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## **A Relational Understanding of Co-Educating and Learning: Information Sharing and Advice Seeking Behavior in a Dairy Cooperative in Gujarat, India**

### **Abstract**

This article, building on the 5<sup>th</sup> principle of the Statement of the Cooperative Identity explores the practice of co-educating and learning behavior among the members of a dairy cooperative society. The study adopts a social network approach by focusing on two relational social ties: *information sharing and advice-seeking*. Building on a case of a 55-year-old dairy cooperative in India, the social network analysis finds *information-sharing* relations among members to be inclusive, with no members isolated, and information exchanged along formal and knowledge hierarchies. Likewise, information sharing is horizontal, with information smoothly exchanged even among new and already established members, as is the transfer of leadership roles from the older members of the cooperatives to the younger members. *Advice-seeking* networks tend to be a bit more centralized toward board members and members exerting day-to-day leadership because of their knowledge and expertise regarding the organization and its policies. Our analysis suggests inclusive information sharing among members and a well-structured and functioning advice and knowledge-sharing network that contributes to learning of the cooperative members.

**Keyword:** Co-Education, Co-Learning, Dairy Cooperative, Information Sharing, Advice Seeking, Social Networks

## 1. Introduction

The paper explores structural properties of co-education and learning relationships within a Dairy Cooperative Society (DCS) at a village<sup>1</sup> based community-managed collective enterprise in Central Gujarat, India. Gujarat's dairy cooperatives are universally acknowledged as successful community-managed enterprises (Attwood and Baviskar 1987; Cunningham 2009). The success of Gujarat's dairy cooperatives is a consequence of the small and marginal dairy producers banding together as collectives (World Development Report 2008; Vandeplas, Minten, & Swinnen 2013). We base our arguments for cooperative education and learning in this paper on the 5<sup>th</sup> principle of the 'Statement of Cooperative Identity (ICA, 2015). Education and learning for cooperative stakeholders is gaining traction after decades of neglect (MacPherson, 2008: 17). Experience suggests that education and training are critical for enhancing a cooperative's success (Miner and Guillotte, 2014; FAO, 2016; Anania and Rwekaza, 2018). The Guidance Note on the Statement of Cooperative Identity (ICA, 2015), while discussing the 5<sup>th</sup> principle, advocates that the “*cooperatives provide education and training for their members, elected representatives, managers and employees*” (p. 58). The Guidance Note highlights the cooperatives' formal education and training programs for members, leaders, and workers, and argues “*that a definite percentage of profits should be allotted to education*” (p.57). Additionally, the note urges a greater emphasis on cooperative research and a push for cooperative education to be included in the national curriculum (p. 65, 67).

In other words, the 5<sup>th</sup> principle argues for a dual approach to education: education inside cooperatives and education for the broader public (Miner, 2016). Both approaches overemphasize organizational learning processes (awareness, orientation, and training programs). Top-down, administrative (or bureaucratic) attempts to educate and train stakeholders ignore the natural inclination of cooperative members. There is no denying that formal education and training efforts add to a cooperative's management competency (Tuominen, Jussila and Rantanen, 2010). However, formal education (courses, training, orientation programs) is individualized and cannot be transmitted to peers without an expert's help. The demand for top-down educational efforts grows with more members, leaders, and stakeholders joining the cooperative. Formal education alone cannot equip its members and leaders to utilize know-how and social resources including social capital and mutual trust (Shapira, 2013). The trust on fellow cooperative members, local knowledge, the social environment, and individual qualities are all necessary components of cooperative members' co-education (Fine and Harrington, 2004). As a corollary, it is critical to acknowledge the importance of co-education. Co-education is defined in this context as the process of co-learning or co-creation of knowledge via the use of social context, social embeddedness, and structural characteristics of social networks (Rustinsyah, 2019). Co-education, in the context of this study, refers to collaborative learning facilitated by reciprocal knowledge generation and exchange (Okada *et al.* 2015).

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<sup>1</sup> We maintain anonymity of the village as we discuss the role of few specific individuals who hold leadership positions in the DCS and can easily be identified.

In this study, we postulate that the social and organizational dynamics represented in members' relationship networks offer a platform for co-education and learning that extends beyond the cooperative management's official education and training mechanisms. By assessing the DCS members' 'information sharing' and 'advice seeking' relationships, this research focuses on informal learning behaviour. While information sharing allows members to acquire new opportunities and knowledge about the organization's operation (Savolainen, 2017), advice seeking enables members to gain technical and strategic insights on a mutual basis. Advice seeking is the transmission of particular information from people who possess it to others who do not (Hendriks, 1999). Both information sharing and advice seeking are critical components of organizational co-education and learning. Significant choices in a communal collective, such as DCS, become inclusive when the relevant information is accessible by a large number of people (Galbraith, 1971). Hence, information sharing is crucial to fostering cooperative education among cooperative members. Undoubtedly, information and advice are critical components of an organizational learning ecosystem (Jarvinen and Ylinenpaa, 2017; Borgatti and Cross, 2003; Huber, 1991), which are practised in accordance with the organization's structural properties (social capital, trust, reciprocity).

We have investigated the DCS using a social network approach. Social networks are often regarded as critical factors in the development of collective action-based enterprises (Marwell *et al.* 1988; Siegel 2009). We explored two distinct forms of member-to-member relational networks (information sharing and advice seeking), which include four distinct types of relationships (ties) between DCS members. We investigated information exchange among DCS members about personal dairying practices and DCS operations. Daily personal dairying techniques include incorporating mineral blends in cattle feed and balancing diets while preserving animal health, milk quality, animal care, and sanitation. Measurement of milk quality, prices/rates set by DCS, frequency of payment to members who sell milk via the DCS, scheduling of milk collection, input services provided by the DCS to its members, and decisions taken at governing and general body<sup>2</sup> meetings are examples of DCS-related concerns. The second type of social network is related to *seeking advice* while distinguishing between personal *dairy issues* and *DCS issues*.

By elucidating the patterns of information sharing and advice seeking inside the DCS, this research can highlight the importance of co-learning and knowledge sharing practices in community-organized collective activities. Since these relationships also reflect the organization's structural characteristics, the research results may also offer insights into the organization's overall structural cohesiveness, which has practical consequences for cooperative managers and contributes to the academic literature on cooperatives, collective actions, and social capital.

## **2. Literature Review**

### ***2.1 Co-Education and Learning in Cooperatives***

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<sup>2</sup> General body comprises all members of the DCS and meets annually.

