

Applications of Social Network Analysis in Human Resource Development

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Abstract

Social network analysis (SNA) is a technique that focuses on identifying and comparing relationships within and between individuals, groups and systems in order to model the real world interactions at the heart of organizational knowledge and learning processes. SNA promises to add significantly to theory building in the field of Human Resource Development (HRD) by providing a methodological approach for improving empirical rigor of conducting research in organizational development, organizational learning, leadership development, training and development. Thus, SNA can play an important role in moving HRD forward. An attempt has been made here to project SNA as a methodology to approach, deal, analyze, plan issues related to HRD. Since HRD forms a vital component of extension management, SNA methodology gains strategic significance.

Social network analysis (SNA) is a sociological paradigm to analyze the structural patterns of social relationships (Scott, 1991, Wasserman and Faust, 1994 and Wellman and Berkowitz, 1988). SNA is a research technique that focuses on identifying and comparing relationships within and between individuals, groups and systems in order to model the real world interactions at the heart of organizational knowledge and learning processes (FAO, 2006). It provides a set of methods and measures to identify, visualize and analyze the informal personal networks within and between organizations. SNA has been emerging as a key technique in modern sociology, anthropology, geography, social psychology, communication studies, organizational studies, economics and biology, as well as a popular topic of speculation and study (Abdel-Ghany, 2008). Thus, SNA can become an integral method of organizational design and strategy to support processes of inter-organizational community building, communication and knowledge sharing (Muller-Prothmann, 2006). At this juncture, an attempt has been made in this paper to project SNA as a methodology to approach, deal, analyze, plan issues related to HRD, through a brief review of similar kind of studies. Since, HRD domain forms a vital component in extension management, this methodology gains strategic significance.

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The HRD domain is relatively new and continues to explore and adopt new theories and methodologies. It has slowly shifted its focus from the individual to a greater consideration of multiple levels: individual, group, work process and organization (Swanson and Holton, 1997). In a given situation, it may be either an individual, group, or organization as a whole. The role of HRD practitioners is to strive towards achieving organizational effectiveness through learning and performance improvement methods (Cohan, 1990, Sambrook, 2005 and Yamnil and McLean, 2001). However, tailor-made HRD methods through which the practitioners can analyze the level of interaction between individuals and their environment, which is key factor contributing organizational effectiveness, have not been readily available. Hence, HRD scholars continue to search for as many tools as possible to explore processes in which organizations become more effective. In this way, SNA promises to add significantly to theory building in the field of HRD by providing a methodological approach for improving empirical rigor of conducting quantitative research in organizational development, organizational learning, leadership development, organizational change and training and development (Hatala, 2006). Thus, SNA can play an important role in moving HRD forward.

SNA methodology

The initial step in SNA methodology is to identify the target network. The network refers to the group of human resources pertaining to the target domain organizations for which the SNA methodology will be applied. The next step is to assess the problem to be addressed through SNA methodology. This includes outlining and defining the objectives of the study and the scope of analysis. The level of reporting needed through SNA analysis will also be decided in this step. Here, the decided objectives provide scope for formulating hypotheses based on the questions to be answered. Amidst such settings, the survey methodology will be decided. Once, the survey methodology is decided, the employees in the social network of the target domain will be interviewed for information pertaining to relationship variable that has to be revealed through the study.

The data thus collected will be utilized for depicting the variable of relationship in the network either manually or through software tools available for SNA methodology. The depicted relationship reveals baseline situation in the organizations and thus provides scope for conclusions and pragmatic implications. Once, social relationships and knowledge flows become visible, such relationships can be evaluated, compared and measured. The following are the various measures that can be analyzed through SNA methodology (Abdel-Ghany, 2008):

1. Connection and distance

- Accessibility-among the network members
- Connectivity-among the network members
- Distance and diameter-among the network members

2. Embedding

- Reciprocity-among the members while communicating
- Clustering-groups in the network
- Hierarchy-in the network

3. Ego networks

- Network density-to reveal the loose and close connections
- Structural holes-lack of connectivity at network positions
- Brokerage-relationship among members through intermediary members

4. Centrality and power

- Degree centrality-proportion of central players
- Closeness centrality-distance between central players and other members
- Betweenness centrality-distance among the members

5. Cliques and sub-groups

- Cliques-group of members having close links
- Components-sub-groups in the cliques/ networks

6. Measures of similarity and structural equivalence

- Matches-members with similar links
- Visualizing similarity
- Describing structural equivalence sets

In general, the above measures can explain the size of the network (nodes or members), network centralization (degree to which relationships are focused around one or a few network members) and density (ratio between total number of actual and possible ties). It identifies the cliques/ clusters (sub-groups), cut-points (bottlenecks), hubs (enablers) etc. Three kinds of centrality measures viz, degree-centrality (indicator of power of network members), closeness-centrality

(integration of network members) and betweenness-centrality add depth to the interpretation of the data and help identify the knowledge brokers and information gatekeepers within a network of an organization. SNA also delineates experts, contact persons and knowledge consumers in a network.

