Network Measures for Organizational Learning Subprocesses:

Case of a Consultancy Firm

Nobin Thomas

Doctoral Candidate

Organizational Behaviour Area

IIM Ahmedabad

Prof. Neharika Vohra

Organizational Behaviour Area

IIM Ahmedabad

Abstract

A new scholarship has emerged that proposes the use of social network analysis as a tool for measuring organizational learning. O'Reilly's (1991) remark that organizations are fundamentally relational entities clearly endorses a move in this direction. The key advantage of using social network analysis in organizational learning is the ability to conduct multi-level data analysis (Contractor, 2006), which had been a serious limitation for organizational learning studies till date. This study attempts to take this field forward by developing a multi-level framework for understanding some of the subprocesses of organizational learning based on a social network approach. A detailed field-based case study of a consulting firm was undertaken and results support the merit in using social network analysis for studying organizational learning.

Keywords: Multi-level, social network analysis, organizational learning

Network Measures for Organizational Learning Subprocesses:

Case of a Consultancy Firm

"All organizations learn, whether they consciously choose to or not - it is a fundamental requirement for their sustained existence". *Kim (1993)*

Organizational learning can be thought of as an allegory built on our limited understanding of individual learning. Quite contrary, there is no denial that over a period of time, organizations learn through the efforts of its individual members. This dichotomy has been in existence for almost half a century now. Studies have used different definitions, frameworks, methodologies and perspectives in seeking clarity towards a better understanding of organizational learning, but much in vain. Equally important is that fact that a theory of organizational learning may still be in its sprouting stage. Crossan, Maurer, and White (2011) echoes the same sentiment when they say that a theory of organizational learning (OL) has not yet emerged. Lately, a new set of scholars have started talking about the possibility of using social network analysis as a tool for studying organizational learning. O'Reilly's (1991) remark that "Organizations are fundamentally relational entities" (p.446) clearly endorses the fitness of social network approach to organizational learning. The key advantage of using social network analysis in organizational learning is the ability to conduct multi-level data analysis (Contractor, 2006), which has been a serious limitation of organizational learning studies till date.

This study adopts a cognitive view of organizational learning (Huber, 1991) for two reasons. A purely cognitive view describes learning as the development of new insights through mental processes such as changing assumptions, causal maps and interpretive schema (Kim, 1993; Huber, 1991; Friendlander, 1983), which fits in with the social network analysis approach.

Second, the cognitive view classifies organizational learning into a number of subprocesses and different levels of learning (Scott, 2011). Based on an extensive review of articles published on organizational learning between 1970 and 2009, Flores et al. (2012) identified five subprocesses of organizational learning. They are information acquisition, distribution, interpretation, integration and organizational memory. Information acquisition refers to the process through which an organization acquires information from external and internal sources (Huber, 1991). It is considered to be the first step towards organizational learning (Walsh & Ungson, 1991). Information distribution is the process through which individuals, groups or units of the organization share information among themselves (Huber, 1991). It is important for organizational learning because the information that is acquired and not distributed would be limited to individual learning. Information interpretation describes the processes through which individuals and organization make sense of the information that they have received. Information integration refers to the process that leads to the establishment of shared observations and understanding among members of the organization (Crossan et al., 1999). What deserves special mention is that it is these shared insights and mental models that distinguish organizational learning from individual level learning. The information is then stored in knowledge repositories like standard operating procedures, routines and scripts that constitutes the organizational memory (Levitt & March, 1988).

The purpose of this study is to develop social network measures for the first two subprocesses of organizational learning – information acquisition and information distribution - from a multilevel perspective - individual, group and organizational levels. The context chosen for this study is a consultancy firm, ‘Scope’. Scope is one of India’s leading organizational development (OD) and human resource (HR) consultancy firms. Scope offers support through consultancy, training,

systems facilitation, and managed HR services. Scope is led by a team of extremely talented and experienced professionals who have been in the field of human resource management for over three decades. Scope has three levels in their organizational hierarchy – Principal Consultants, Senior Consultants and Consultants.