The practice of co-educating and learning in organizations, including collection actions, has been studied from the organizational knowledge management perspectives (Polanyi, 1958; Nonaka, 1994), where knowledge sharing is considered as a social process (Nonaka and Takeuchi, 1995) and take place in 'explicit' (organizational and formal) and 'tacit' (personal and informal) ways (Polanyi, 1966). Empirical studies have confirmed these practices. Spielman *et al.* (2011) find that social interactions between the members of an organization generally contribute to the practice of co-education and learning in the organization. Cross *et al.* (2003) find out that high level (positive) social capital promotes learning within the organization by creating social interaction-driven energies among the members of the organization. Ghauri *et al.* (2021) find in a study of small and medium enterprises-based cooperatives that individuals involved in small businesses in the isolated regions attach significant value to knowledge sharing and collaboration with other members as they see it as a benefit. Stressing upon the need of horizontal (member to member) interaction and sharing of innovation, Read and Hickey (2016) find out that vertical sharing (between power hierarchies) of innovations in the cooperatives were controlled by a few actors and created gaps in the prospects of members adopting the innovations.

The mechanism of co-education and learning in an organization is mainly dependent on organization's ability to generate social capital and members' ability to use the capital for mutual learning (McElroy *et al.* 2006). Hoffman *et al.* (2005) find that organizations with greater social capital have a higher learning environment. The major elements of social capital are norms, trusts, rules and beliefs (Coleman, 1990; Putnam, 1993). These elements result in reciprocity and embeddedness, where reciprocity promotes learning and develop 'greater trust' among the members (Flynn, 2003), and embeddedness ensures long term relations between the individuals (Granovetter, 1985). Lang (2004) brings social context for human interactions as a relevant factor that determines the nature of co-education and learning; the context may facilitate such learning or hinder it. Nahapiet and Ghosal (1998, p. 250) observes that learning processes are 'complex social processes' and are 'socially embedded', hence contextual configuration of social interaction would be important to understand in a study of intra-organizational co-education and learning processes. Dhananjay *et al.* (2019)'s Three-Dimensional Framework on cooperative underlines the theoretical position that members of a cooperative do consider the non-financial aspects while evaluating their association with the cooperative. Hence the factors such as social capital get substantial attention in cooperative functioning.

## **2.2 Information Sharing**

Information sharing is a fundamental characteristic of collective action (Ostrom, 1998). Scholars of rational choice theories consider information a social capital "resource," which is a product of "interaction between rational agents" (Woolcock 1998: 156). Information sharing is critical to foster the learning of the actors in the network and to enable them to mitigate the risks (Sligo and Massey 2007). Information sharing is about "who shares what with whom" and the state of communication among the members of a network. Communication allows actors to determine their trust in and the reliability of other members (Ostrom 1998 p. 13). This determination is particularly important when members of a cooperative must consume information as practitioners (farmers or workers in their

occupations) and also as managers of the collective action (Sligo and Massey 2007). Information sharing also helps the cooperative build bonding social capital that is an important capital for a collective action to sustain (Tenzin and Natsuda 2016).

A dairy cooperative, conceptually, requires having an effective communication system for effective internal governance, and for this reason, leaders of cooperatives have important roles in the delivery and management of information (Ling 2012). Some studies (Bodin and Crona 2009; Pretty and Ward 2001) have found high network density in information-sharing networks conducive for collective action because it offers increased possibilities of communication, reciprocity, and trust among actors within the network. Additionally, links to "external actors" are crucial in bringing in "new" information. However, the positive association between the density of a network and the potential for collective action is not necessarily limitless because if networks become excessively dense, there tends to be a "*homogenization of information and knowledge which results in less efficient resource use and/or reduced capacities to adapt to changing conditions*" (Bodin and Crona 2009: 368).

### **2.3 Advice Seeking**

Cooperatives, similar to any social system, have advice-seeking ties that form a social ecosystem. Nebus (2006) develops a theory of "advice networks" where individuals who have valuable information or knowledge are purposefully contacted by individuals who seek information and advice. Keith *et al.* (2017) show that when there is little uncertainty involved in a task, members with similar characteristics and demographics are contacted for advice. However, if uncertainty is high, members that possess greater knowledge and resources are contacted for advice (Keith *et al.* 2017). Such members are positioned as "knowledge brokers" within the network (Jessani *et al.* 2016).

Seeking advice from peers of the same network depends on various shared characteristics of the advice seekers and advice sharers, for example, age, membership tenure, social status, and ethnicity (Xu *et al.* 2010). However, the formal role of the actors in the network is also an important factor. A study of mathematics school teachers' relationships with principals and coaches finds that the teachers who became coaches were more consulted than when they were teachers. This finding indicates that the teachers promoted to coach positions experience an elevation in their social status in the network and become more central in providing advice (Berebitsky and Andrews-Larson 2017). Zagenczyk *et al.* (2015) highlight the role of leaders and experts in advice sharing and find that the "high-trust advice ties" were very different from the "high-trust friendship ties" with the same leaders because "*friends are likely to share unproven ideas or opinions*" more than to share advice related to professional responsibilities (Zagenczyk *et al.* 2015, p. 114). Erdogan, Bauer, and Walter (2015) find that whether the leaders leverage their status in providing advice depends on their actions. The study establishes that leaders' "*high tendency to help their members*" and "*low tendency to gossip*" is "*positively related to advise network centrality*" (Erdogan, Bauer, and Walter, 2015). This means that the tendency to help others in providing requested advice is insufficient;

the advice must be coupled with leaders' tendency not to gossip, which would "*neutralize the effect of the tendency to help others*" (Erdogan, Bauer, and Walter 2015, p. 202).

The literature review presented in this section acknowledges social interactions and tacit knowledge-sharing practices among the community members and their importance in promoting collective and informal learning. The literature also stresses that an organization's ability to promote informal learning is based on the structural properties of member-to-member relations. Additionally, the review also establishes that information sharing and advice-seeking are the practices that reflect the member-to-member interactions as part of a broad ecosystem of learning and knowledge. Hence, the existing literature provides adequate support, and motivation for this study, for our argument that informal learning is an important medium for promoting co-education and learning in a community organization.

### **3. Methodology**

#### ***3.1 Study Setting: Organizational Setup and Network Boundaries<sup>3</sup>***

DCSs function in a three-tier structure that varies from the village level to the state level. The DCS is the lowest structure at the village level, where dairy farmers become a member (figure 1). The DCSs are federated in a district level organization, known as the District Milk Union (DMU), prefixed with the district's name. The DCSs collectively elect the members of the DMU's Governing Body (GB). DMUs procure milk from DCSs, process it further, and produce dairy products (e.g., packaged milk, milk powder, ice cream, butter). In addition to procuring milk from DCSs, DMUs also help DCSs set up their structures, accumulate assets, provide input services, and build the capacity of the DCS. The third tier is a state-level federation of DMUs, which has branding and marketing dairy products' responsibilities. At the end of the financial year, DMUs calculate the profit generated by each DCS. After deducting the DMU's operational cost, the profit amount is transferred to the DCS, where the DCS distributes the profit among its members in the ratio of the milk sold over the entire year.

