friends are the principal supporting actors. In AP, the family had an in-degree of 44, followed by friends with in-degree of 28. RBK with value 13 and landlords with value 5 were other important supporting actors to farmers. In Kerala, family had a value of 29, followed by friends with value 24. However, the Kerala network also had the presence of other actors such as Padashekaram members (21), Krishi Bhavan

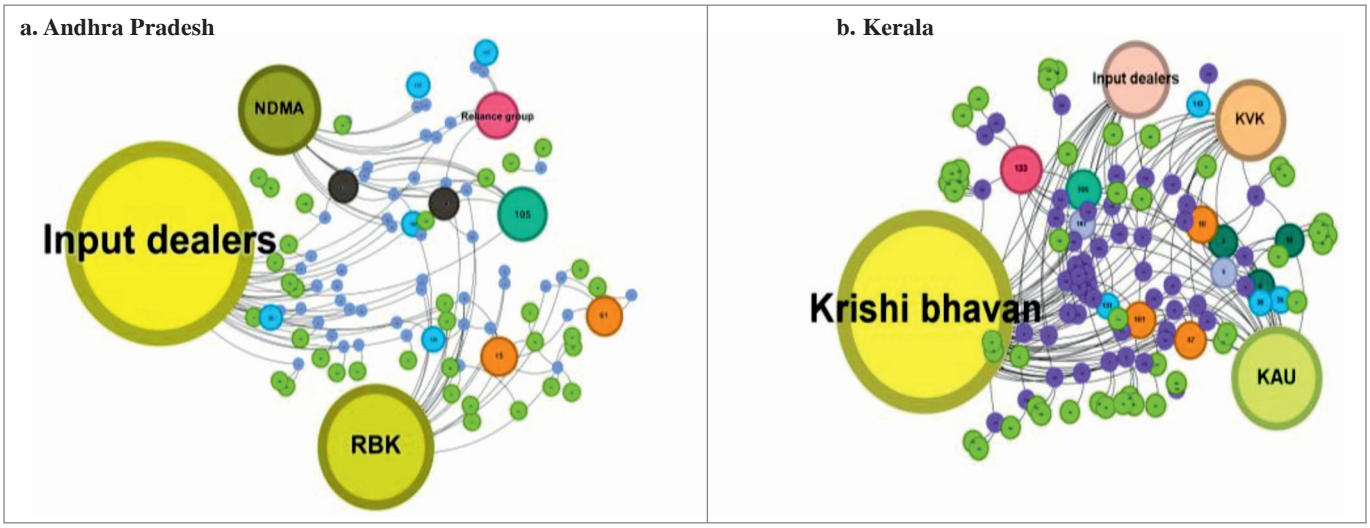

Figure 1. Information sourcing network map of rice farmers of Andhra Pradesh and Kerala regions

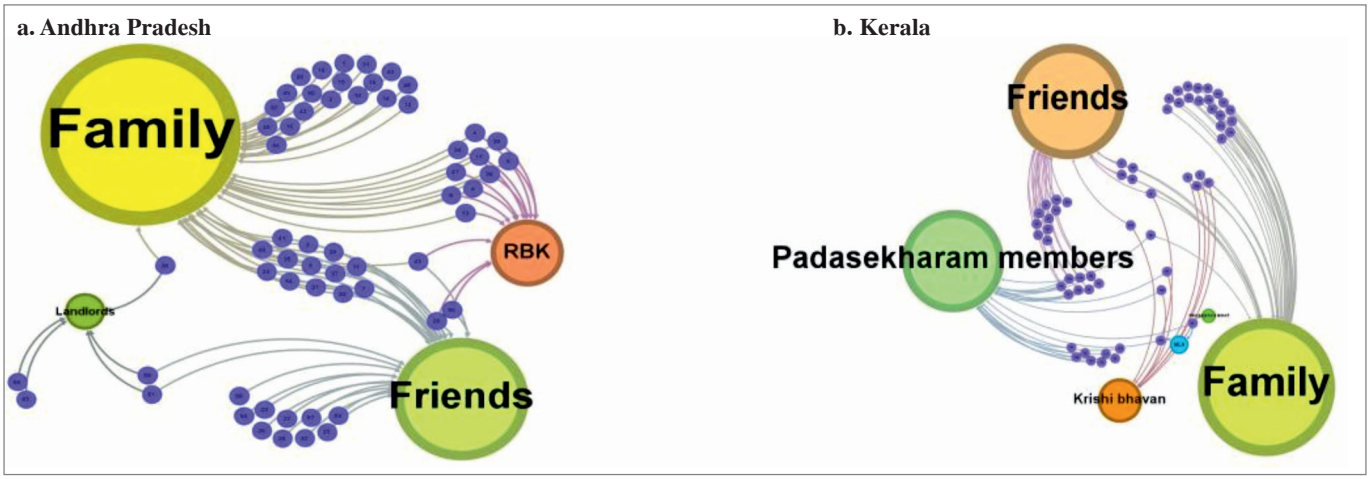

Figure 2. Emotional support network map of rice farmers of AP and Kerala regions

(8), MLA (2) and Panchayat President (1). Results show that farmers in Kerala relied on diverse set of actors while AP farmers relied heavily on a close-knit family and friends for support.

Social capital of the rice farming systems

The network linkages between actors and the centrality measures derived from SNA were used to categorise the social capital into three levels: bonding, bridging, and linking capital.