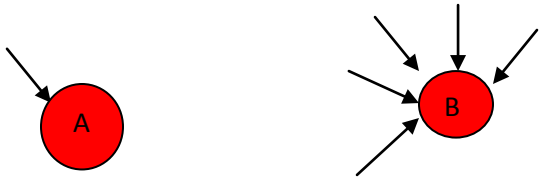
The Principal Consultants are people who possess distinctive knowledge and use it to serve as counselors, advisors, and mentors. P1, Scope CEO (also a Principal Consultant) has over 25 years of rich experience across multiple industries. Principal Consultants, P2, has about 19 years of experience across multiple industries and P3 has over 27 years of work experience. While Principal Consultant, P4 leverages his 18 years of experience across spectrum of industries to provide value to clients, Principal Consultant, P5 associates with Scope for select assignments requiring strategic shift for organizations.

Scope has a large pool of senior consultants, who is one level below the Principal Consultants and they work independently as well as in teams. Senior Consultants, S1 has over 14 years of experience and S2 has over a decade of experience in training and development. S3 has an overall experience of 8 years in human resource management. S4 has over 10 years of experience across diverse industries. S5 has 14 years of experience in diverse set of industries. S7 has over 7 years of experience in talent acquisition. Senior Consultant, S8 has over 10 years of core experience in HR. S11 has about 9 years of experience across pharmaceuticals, IT, oil and gas industries. S12 has over 10 years of experience across hospitality industry in training customer service teams. Senior Consultants, S9 has 15 years of functional and strategic HR experience across multiple sectors and S10 has over 15 years of diverse work experience ranging across consulting, teaching, consumer research and brand management.

The junior consultants, C1 and C2 and Asst. Manager form the remaining parts of the network.

Network Measures

In the case of information acquisition described earlier, our emphasis is on the role that each of the actors in the network play as 'sources' of information. The number of actors who seek information directly from a particular node can be represented by the network measure 'in-degree' for that particular node. Indegree refers to the number of arrows pointed to a node in a directed network. Related to organizational learning networks, the higher the in-degree of a node, the higher the number of people that claim to be learning from that node. To illustrate it, consider Fig (i) below where we find only one person approaching node A for information and hence his indegree is calculated as one. In Fig (ii), we see actor B being approached by five different individuals for information. This makes B's indegree five.



(i) (ii)

Fig 1. Illustration of information acquisition

Another network measure called the 'eigenvector' finds the most central actors (i.e. those with the smallest farness from others) in terms of the 'global' or 'overall' structure of the network, and pays less attention to patterns that are more 'local'. The idea is that even if a node seeks information from just one other node, who subsequently seek information from many other nodes (who themselves seek information from still more others), then the first node in that chain is highly influential. In other words, those nodes which have high alter connectivity would be

most sought after for information as they themselves are connected to many others in the network indirectly.

Closeness centrality approach focuses on the distance from an actor to all other actors in the network. Information acquisition network being a directed network, we calculate the inCloseness network measure. A node with low inCloseness score has short distance for others to reach the node, and so will be a good source of information for nodes lying close to it in the network. We normally think of nodes that corresponds with high inCloseness scores as being well-positioned to obtain novel information early, when it has the most value.

In the information distribution network, the number of actors to whom a node disseminates information directly can be represented by the network measure ‘out-degree’ for that particular node. Related to organizational learning networks, the higher the out-degree centrality of a node, the higher the number of people with whom the node shares information.

Suppose that an employee wanted to talk to the CEO about a new cost saving technique that he/she has perfected over the years. According to the rules of bureaucratic hierarchy, he/she must forward the proposal through his supervisor, unit head, department head, divisional head, and finally it reaches the CEO. Each one of these people could delay the request, or even prevent his request from getting through. This gives the people who lie ‘between’ him/her and the CEO power with respect to him/her. Freeman suggests that betweenness centrality is particularly appropriate for measuring the control of flow of information, in that the mediating actor may withhold or distort information that is passed on. Betweenness centrality has been studied as a correlate of network control and as a predictor of power and influence. Sometimes, individuals with high betweenness centrality “strategically hide or deceptively share what they know about

the expertise of those members with whom they connect, so that those members would develop an inaccurate recognition of each other's expertise and people with high betweenness centrality would gain a unique competitive edge in the group" (Su, 2012, p.619).