Dairy farmers of the village become members of the DCS, and to do so, a farmer must fulfil either of two conditions: 1) he/she must sell a minimum of 700 litres of milk in 1 year, or 2) he/she must sell milk for a total of 180 days in 1 year. Under the second condition, the quantity of milk is not fixed. To register with the DCS, a member also must buy one share in the DCS at a one-time price of INR 10 (less than USD 0.15) per share, which is negligible and granted for life. Members who sell milk for the entire year are called "active members," and they are entitled to the bonus generated by the DCS. Importantly, non-members can also sell their milk to the DCS, but they are not entitled to any benefits the DCS provides to its members.

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<sup>3</sup> Information presented in this section has been gathered from the DCS and DMU officials. Quantitative information was provided by the officials from their records.



Every DCS must be registered under the Gujarat Co-operative Societies Act 1961. The DCS has its bylaws (rules and regulations), which define and regulate the DCS functioning. The DCS is governed by a GB, generally comprising between 9 and 13 members elected by DCS members. The GB recruits/deputes one Secretary<sup>4</sup>, usually a member of the DCS, who takes care of administrative responsibilities and the daily functioning of the DCS. The tenure of the GB varies from three to 5 years across the DCSs, depending on what has been provisioned in the bylaws. Although the tenure of the GB is fixed, there is no restriction on the number of times an individual can become a member of the GB.

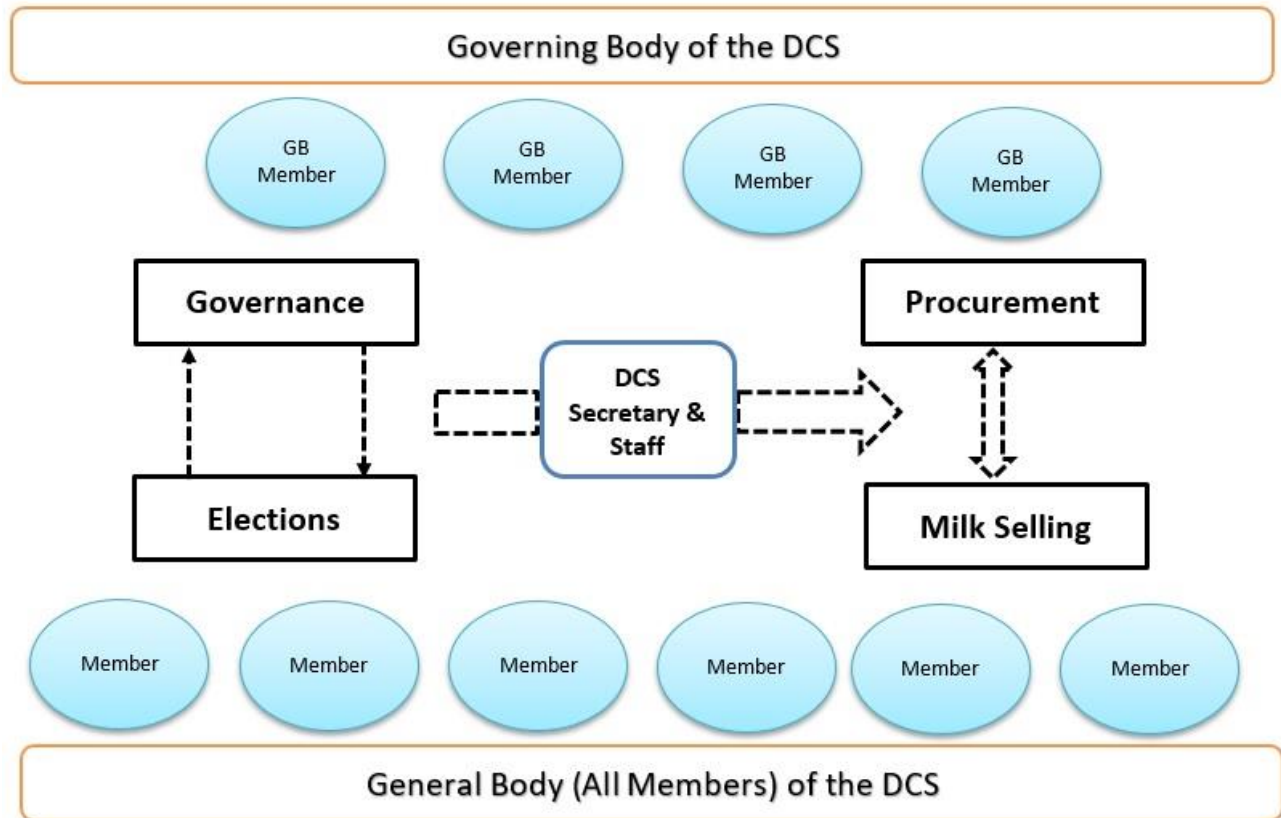
Our study is based on a 55 years old DCS located in Central Gujarat, which was established in 1965 and has 340 members, of which 100 are active. Usually, one family member becomes a DCS member, notwithstanding some exceptions where more than one member from a family becomes a member. The DCS is managed by a GB, which comprises 11 members (all male) who meet monthly and at the annual general body meeting (all members of the DCS). The DCS, as per the officials of DMU, is considered a successful DCS for the following reasons: It collects an average of 700 litres of milk every day, and it has maintained continuous milk collection and matched the average per day/per member milk collection for the entire DMU. Of the households in the village, the DCS membership rate is 95%. The DCS reached this saturation point almost two decades ago and has successfully maintained its membership base. Another indicator of its success is the quantity of the bonus that the DCS provides to its members. In line with its performance over the years, and during the last financial year (2016–17), the DCS has provided 24% of the total milk sold as a bonus to its members, which is considered very high.<sup>5</sup>

### **Figure 1: Organizational Structure of the DCS**

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<sup>4</sup> The secretary is formally not part of the GB, but he informally plays a crucial role in the governance of the DCS and members consider him a leader. Hence, for the purpose of our analysis we will consider the Secretary as part of the GB.

<sup>5</sup> Source: DCS functionaries and DMU Officials.



Source: Authors' own construction

### 3.2 Data Collection

Primary data were collected from all available active members in March 2018. A network survey protocol was prepared for this purpose. Apart from the network questions (Table 1), the survey protocol also had a section on socioeconomic attributes of the respondents that include information on their demography; income; education; membership; milk production; social categories, such as caste and religion; and their association with other collective actions, if any. We also conducted a pilot test in another DCS to assess the effectiveness of the survey protocol. Based on the pilot test results, the survey protocol was revised and finalized.