Mapping-out of network relationships either visually or manually needs software that is developed specifically for the purpose. There are many software available in the market to cater to the needs of SNA methodology. The following literature reveals the various software packages available to assess the relationships in social networks of organizations:

- UCINET IV offers researchers the ability to compute network measures as well as to generate sociograms through its incorporated visualization software NetDraw (Borgatti *et al*, 2002).
- Pajek 1.04 was used for data analysis to understand the learning network of organizations (Skerlavaj and Dimovski, 2006).
- UCINET was used for information auditing and in evaluating the performance of information management in organizations (Haotari, 2000), for modeling information flow of face-to-face meetings in organizations (Zhenghao and Rudolph, 2004), to rate the opinion of peer group for leadership development, for assessing knowledge sharing in organizations (with additional tools NetDraw for network visualization and Mage for 3D visualization) and for mapping organizational change (Steffen-Fluhr *et al*, 2010).
- The software 'Pajek' has also been used for assessing knowledge sharing studies in a larger network. There are six software packages widely used among the SNA community: four are freeware (MultiNet, StOCNET, STRUCTURE and Pajek) and two are priced products (NetMiner and UCINET) (Mueller *et al*, 2007).
- The data collected from the surveys of Leadership Learning Circles were analyzed using UCINET and NetDraw (Anonymous, 2007).
- Programmes that can be used for assessing the social network of diffusion of innovations in organizations are UCINET, NetDraw and Pajek. The data pertaining to social isolation analysis was exported from the survey as a series of files and then imported to UCINET for visual analysis *via* NetDraw (McDonald *et al*, 2005).

- Training transfer climate was subjected to analysis through UCINET VI that offers the researcher facility to compute network measures and to create network maps through inbuilt visualization software NetDraw (Hatala 2007).

All the above citations conclude that UCINET and its inbuilt graph visualization software NetDraw are commonly used by the practitioners of SNA. However, the use of such software programmes for analyzing SNA methodology needs in-depth insight, so that the readers can understand the methodology beyond doubt.

Utility of SNA in HRD

Training and Development

SNA can be used as a methodology to plan capacity building programmes based on the needs of the employees and prevailing organizational support climate. Participation in capacity building programmes by employees and transfer of knowledge, attitude and behavior that are learnt during such capacity building programmes back at work, are influenced by personal capacities and attributes of the employees, effectiveness of training design and delivery and the prevailing organizational support climate. In this regard, SNA has been recognized as a methodology for assessing the transfer climate prior to, during and after training. SNA serves as tool for analyzing the participants' organizational network relationships prior to training that will help the training facilitator, trainee and supervisor gain an accurate picture of the transfer climate. Such analysis prior to the training provides a clue about the key performers to whom imparting of training may be essential in an organization. It can also serve as an assessment tool prior to the planning of the training intervention to identify who are true opinion leaders within the organizational climate, so that such opinion leaders can be molded and utilized for effecting transfer of new learning through the trained employees. SNA also helps to improve the organizational climate in order to support training transfer as needed by the trained employees, so that they can exhibit training-induced job performance, which may have positive impact on peer group performance and in turn the overall organizational performance (Hatala, 2007).

Training transfer can be studied through analyzing perception of employees about organizational climate prior to, during and after capacity building programmes. Such perception responses can be mapped as network diagrams through appropriate software. The network structure and the response are to be correlated to assess the prevailing support culture for training transfer. The

correlation results may lead to pragmatic strategies for remodeling organizational support climate to effect appropriate training transfer. Assessing the role of organizational support climate for training transfer through SNA methodology was explained by Hatala, 2006 through a case of sales group in an organization.

Organizational Learning

Organizational learning represents the learning about organizational process with respect to knowledge flow among the employees. It refers to both participation of employees in practice community and flow of previously acquired knowledge. Tracking learning process in organizations depends upon studying actor dynamics and work characteristics. Organizational learning may be aroused through physical proximity, complementarities in knowledge possessed, personal traits and level of expertise. Such learning process in organizations may be studied through SNA.