E-I index is a good measure of the group-level information acquisition and distribution. The E-I index measures the ratios between external ties (between members of different groups in the organization) and internal ties (within groups in the organization) and normalises them to a value with a range of -1.0 to +1.0. An E-I index of -1.0 would indicate that only internal relationships exist, while all relationships would be external for an E-I index of +1.0. The E-I index provides a measure for the boundary-spanning character of the individuals while seeking or distributing information from or to other members of the network, who may be in the same group or different groups.

It is true that not all individuals share knowledge easily and some might be better at sharing information than others. Network centralization index measures the extent to which information flow is organized around one or two actors within the organization (Borgatti & Foster, 2003; Brass 1995; Wasserman & Faust, 1994). It is important to measure centralization index because it indicates how much network members are reliant upon passing through central nodes to reach each other. Some degree of centralization may be good for the network to function efficiently, but an overly centralized network can also be inefficient because of bottle necks due to limited paths for information to pass through (Borgatti, 2005). In a highly centralized unit, a small number of users will have a comparatively higher concentration of ties than other users. In less centralized networks, ties are spread more evenly among users.

We focus on centralization index because it provides a direct indication of how information is distributed within the organization. Organizational hierarchies reflect the common assumption that centralized communication structures provide the most efficient distribution of information. Indeed, organizations designate a relatively few number of individuals to distribute information to others. Although this might be efficient for the distribution of easily codifiable information, network research suggests that it might be ineffective when tasks are complex and sharing of tacit knowledge is necessary (Uzzi & Lancaster, 2003).

Methodology:

We collected network data using socio-metric techniques (Wasserman & Faust, 1994). Socio-metric techniques provide each respondent with a fixed contact roster and ask him/her to describe him/her relationship with every individual in the roster. The advantage of using sociometric approach is that it provides information on all interactions inside the network under consideration. The technique is not fully free of inaccuracies that can creep into network data. To the extent that the network boundary varies from one person to the other, asking each respondent to report on connections that lie outside his or her frame of reference can be problematic. Individuals provide more accurate network data on that part of the network with which they are most familiar (Kumbasar et al., 1994). Their assessment of network connections involving distant individuals is less accurate (Krackhardat & Kilduff, 1999). Defining an appropriate boundary around the network, the set of individuals who are interconnected, is critical. In the case of Scope, defining network boundary apriori was easy, as we included all the Principal Consultants, Senior Consultants and Consultants in the firm as part of our study.

Information Acquisition

We first look at the information acquisition network for Scope given below in Fig 2.