The cooperative comprised 340 members, of which 100 were active. The 240 inactive members, defined as those who had not sold milk for more than one year (many years in a couple of cases), were not interviewed because they were not part of the active network for more than one year.<sup>6</sup> Because many activities and benefits are related to pouring milk, active (compared to non-active) members were in the best position to depict network dynamics. Out of

<sup>6</sup> To check whether there are important differences in terms of socioeconomic and demographic attributes among active and inactive members, we conducted 15 semi-structured interviews with inactive members. When comparing their profiles with active member profiles, we found no clear differences in terms of socioeconomic characteristics (e.g., caste, gender, education). The missing data, as in the case of inactive members, can be ignored if it does not affect the vital character of the observed ties and shows resembling patterns with the observed data (Rubin, 1976 and Kossinets, 2006).

the 100 active members, we collected data from 85 (75 general DCS members and 10 GB members). The missing data of the remaining 15 active members<sup>7</sup> was because of the demise of some members, and other members were visiting relatives and not scheduled to return soon. We also conducted three semi-structured interviews with the officials (Secretary, assistant, and DCS Chairman) from the DMU who oversee the DCS's administrative responsibilities.

**Table 1: Social network Ties**

	<b>Ties (Relationships)</b>	<b>Network Survey Questions</b>
Information Sharing	<u>Information</u> sharing on personal <b>dairy</b> matters	If you have information related to general dairy matters, with whom among the DCS members do you share?
	<u>Information</u> sharing on matters related to <b>DCS</b>	If you have information related to the functioning of the DCS, with whom among the DCS members do you share?
Seeking Advice	Seeking <u>advice</u> on personal <b>dairy</b> matters	If you need advice on general dairy matters, who among the DCS members do you approach?
	Seeking <u>advice</u> on matters related to <b>DCS</b>	If you need advice on DCS matters, who among the DCS members do you approach?

Table 2 provides socioeconomic and demographic details of the respondents. One-fourth of the members are women<sup>8</sup>, and approximately 17.6% of the respondents are illiterate, which is lower than the illiteracy state average (20.2%) in Gujarat. Because the DCS is more than five decades old, many respondents have been members for 15 or more years. Milk production is fairly distributed across different categories, which indicates the DCS not being dominated by bulk milk producers. The per annum milk income of approximately 90% of the DCS members was INR 100,000 or less, resembling non-dairy income. This, for example, indicates that the DCS has been an essential source of livelihood for almost 90% of the DCS members.

**Table 2: Socioeconomic Attributes of the DCS Members**

<b>Gender and Position</b>	<b>Frequency (%)</b>	<b>Education</b>	<b>Frequency (%)</b>
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<sup>7</sup> To verify that these missing members were not crucial actors within the network, we checked how often those actors were mentioned by other actors. None of these missing members were named by others more than three times in the information sharing networks on personal and dairy matters. Therefore, the missing members are not key actors in the network; the absence of the data of these members does not drastically change the overall character of the networks.

<sup>8</sup> This study provides insights into important gender dimensions, which need exclusive focus with further analyses and discussions in a separate paper.

<b>Total</b>	<b>85 (100)</b>	Illiterate	15 (18)
Male	68 (80)	UP to 5th	16 (19)
Female	17 (20)	6th-10th	35 (41)
DCS Members	75 (88)	11th & 12th	18 (21)
GB Members	10 (12)	>12th	1 (1)
<b>Age of the membership (Years)</b>	<b>Frequency (%)</b>	<b>Milk production (litres per month)</b>	<b>Frequency (%)</b>
0-5	19 (22)	>180	11 (12.9)
6-10	15 (18)	91-180	41 (50.6)
11-15	20 (23.5)	0-90	31 (36.5)
16-20	9 (10.5)		
21-25	6 (7)		
>25	16 (19)		
<b>Dairy income per annum (INR)</b>	<b>Frequency (%)</b>	<b>Non-dairy income per annum (INR)</b>	<b>Frequency (%)</b>
<50000	47 (55)	<50000	45 (53)
50001 - 100000	27 (32)	50001 - 100000	28 (33)
100001 - 150000	5 (6)	100001 - 150000	10 (12)
>150001	6 (7)	>150001	2 (2)

Source: Authors' analysis

### 3.3 Methodology for Data Analysis

We used social network analysis (SNA), a collection of measures used to analyze social networks and social relationships among network actors by using "sociomatrices" and visualization tools (Scott and Carrington 2011). SNA is based on the "intuitive notion" that social relationships of actors have "important consequences" for the actors and that the "structural patterning" of these relationships explains actors' individual and collective behavior (Freeman 2004, p. 2). We used UCINET software (version 6.652) to analyze network data and Netdraw to visualize the network data (Borgatti *et al.* 2002).

The network data is mainly information on actors (nodes) and relations (ties) between those actors. The latter incorporates three elements of information: meaning, direction, and weight (De Brun and McAuliffe, 2018, p. 2). "Meaning" indicates the type of relationship (e.g., information sharing) that the data explains, "direction" refers to the direction of the relationship, namely, who is contacting/sending/sharing with whom, and "weight" reflects

whether the responses are valued (using scales) (De Brun and McAuliffe, 2018). The data used for our analysis is unvalued (expressed in binary measures)<sup>9</sup> and is directed<sup>10</sup>.

Table 3 synthesizes the two major types of network measures we used to analyze the data: measures related to the overall network characteristics and actor-level network measures. Overall, network measures describe the features of the network as a whole, and actor-level measures explain how the position of a specific actor in the overall network enables or constrains his or her behavior.

**Table 3: Network Measures**

Measures	Definition and Explanation
<b>Overall network-level measures</b>	
Density	"Density, in a binary network, is the ratio of actual ties to all possible ties" (Hanneman and Riddle, 2005, p. 118).
Degree centralization	"The Graph centralization measure expresses the degree of inequality and degree of variance in a network as a percentage of that of a perfect star network of the same size" (Hanneman and Riddle, 2011). The degree of centralization is based on the difference between the number of ties the most central node has and those of all other nodes (Borgatti <i>et al.</i> 2013).
Reciprocity	"Reciprocity is the proportion of pairs that have mutual ties between them" (Hanneman and Riddle, 2005, p. 121). The relationship between two nodes is reciprocated when both establish ties with each other (Hanneman and Riddle, 2005).
Diameter	"Diameter is the length of the largest geodesic distance between any pair of the nodes in a connected graph" (Wasserman and Faust, 1994, p. 111).
<b>Actor-level measures</b>	
Degree centrality	"A centrality index which measures how many other nodes a node is connected to" (Hanneman and Riddle, 2005). We also observe in-degree centrality (incoming ties to a node) and out-degree centrality (number of ties sent by a node to others) (Hanneman and Riddle, 2005).
Betweenness centrality	Betweenness centrality is "the extent to which a particular node lies between various other nodes in the graph" (Scott, 2000, p.86).