Table 1. Network properties of information networks of AP and Kerala rice farming systems (n=120)

Network properties	Andhra Pradesh	Kerala
Density	0.012	0.016
Closeness centrality	0.538	0.463
Modularity	0.629	0.398
In-degree centrality	1.215	1.80
Betweenness centrality	2.04	1.377

Network properties of the information networks of rice farmers of both states are represented in Table 1. Bonding capital of the networks was assessed based on the measures of density, closeness centrality, and modularity. Kerala network had a relatively higher density value of 0.016 than the AP network, which had a value of 0.012. Both the networks had less than two per cent of the total possible connections, indicating the presence of scarce connections among the farmers. In closeness centrality, both the regions had moderate closeness with values 0.538 and 0.463, respectively in the AP and Kerala regions. Moderate closeness implies the possibility of a delay that may occur in information dissemination. In modularity, AP had a higher value of 0.629, while Kerala network had a value of 0.398, indicating less fragmented networks than AP networks. The AP network had relatively higher cliques that interact more among themselves and less with other cliques, which could also be the reason for less density.

The bridging capital of the communities was assessed using the in-degree centrality and betweenness centrality measures. In in-degree centrality, the Kerala region had a higher value of 1.8 than the AP region, with a value of 1.215, indicating that the Kerala region had more influential actors. The results indicate that farmers in the Kerala network had multiple actors whom they could rely on for any need, while AP farmers relied on a few influential actors. In the case of betweenness centrality, the AP region had a higher value of 2.04, while the Kerala region had a value of 1.377. A higher value of AP indicates higher dependence on a few actors for information flow, who can act as gatekeepers of information.

Linking capital was assessed based on the number of linking actors present in both regions, both in information and emotional support networks. Institutional actors present in the Kerala region were KVK, KAU, Krishi Bhavan, MLA, and Panchayat President. In the case of AP regions, RBK, NDMA, and the Reliance group were the only prominent linking actors. Based on the in-degree values of institutional actors, Kerala network exhibited stronger links with a total of 93 ties, while AP had only 32 such ties. A higher number of ties ensures that information, even if not reached through a specific actor, will arrive through the other actors. Such a wide association with formal institutions can assist the governments in understanding the local capacities of communities to deal with any stresses and their further needs to increase their resilience (Carmen et al., 2022).

DISCUSSION

The study reveals key differences in the rice farmers social networks between the both states of AP and Kerala. Kerala farmers preferred government agencies for information due to their long-established trust and the presence of Padasekhara Samithies that brokered institutional ties through various meetings. The results of Kadeejabanu and Vishnupriya (2021) also revealed that 98 per cent of the farmers visited Krishibhavans to source information. However, in AP, the absence of agricultural government agencies at the village level till the recent establishment of RBK's in 2020 pushed the farmers to rely more on input dealers. In support networks, family and friends were the primary actors in both regions due to their physical proximity and everyday interactions. However, in Kerala, there is a wider presence of other institutional actors, which is limited in AP regions. The presence of MLA and Panchayat President as actors in the networks of Kerala was due to the presence of Padasekhara Samithies, whose leaders were acting as bridges connecting farmers. Such links connect the in the AP region, the presence of landlords in the network is due to the prevailing nature of tenant farming in the region of East Godavari (Revathi, 2014). Tenant farmers, being resource-poor, source financial and other resources from landlords.

Social capital assessed using SNA metrics shows relatively higher levels in Kerala than in AP farmers. However, the bonding capital of both the regions was found to be less, primarily due to fewer interactions between the farmers and presence of cliques. Dense connections within the network reportedly increase the social support available to all the members and also increase their adaptation levels to extreme weather events (Cassidy & Barnes, 2012; Béné et al., 2016; Yadav & Ghosh, 2023). Thereby, increasing connections by organising of farmers into groups and increasing their interactions through regular meetings is essential. In the case of betweenness centrality, network in which actors have higher betweenness centrality values can exert control over the information content and its flow (Elkady et al., 2023). Such control when exerted significantly by profit seeking actors such as input dealers, can be harmful. It is essential to increase the reach of governmental institutions in AP regions to serve the needs of farmers. Also, there was higher presence of opinion leaders in Kerala regions which lacked in AP regions. This can be attributed to the presence of Padasekharam Samithies, which facilitates the emergence of leadership among farmers. These opinion leaders improve the interconnections in the network by acting as bridges for information dissemination (Centola, 2010; Singh et al., 2023). Lack of such farmer groups and opinion leaders in AP region hinders them from forming consistent connections with formal institutions and leaders, leading to their lower linking capital.

While the study reveals critical insights into the social capital of rice farmers, certain limitations should be acknowledged. As the data was collected at a single point of time, only a cross-sectional representation of networks were captured. However, social networks are dynamic and evolve over time. RBKs of AP will likely

expand their reach to farmers, which could be effectively captured using longitudinal research. Also, the study was based on self-reported and recall data, which could have caused under-representation of infrequent ties.

CONCLUSION

The study was conducted to explore into the social capital of rice farmers. Results revealed that the regions of Kerala had relatively higher levels of social capital, compared to those of AP. While bonding capital was low in both regions, Kerala networks showed stronger bridging and linking capital through the presence of multiple opinion leaders and institutional actors. The difference can be attributed to the wider presence of Krishi Bhavans and Padasekharam Samithies, which together fostered the emergence of opinion leaders and created a platform for linking farmers with government leaders and institutions. In AP, a higher reliance on few key actors, particularly input dealers, and less presence of institutional actors limited their social capital. Organising AP into farmer-producer groups and facilitating the emergence of leadership could enhance their social capital. Also, RBKs need to increase their rapport with farmers and increase their role in information dissemination. Wider presence of input dealers in the farmer networks could be effectively leveraged for providing advisory services by training them to become para-professionals.

DECLARATION

Competing interests: The authors declare no competing interests.

Ethical consideration and consent to participate: Informed consent of the participants.

Conflicts of interest: The authors declare no conflicts of interest.

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