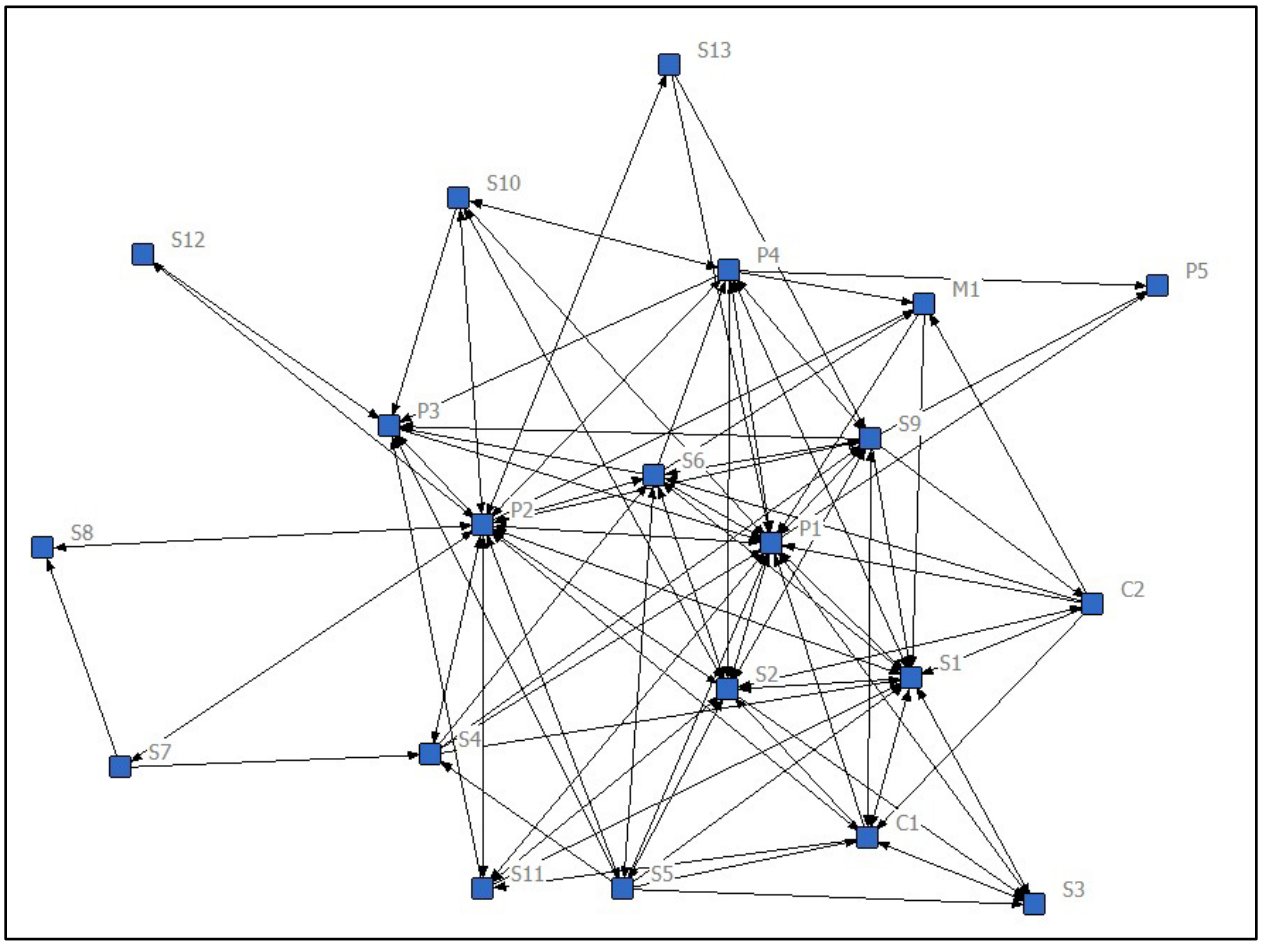


Fig. 2: Information acquisition network

What we find is that the number of ties or relationships that members of Scope have determines their embeddedness in the network that further enhances their opportunities, influence and power in the information acquisition process. Since a whole-network model was followed in this study, the maximum number of people from whom a node can seek information is limited. In the case of Scope, a node can have maximum of 21-1 = 20 connections (The rule is if there are ‘k’ actors, the maximum number of connections one can have is k-1).

From Fig 2, it looks like P1 occupies a central position in the information acquisition network. To confirm, we calculate the indegree of all the actors in the network. As explained earlier, the indegree of a node in Fig 2 is the total number of nodes that have lines directed towards it. In the case of information-seeking network for Scope, indegree would be the number of people who come to a node seeking information. In Table 1, P1 has an indegree of 16 and P2 has 15. It simply means that there are 16 actors who approach P1 for information and 15 actors who approach P2. For a network size of 21, this translates to nearly 3/4th of Scope members finding P1 and P2 useful sources of information. It could also be argued that P1'spower as CEO might be an influencing factor for people to seek information from him and thus, his high indegree. It may also be linked to an open-door policy of the top management. Another interesting observation is that P1 and P2 are the Principal Consultants spearheading the activities of Scope in two different locations and hence it is natural for people to seek information from their top bosses in their respective locations, especially in a knowledge-intensive industry.

Actor	Indegree	NormIndeg
P1	16	80
P2	15	75
S1	12	60
S2	11	55
S9	8	40
P3	8	40
S6	7	35
P4	6	30
C1	6	30
S3	5	25
S11	4	20
M1	4	20
S5	3	15
S4	3	15
S10	3	15
P5	3	15
C2	2	10
S8	2	10
S7	1	5
S13	1	5
S12	1	5

Table 1: Indegree for information acquisition network

In Table 1, we also find that the indegree of S2 and S1 are also higher. These two senior consultants seem to cluster around P1 (see Fig 2), which in turn gives them the power to become important sources of information for others in the network, arising mainly from their proximity to the central actors in the network. It brings out an interesting point that locating a node near to

the central actors (in this case, P1) increases its influence in the network and people approach this node for visibility to be seen closer to individuals holding high prestige.