## 4. Results

### 4.1 Overall Network Characteristics

Table 4 presents an overview of the network-level measures for all four ties<sup>11</sup>. Both **information-sharing networks** (personal dairy matters and DCS matters) are inclusive because no actor is excluded (no isolates) from the network;

<sup>9</sup> "Ones" (1s) are assigned to people contacted by (or collaborated with) the respondents for a particular task and/or objective; the others are assigned zero (0s).

<sup>10</sup> A relation between two actors is directed if the relation is not inherently symmetric. Whereas undirected ties such as "being family/a relative of" always imply that the tie is the same in both directions (if A is a relative of B, B is also a relative of A), directed ties can differ between two persons depending on the direction of the tie. For example, if A sends information to B, but B does not send information to A, or vice-versa, the relation between A and B is asymmetric.

thus, all 85 members of the cooperative exchange (either receive or share) information with at least one person. The average degree of both the information networks is close to three, which means that every actor, on average, exchanges information with three other actors. In a large human network, an average degree of three could be considered an indicator of a connected network.<sup>12</sup> Overall, the degree centralization of information sharing on personal dairy and DCS matters is less centralized, especially compared to the remaining ties. Although both the information networks' centralization is relatively low, the in-degree centralization is higher (0.061) than the out-degree centralization (dairy matters: 0.012 and DCS matters: 0.025). This implies that receiving information is more centralized than sharing information is. Thus, many members share information with others, but there is a tendency to share with the same actors, who receive more information than other members. The volume of both the information-sharing networks is almost the same; namely, not much difference is found in various indicators such as the number of ties, isolates, average degree, and density. However, information sharing on DCS matter is a little more centralized (degree centralization: 0.086) and reciprocal (48.8 %) than the information sharing on personal dairy-related matters (degree centralization: 0.61; reciprocity: 40%).

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<sup>11</sup>We computed the association between the four ties. All ties are positively and significantly associated with each other, and—as expected—the association between two ties of the same dimension are the highest: The QAP correlation coefficient between information sharing on personal dairy - DCS matters is 0.121 ( $p = 0.00$ ); advice seeking: dairy- DCS (0.186) ( $p = 0.00$ ).

<sup>12</sup>In line with Faust (2006), the authors posit that density should be interpreted by taking the size of the network because, especially for humans, there is a limit to their number of ties, depending of course also on the type of relation under study. If, for example, in a network of 10 actors, every actor maintains three friendship ties, the density would be 0.33. We may conclude that it is a moderately-connected network, because the total number of actors in the whole network is very small (10), and we could expect everyone in the network to establish ties with almost everyone. In a network of 100, if an actor still maintains three ties, the density would decrease to 0.0303. In this network, we cannot expect each actor to establish a tie with all other (99) actors by contrast it would pragmatically be exceedingly difficult. Hence, to evaluate social cohesion and interactions within a network and compare densities with other networks, it is advisable to consider the size of the network (and therefore compare to networks of similar size). We can use the average number of ties as a means to compare the level of interaction when network sizes differ substantially.