We now calculate the outdegree of actors in the information acquisition network. In this case, it would be the total number of people whom a node would approach in seeking information. Table 2 shows that outdegree for P2 is the highest. P2 reaches out to 17 other actors in the network for seeking information. S9, P4, S2, S6 and P1 have relatively higher outdegrees. It also needs to be noted that other than P2, no one else in the network seems to be going to even half the other actors in the network. As was the case with indegree, S7, S13 and S12 have low outdegrees as well. This means that neither do they approach anyone for information nor do anyone seek information from them. S8 seeks information only from P2. This suggests that S8, who has an experience of more than 10 years, works on independent projects with Principal Consultant, P2. In P5's case, his low outdegree may be attributed to the select assignments which he engages with Scope.

Actor	Oudegree	NormOutdeg
P2	17	85
S9	10	50
P4	9	45
S2	9	45
S6	9	45
S5	9	45
P1	8	40
C1	7	35
S1	7	35
C2	6	30
S4	5	25
S10	5	25
S11	5	25
S3	3	15
S7	3	15
S13	3	15
M1	2	10
S12	2	10
S8	1	5
P3	1	5
P5	0	0

Table 2:Outdegree for information acquisition network

Combining Table 1 and 2, we see that P2 has a very high indegree and outdegree that might indicate that P2 acts as a 'communicator' or 'facilitator' for the whole network. P2 can also act as a 'bridge' between different geographical locations and hierarchical levels. The individuals

who have very low indegree and outdegree may be experts in their domains and don't require much information from others or it could be that their learning intentions are extremely low.

As discussed earlier, closeness centrality adds a different dimension towards understanding the information seeking behaviours of individuals in a network. It simply says how "far" an individual is from everyone else in the network in terms of his/her information seeking behaviour.An actor who is close to many others can quickly access information without going through many intermediaries and the information that he gets would be more relevant and non-redundant. Thus, if two actors are not directly tied, requiring only a small number of steps to reach one another translates to higher closeness centrality in the information acquisition network. From Table 3 below, it becomes clear that those individuals who are close are also having high degree centrality in the information seeking network for Scope. P1 is most close to everyone else in the information seeking network. Similarly, P2, S1 and S2 have high inCloseness values, which shows their ability to reach others for information with greater ease.

Actor	inFarness	inCloseness
P1	43	46.51
P2	44	45.46
S1	47	42.55
S2	48	41.67
S9	51	39.22
P4	53	37.74
P3	53	37.74
S6	53	37.74
C1	54	37.04
S11	55	36.36
M1	57	35.09
S3	57	35.09
S5	59	33.9
S10	59	33.9
S4	60	33.33
S8	61	32.79
S12	62	32.26
S7	62	32.26
S13	62	32.26
C2	63	31.75

Table 3: InCloseness for information acquisition network

We also calculated the network measure called 'eigenvalue' to help us find the most central actors (i.e. those with the smallest farness from others) in terms of the 'global' or 'overall' structure of the network. From Table 4, we find that actors P1, P2, S1 and S2 have higher eigen values. It means that if P1 is sought by individuals who themselves are sought for advice, then

P1gains even more status. Suppose both P1and P4 are sought by five individuals each. If P1's five individuals are highly sought themselves whereas P4's five individuals are never sought for advice, then even though P1 and P4 have the same degree centrality, P1 has higher status than P4 according to eigenvector centrality.

	Eigenvec	nEigenvec
P1	0.36	51.17
P2	0.33	47.52
S1	0.31	44.11
S2	0.29	41.38
S9	0.28	40.07
S6	0.28	39.80
P4	0.24	35.07
S5	0.23	33.12
C1	0.23	32.76
P3	0.21	29.78
C2	0.19	27.22
S4	0.18	26.23
S11	0.17	24.54
M1	0.17	24.36
S10	0.14	20.38
S3	0.14	20.15
P5	0.09	13.95
S13	0.09	13.80
S7	0.05	7.88
S12	0.05	7.69
S8	0.03	5.51

Table 4: Eigenvector centrality for Information seeking network

The examination of information seeking network based on the above three network measures leads us to three conclusions. First, actors who have high values for indegree are approached by more people for information, which may indicate that there are better chances of organizational learning at the individual level if there are more people with high indegree values. Second, when an actor lies close to other members in the network, it is easier for him/her to seek information from others, save time and energy. So, learning opportunities are enhanced when the influential

nodes are close to other nodes in the learning network. In addition to this, when individuals themselves are connected to other actors who are themselves well-connected, it increases the chance of information acquisition and hence higher eigenvector values for individuals in a network would suggest better individual learning capabilities.