Figure 2: Information sharing on dairy matters

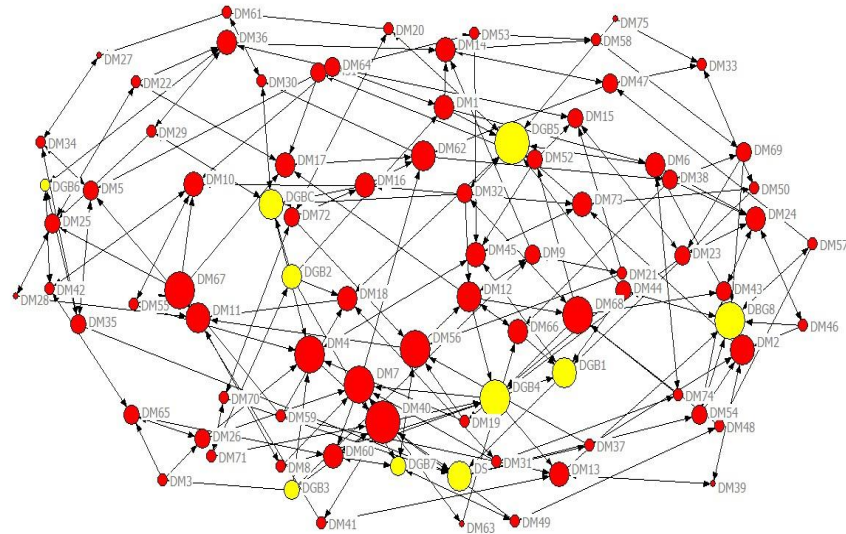


Figure 3: Information sharing on DCS matters

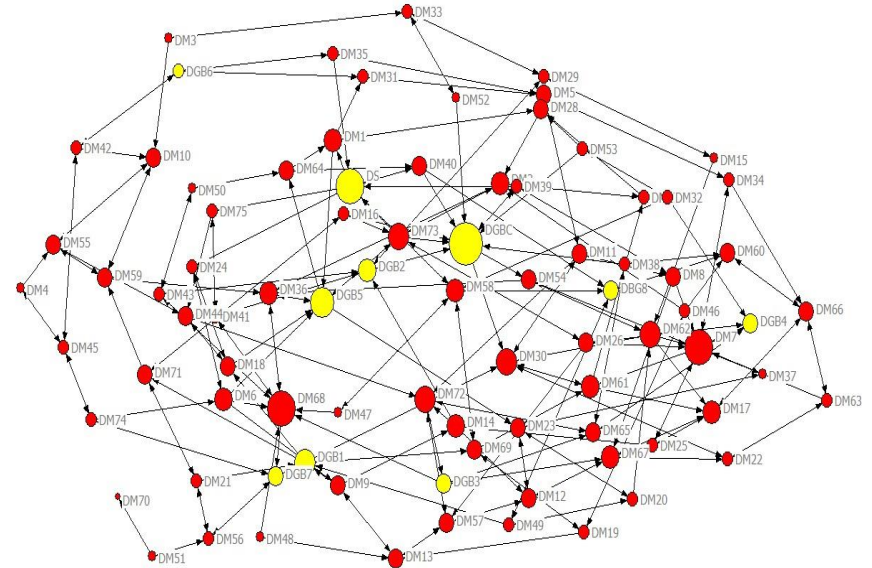


Figure 4: Advice seeking on dairy matters

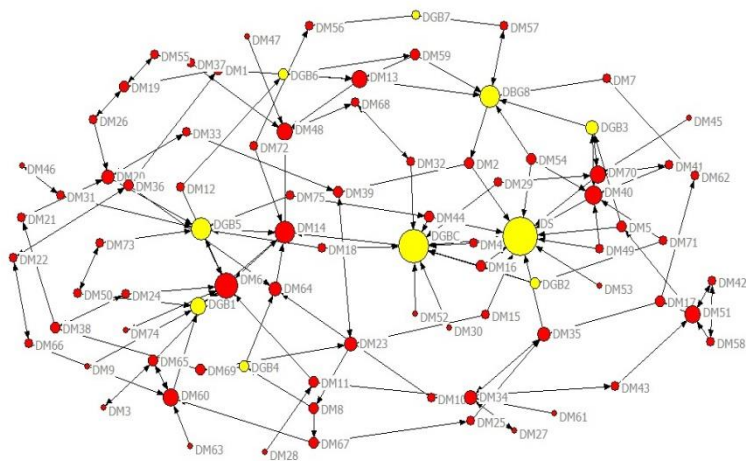
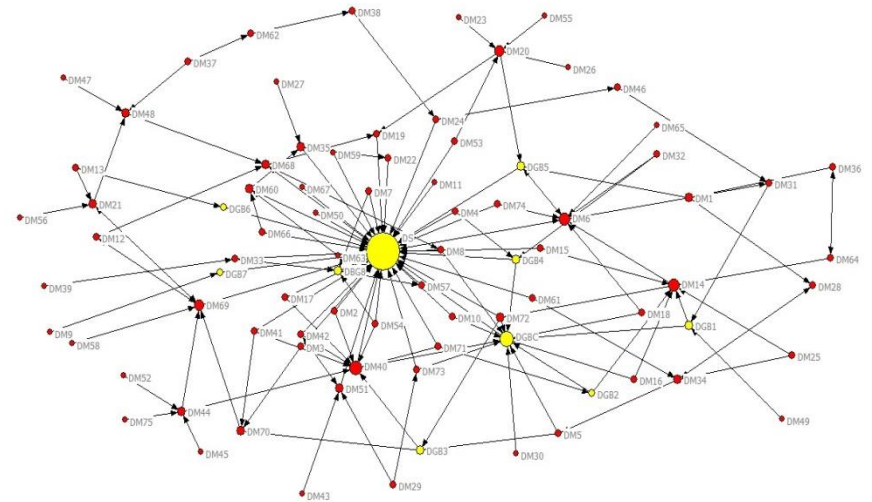


Figure 5: Advice seeking on DCS matters



**Legends for figures 2 to 5:** Size based on degree centrality of the actors, and color based on membership type (red- general member, yellow-GB members)

**Table 4: Network-Level Measures**

<b>Characteristics</b>	<b>Info sharing</b>		<b>Advice seeking</b>	
	<b>Personal dairy matters</b>	<b>DCS matters</b>	<b>Personal dairy matters</b>	<b>DCS matters</b>
<b>Total no nodes</b>	85	85	85	85
<b>No of Ties</b>	252	247	150	150
<b>No of Isolates</b>	0	0	0	0
<b>Average Degree</b>	2.965	2.906	1.765	1.765
<b>Dyad Reciprocity</b>	0.400	0.488	0.19	0.095
<b>Degree Centralization</b>	0.061	0.086	0.137	0.466
<b>In-degree Centralization</b>	0.061	0.061	0.135	0.449
<b>Out-degree Centralization</b>	0.012	0.025	0.015	0.027
<b>Density</b>	0.035	0.035	0.021	0.021
<b>Diameter</b>	12	10	15	12

Source: Authors' analysis

As we expected, the average degree of the **advice-seeking networks** is lower than that of both information networks because not everyone needs advice on every matter. Individuals seek advice only when they have less or no knowledge of a subject or face dilemmas in taking appropriate decisions. Likewise, reciprocity in advice-seeking is also much lower than that for information sharing. Advice seeking is less reciprocal because individuals are looking for a more knowledgeable person than themselves for advice, whereas the receiver's knowledge is less important for information sharing. However, the results show that the reciprocity on personal dairy matters is higher than that on DCS matters, which hints that individual more often engage in mutual advice-seeking on matters such as cattle rearing, cattle health, cattle feed, decisions to buy or sell livestock, than on issues related to the DCS. We are not surprised by this finding because the latter requires specific technical and administrative information, knowledge, and experience, which not everyone has access to. This also explains why the DSC advice-seeking network is more centralized than the one related to advice-seeking on personal diary matters.

#### **4.2 Actor-level Network Measures**

To determine the most crucial actors in the network, we studied different types of centrality scores (Table 5). This analysis helps determine who, among the GB members and DCS members, play crucial roles in assisting the DCS to



run its operations and administration smoothly and effectively. In both the **information-sharing** networks, all actors have participated in either information-receiving or information-sharing ties. Thus, no actor is excluded from the networks, and no communication barriers exist in the DCS. The out-degree centrality scores have slight variation among actors (all nodes seem to share information with a similar number of other actors), and the in-degree centrality scores differ considerably (i.e., some actors receive more information than others; Table 5).

**Table 5: Actor-level analysis (top 5 actors)**

Information sharing on personal dairy matters				Information sharing on DCS matters				Advice seeking on personal dairy matters				Advice seeking on DCS matters			
ID	1	2	3	ID	1	2	3	ID	1	2	3	ID	1	2	3
DGB5	8	989	3	DGBC	8	628	3	DS	13	273	1	DS	39	385	2
DM40	7	543	4	DM7	7	439	3	DGBC	10	398	2	DGBC	12	111	2
DBG8	6	635	3	DM68	7	1083	4	DM6	7	347	2	DM40	9	29	2
DS	5	623	3	DM30	6	500	3	DGB5	6	336	2	DM6	8	96	2
DM7	5	510	3	DM36	5	637	3	DBG8	6	589	2	DM14	6	131	2

Note: 1 - In-degree centrality; 2 - Betweenness centrality; 3 - Out-degree centrality; the top five actors were always selected based on the in-degree centrality score.

Among the five most central actors in receiving information on *personal dairy* matters (in-degree), two actors are GB members (DGB5 & DGB8). The other two are "ordinary" members (DM40 & DM7), complemented by the Secretary (DS) of the DCS, who is not a formal member of the GB but can be considered a leader because of the critical role he plays in running DCS operations. However, if we increase the scope and observe the ten most central actors, the diversity among top actors in formal roles increases. Out of the top ten, five are ordinary members (Figure 2). Out of these five ordinary members, the age of membership of three members is five years or less, and the other two have been members of the DCS for at least 15 years.

Similarly, regarding information receiving (in degree) on *DCS matters*, among the five key actors who receive most of the information, one is a GB member (DGBC). Four are ordinary members (DM7, DM68, DM30, DM36), and the age of membership varies from 3 to 15 years (Figure 3). This finding indicates that the GB members are central in the information-sharing network for both types of information sharing. Many "ordinary" members and even relatively new members are key players in the overall network.