The E-I Index for information acquisition network for Scope is 0.24 (see Table 5 below). This simply means that there are only lesser number of people who go outside their groups [here groups mean Principal Consultants (group 1), Senior Consultants (group 2) and Consultants (group 3)] in acquiring information. Among the different groups, the E-I Index for Consultants is high as Table 5 shows a value of 0.64. This might be because there are only two of them. The E-I Index for Principal Consultants is higher compared to Senior Consultants (0.43 vs. 0.02).

	Frequency	**Percent**	**Possible**	**Density**
Internal	64	0.38	182	0.35
External	104	0.62	238	0.44
E-I	40	0.24	56	0.13
Group	**Intern**	**Extern**	**Total**	**E-I**
1	16	40	56	0.43
2	44	46	90	0.02
3	4	18	22	0.64

Table 5: E-I Index for information acquisition network

Information Distribution

As explained earlier, we examine information distribution network from two aspects. How many other nodes does a node distribute information measured by its outdegree and how many connections for which a node lie in the middle of two other nodes who are trying to

communicate captured by its betweeenness score. Betweenness centrality views an actor as being in a favoured position to the extent that the actor falls on the geodesic paths between other pairs of actors in the network. That is, the more people depend on a node to pass information to other people, the more power the node has. If, however, two actors are connected by more than one geodesic path, and a node is not on all of them, then the particular node loses some power.

The information distribution network is shown in Fig 3.