Figures 4 (advice-seeking on dairy matters) and 4 (advice-seeking on DCS-related matters) highlight that the Chairman (DGBC) and the Secretary (DS) of the DCS are the most central actors who were contacted for advice (Table 5). Among the five key actors who were most contacted for advice on DCS matters (i.e., highest in-degree score), the Secretary (39 ties) and the Chairman (12 ties) remain the most central actors. The Secretary emerges more as important than the Chairman because he manages daily operations of the DCS; therefore, individuals find

him more knowledgeable in advising on DCS-related matters. The Secretary (13 ties) and Chairman (10 ties) are the key actors being asked for advice on personal dairy-related matters, and other senior members of the DCS also play central roles. The profile of the advice-seekers in both networks is very broad and covers the members and the leaders, with varying membership duration.

In summary, advice-seeking networks are centralized toward certain individuals who either have a leadership role in the DCS or have enormous experience and knowledge being a member of the DCS for a longer period. As such, advice-seeking networks exhibit both types of hierarchies: positional (based on the type of membership) and knowledge (based on the number of years of experience). The advice network on personal dairy matters allows more for knowledge-based "hierarchy," and the advice network on DCS matters is based on "positional" hierarchy.

Table 5 shows that although actors with high in-degree centrality tend to have relatively high positions in the betweenness centrality ranking, the correlation between in-degree and betweenness centrality is imperfect. This finding makes sense because, unlike degree centrality, which only considers the immediate ties of an actor, betweenness centrality depends on the actor's position in the *entire* network (for a definition, see Table 1). However, our results show that the betweenness centrality scores of each of the top five actors of our network are also among the top 10 scores. It indicates that those top five actors listed in Table 1 tend to have top positions in both "localized forms of influence" (degree centrality) and "strategic" positions (betweenness centrality) in the overall network.

#### ***4.3 Intergroup and intragroup relations***

This section presents results related to intergroup and intragroup densities to assess if any within-group or between-groups relations help explain the network better. For **information sharing and advice seeking**, the status of members in the DCS (a general member or GB member) and knowledge and experience (age of DCS membership) play important roles. To delve into this aspect further, we calculated intergroup and intragroup densities by considering these two types of characteristics.

Studying information sharing and advice-seeking from an intergroup and intragroup perspective, Table 6a reports the number of ties (density), differentiating between DSC members and GB. If the interaction is primarily within groups (member-member and GB-GB), we expect to find the highest number of ties (densities) on the tables' diagonals. Similarly, for experience and seniority<sup>13</sup>, medium-age members are most consistent in sharing information with the other two categories on dairy and DCS matters (Table 6b). New members participate actively in information sharing among themselves in both the information networks and medium-aged members (0.040) on personal dairy matters. These results confirm that information sharing does not seem to be a problem in the formal hierarchy, preventing information from being shared in all directions.

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<sup>13</sup> The age of membership varies from 1 year to 52 years. We divided the members into three categories: new members: 0–10 years (N = 34), medium age: 11–25 years (N= 35), and old members: 25–52 years (N= 16).

**Table 6a: Intergroup and Intragroup Densities (Status of Members)**

Info Sharing - Dairy matters			Info Sharing – DCS matters		
Status	No of ties ( <i>Density</i> )		Status	No of ties ( <i>Density</i> )	
	Member	Leaders		Member	Leaders
<b>Members</b>	183 (0.033)	39 (0.052)	<b>Members</b>	175 (0.032)	37 (0.049)
<b>Leaders</b>	27 (0.036)	3 (0.033)	<b>Leaders</b>	34 (0.045)	1 (0.011)
Advice Seeking Dairy matters			Advice Seeking DCS matters		
<b>Members</b>	91 (0.016)	40 (0.053)	<b>Members</b>	73 (0.013)	58 (0.077)
<b>Leaders</b>	15 (0.020)	2 (0.044)	<b>Leaders</b>	10 (0.013)	9 (0.100)

**Table 6b: Inter and intragroup Densities (Age of Membership)**

Info Sharing - Dairy matters				Info Sharing – DCS matters			
	No of ties ( <i>Density</i> )				No of ties ( <i>Density</i> )		
	New	Medium	Old		New	Medium	Old
<b>New</b>	37 (0.033)	46 (0.040)	15 (0.026)	<b>New</b>	51 (0.045)	34 (0.029)	12 (0.021)
<b>Medium</b>	42 (0.036)	40 (0.036)	20 (0.035)	<b>Medium</b>	37 (0.032)	45 (0.040)	19 (0.033)
<b>Old</b>	15 (0.026)	31 (0.056)	6 (0.022)	<b>Old</b>	15 (0.026)	28 (0.048)	6 (0.022)
Advice Seeking Dairy matters				Advice Seeking DCS matters			
<b>New</b>	15 (0.013)	27 (0.023)	17 (0.029)	<b>New</b>	4 (0.004)	37 (0.032)	18 (0.031)
<b>Medium</b>	16 (0.014)	27 (0.024)	18 (0.031)	<b>Medium</b>	9 (0.008)	39 (0.035)	14 (0.024)
<b>Old</b>	4 (0.007)	16 (0.028)	10 (0.037)	<b>Old</b>	3 (0.007)	17 (0.029)	8 (0.029)

Similarly, in terms of experience and seniority, the *information-sharing* densities on dairy are comparable among all types of member categories, with the medium members receiving the most information. New members are reasonably active in information sharing among themselves (0.033) and also with medium-aged members (0.040). For DCS matters, the most intense information-sharing patterns were among new members (0.045) and from established (medium and old) members to medium members (0.040 and 0.048). These results confirm that information sharing does not seem to be a formal hierarchy problem preventing information from being shared in all directions, even though the lowest densities seem to be between new and old members. This finding is somewhat surprising because this type of "mentoring" sharing might close the most significant gap in knowledge and

experience between novices and routines. In *advice seeking*, unsurprisingly, all types of members seek advice mostly from older members and least from new members.

## **5. Discussion**

We reviewed the structural features of the overall networks, and the central positions within the network and the intergroup and intragroup densities of the cooperatives. We now link back to four relational networks discussed in the first sections to review the results and identify possible factors that have contributed in the co-education and learning in the cooperative.

### ***5.1 Inclusive yet efficient information-sharing networks***

Both information-sharing networks are characterized by an inclusive character (no isolates) and high reciprocity among the cooperative's members. Moreover, information sharing relations are quite substantial in their size, with members exchanging information with almost three other members (average degree is 2.9 for both the information networks). These features have been theorized to be conducive for collective action (Moody and White, 2003; Friedkin, 2004). Overall, the information-sharing network is relatively little centralized, even though receiving information (in-degree centralization) is more centralized than sending information (out-degree centralization). The absence of a few very central actors in sending information (out-degree) means that all members are indeed sharing information with others; therefore, there is a little bias in terms of who shares information. In terms of who receives the information, some actors are more central than others. Some degree of centralization makes the network structure more efficient in gathering information for some key individuals who can then use the information to benefit the DCS. However, we find both "ordinary members" and "GB members" and new and older members among the key actors in information networks. Therefore, there is still considerable diversity, an important aspect of ensuring that information does not become compartmentalized in certain groups of the DCS. This aspect of information sharing reflects that the process of sharing knowledge is quite informal and cohesive.

The role of newer DCS members as key actors in information-sharing networks explains this further. New members must create their space and establish their importance in the DCS, which will pave the way for them to acquire leadership positions in the DCS. New members must acquire the necessary knowledge and skills regarding dairying and DCS operations.

The operational structure of the cooperative affects the frequency of interaction among members. Unlike other forms of cooperatives where members do not meet frequently, members of the DCS visit the DCS office twice per day (morning and evening) for pouring the milk, which takes 3 hours. This also explains why the Secretary, who is also present during the milk collection almost every day and is therefore easily accessible for the members, is a key actor in the network. The DCS has alternatives to information sharing based on information exchange among members. The relevant information (e.g., configuration of GB, contact details of GB members and DCS staff, general body

meetings) is also displayed on the notice board in the DCS office, thereby potentially decreasing the strategic influence of individuals who otherwise could control and manipulate information. However, information related to many other operational issues, including benefits, is not displayed in the DCS office, reinforcing the relevance of the role of the information provider.

## **5.2 Knowledge versus positional hierarchies**

The results indicate two different types of hierarchies—knowledge and positional—in the DCS that play a central role and in various aspects of the dairy network. The knowledge-based hierarchies are represented by longtime, experienced members of the DCS (informal leaders) emanating from traditional knowledge practices. In contrast, positional hierarchies are represented by the formal leaders, namely, GB members and the Secretary, even though the Secretary is not part of the GB. Both the knowledge-based and position-based hierarchies have played prominent roles in information sharing and advice seeking. However, both hierarchies are not entirely distinct; they often overlap. For example, the leadership positions are rotational in the DCS, with GB members being elected for a fixed time. This system provides an opportunity for DCS members to groom their leadership skills by acquiring leadership positions in the GB of the DCS. Therefore, once GB members leave their leadership positions, the knowledge they accumulate during their leadership tenure is valuable for them. Hence, both formal (administrative positions) and informal (knowledge hierarchies emanating from traditional practices) play important role in exchanging the advices.

Similarly, many GB members are reelected multiple times. Out of ten contemporary GB members, four (DGBC, DBG8, DBG1, and DBG4) have also held GB positions in the past. The DCS members have frequently contacted these four GB members (compared to other GB members) to seek advice. It is in sync with the evidence found elsewhere where senior members of the collective action play a key role in knowledge diffusion (Pachoud *et al.*, 2019). The positional hierarchies in the DCS are flexible, as the GB positions keep rotating. These hierarchies are more stringent when a cooperative is relatively new (Simpson *et al.* 2012) but become more relaxed as the cooperative ages. After all, GB members are elected among the members of the DCS for a short period and remain members afterwards while they, similar to any other member, continue participating actively in dairy activities.

## **6. Conclusion**

Our study indicates an inclusive network of information sharing with no sign of blocking information or any other significant obstacles. In terms of socioeconomic characteristics, the village is homogenous. The village is numerically dominated by one caste. Therefore, no prominent social inequalities are found in the network. The results also indicate that the exchange of knowledge and learning among the members is smooth. There is evidence of a smooth transfer of leadership roles from older members to new members. These characteristics could have contributed to the success of the DCS. The study establishes that the inclusive, efficient information exchange network and the balanced advice-seeking network are found in the DCS, where new and old members and general

members and leaders participate. Both networks do not show the character of excessive centralization of information and advice exchange. The information exchange networks exhibit higher reciprocity. Despite being based on specific expertise and skill, the advice-seeking networks show a significantly high reciprocal relationship.

The DCS does not run any formal and regular education programs for its members. The DCS organizes orientation programs on enhancing milk quality, balanced ration to cattle, etc. However, these programs are occasional and do not follow any regular schedule. The inherent networks of information sharing within the DCS members have ensured that peer-to-peer learning is intact and the information sharing remains inclusive. Our discussion with the DCS members reveals that many members who do not have a social affinity (meaning they are not part of the same caste and community) can talk to each other and remain in contact through the dairy information-sharing network. Hence, ties facilitated through dairy information and advice networks provide an opportunity for inter-groups to interact and share the knowledge leading towards co-education and learning.

The findings suggest that co-education and learning in the cooperative can be facilitated through a combination of formal positions and hierarchies (as we find it in the case of advice-seeking) and informal processes of co-creation and co-sharing of knowledge and information (as we found in the case of information sharing) as part of the cooperative's structural embeddedness (not much centralization, cohesion between members and leaders, no isolates, etc.). The findings provide evidence in support of our argument that merely formal educational initiatives would not fulfill members' informational and knowledge-related needs. An informal ecosystem of co-learning and education is an essential aspect of community learning. It hence should be considered in any institutional recognition such as the 5<sup>th</sup> principle of the 'Statement of Cooperative Identity'.

## **8. Limitations, Implications and Contribution**

It is fair to acknowledge that the learning process is also dependent on external factors (Wang and Ellinger, 2011), especially when the organization is engaging with the market to determine the incentives. Our study does not consider relations established by the DCS with the external actors and vice versa. We limit our analysis to internal relationships among the DCS members. Thus, further research in this area is necessary. The findings also point toward the need for similar analysis in the DCSs where society is more heterogeneous (e.g., multi-caste, multi-religion), which this study does not address.

The study offers practical implications for the managers of the dairy cooperatives to use an alternative path (other than formal training and orientation programs) social networks in promoting learning and knowledge within the cooperative. This study provides a background for understating informal and member-to-member co-education and learning in other community-owned social enterprises. The study contributes to the literature on the role of cooperatives in building capacities of their stakeholders and promoting cooperative-managed education (Mulder et al. 2007; Witte, 2014). Social learning outcomes are considered one of the outcomes of a successful community enterprise (Shahidullah and Haque, 2016); hence, the study contributes to the strand literature that explains

community-based enterprises' contribution in promoting co-education and mutual learning (Munoz, Steiner and Farmer, 2014). The study also contributes to the literature that discusses rural community owned enterprises from various dimensions, such as collective action, civic participation and social network embeddedness (Shaw and Carter, 2007; Dale and Onyx, 2005; Leadbeater, 1997).

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