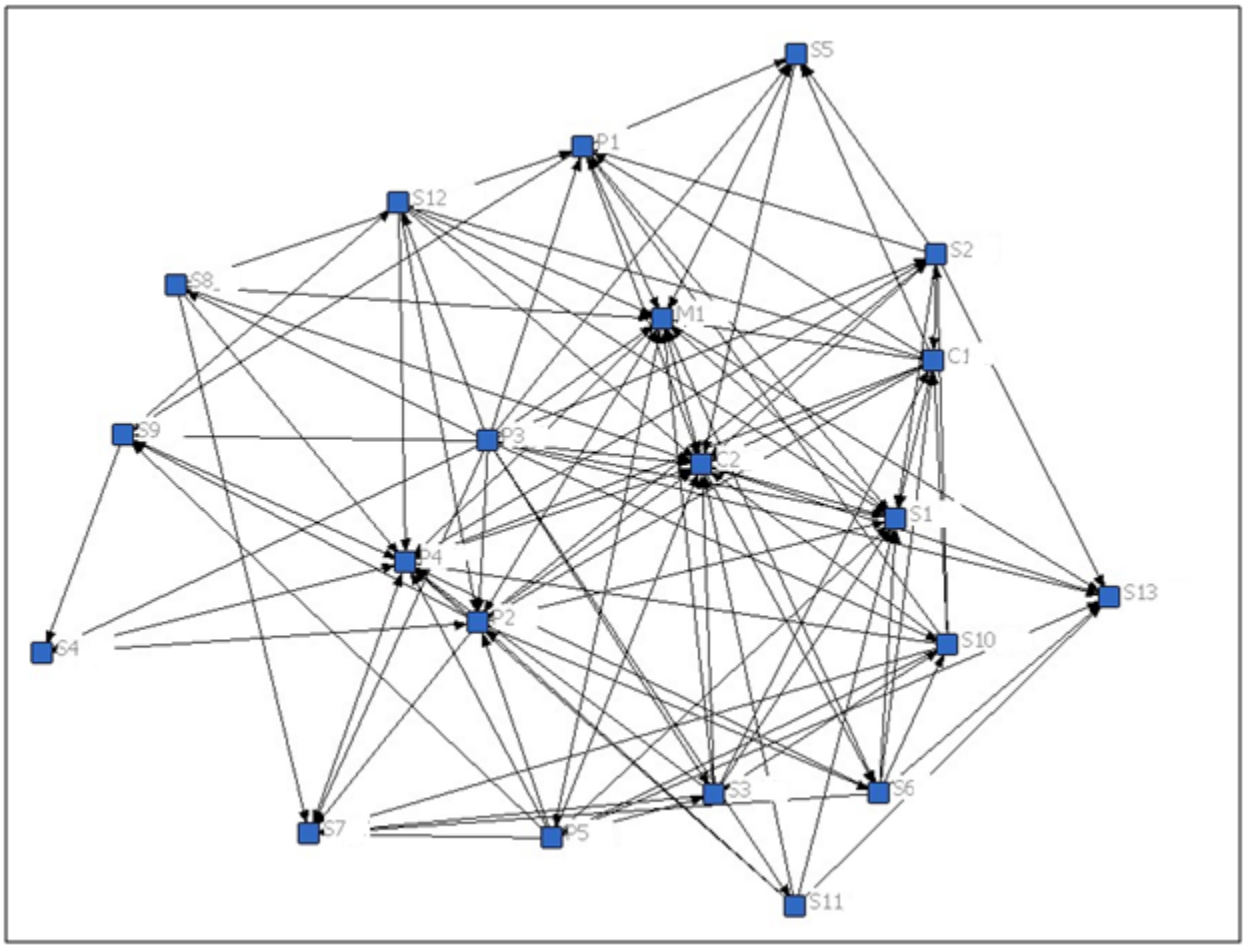


Fig. 3: Information distribution network

The outdegree in Table 6 represents the number of people whom a node disseminates information. Table 6 shows that consultant, C2 has the highest outdegree followed by P4, M1

and S1. It was interesting to see that the outdegree for Scope CEO, P1 and Principal Consultant, P2 was less. They had high values for indegree in the information acquisition network. The outdegree values for the individual nodes in this network are very less, when we take into consideration that the nodes operate in a highly knowledge intensive industry. If the consultants at different levels do not communicate with each other frequently, the organizational learning would be low as the learning would be limited to individual level learning. It was interesting to find that only three of the total 21 nodes had an outdegree higher than 10. What it also suggests is that 84% of the nodes don't frequently communicate with each other.

	Outdegree	NrmOutDeg
C1_J	4	20
C2_A	16	80
M1_R	11	55
P1_H	6	30
P2_P	7	35
P3_S	0	0
P4_V	14	70
P5_C	2	10
S1_M	11	55
S10_Pa	3	15
S11_T	1	5
S12_Ad	3	15
S13_Ni	6	30
S2_R	3	15
S3_Ne	3	15
S4_An	2	10
S5_Pu	5	25
S6_Aj	3	15
S7_V	8	40
S8_S	1	5
S9_K	4	20

Table 6: Outdegree for information distribution network

In Table 7, we can see that there is a lot of variation in actor betweenness (from zero to 87.86). The individual who has high betweenness is M1, an Assistant Manager, who looks after the day-to-day functioning of the organization without much role in the consulting work. It is also interesting to note that the betweenness of both the consultants, C1 and C2 are also high. It could be that they work at the back-end and disseminate information depending upon senior consultants' requirement. The CEO, P1 had a low betweenness compared to other Prinicpal Conusltants . Most of the senior consultants had a low betweenness, as had been the case with other network measures.

Actors	Betweenness	nBetweenness
M1	87.86	23.12
S6	83.93	22.09
C2	61.59	16.21
P2	46.86	12.33
S9	26.71	7.03
C1	23.63	6.22
P4	22.69	5.97
S10	22.22	5.85
P5	19.65	5.17
P1	17.28	4.55
S12	10.36	2.73
S2	6.66	1.75
S3	2.87	0.76
S1	2.78	0.73
S4	1.78	0.47
S5	0.70	0.18
S13	0.17	0.04
S11	0.09	0.02
S7	0.09	0.02
S8	0.09	0.02
P3	0.00	0.00

Table 7: Betweenness of information distribution network

Conclusion:

Social network analysis provides a better way of understanding organizational learning based on a relational view. Hence, for practicing managers, knowledge about the structure and patterns of the learning network helps identify key players who can either become facilitators or bottlenecks of information. The visualization of the various subprocesses networks of organizational learning should be a standard aid for managers while taking decisions.

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