The organizational learning can be studied through a questionnaire survey and the results can be visualized and analyzed through software used for interpreting the results of SNA. SNA can assist in further development of theory-building in HRD viz, learning participation, learning transfer, performance improvement and training design. It can assess the effects of a social environment on learning participation through identification of cultural influences and the impact that social structure has on an individual's motivation to learn. Studies on organizational learning through SNA methodology were done in the University of Ljubljana, Slovenia to assess the learning pattern in organizations by identifying central employees in organizational learning, developing fit between formal and informal structure prevailing in organizations, selecting employees for rewards, renewal of rewarding system, and to plan and organize capacity building and educational programmes through central employees (Neumann, 1989, Isabella, 1990 and Torenvleid and Velner, 1998).

Leadership Development

Identification of central actors within the organization will be beneficial in disseminating the change initiative, because these central employees behave as opinion leaders for the peer group who depend on them for decision making in various stages of the organizational process. SNA helps HRD practitioners to visualize the social structure of the organization and allows them to identify the central employees who may be considered as opinion leaders (Leonard-Barton, 1995 and Rogers, 1983). SNA methodology can differentiate relationships in a network as communication (who speaks to whom), instructional (who asks whom

for help), power relations (who follows whom in informal groups) and interpersonal (who likes who) relationships (Cross *et al*, 2002).

Identification of leaders in the organizational network may be done through peer-rating surveys and the resultant data can be analyzed through SNA methodology using software. SNA helps to determine how individuals use their position within a network to accumulate power in social settings (Burt, 1997). If the identified leaders in the social network of the organizations are cooperative, they can be developed as resourceful assets for the organizations through appropriate leadership development interventions. Such studies were undertaken in SAFTI Military Institute, Singapore to identify the leaders to lead army groups. Similar efforts can be attempted to identify leaders in formal organizations.

Diffusion of Innovations

Social network in a society or a community or in an organization can influence the diffusion of innovations. Such social networks can be traced through SNA methodology. Through SNA, the key information brokers in the innovation diffusion network can be identified. This analysis can be done by assessing the number of network partners or each individual in the network and correlating this measure with innovativeness of individuals (relative time for adoption of the innovations). The principle underlying such assessment is that adoption of certain innovations is directly related to the number of links of individuals in a network. The knowledge of the individual about an innovation, source of information, adoption or rejection of an innovation, the role of peer group in influencing conviction towards such decision of adoption or rejection etc constitutes the assessment towards diffusion of innovations in a social network. The personal network exposure, which is a measure of how intensively an individual is exposed to an innovation, weak ties (people loosely connected to others in the network) and structural equivalence (the degree of equality in network position) influences the adoption of innovations and other social network characteristics which might further influence the diffusion of innovations. These measures enable the HRD practitioner to uncover some properties for the individual, network, subgroup and the whole network and correlate them with his knowledge, use and rejection of innovations. Controlling social network redundancies that are identified through SNA can effectively enhance knowledge diffusion efficiency. If a team fails to manage knowledge diffusion, it will potentially offset any competitive advantages that might be gained *via* upgrading technology (Haung et al, 2010, Callen, 1993, Dipadova and Freeman 1993 and Johlke and Duhan, 2001). Studies on assessing the diffusion of innovations in social organizations have been carried out by the

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Knowledge Management

A critical resource embedded within organizations is the knowledge that highly skilled workers/ employees bring to work on a day-to-day basis. A significant yet often overlooked component of people's information environment is composed of the relationship that they use to acquire information and knowledge. Knowledge management through capturing, utilizing, storing, sharing, retrieving knowledge on various applications in an organization is vital for maintaining the competitiveness of organizations. These knowledge management activities can very well be captured by SNA methodology. SNA have been widely recognized as a potential approach to analyze, evaluate and influence communication processes. Hence, it is argued that SNA is a highly effective tool for identification and implementation of practical methods in knowledge management. For the purpose of knowledge management, SNA may help to evaluate availability and distribution of critical knowledge and thus facilitates strategic development of organizational knowledge, transfer and sustainable conservation of implicit knowledge, creation of opportunities to improve the communication process, identification and support of groups in practice, harmonization of knowledge networks (after mergers and acquisitions of organizations) and sustainable management of external relationships. The research conducted by IBM Institutes for Knowledge-Based Organizations through SNA revealed different relationship dimensions (knowing what someone knows, gaining timely access to that knowledge, creating viable knowledge through cognitive engagement and learning from safe relationship) which are important for effective learning for knowledge management. By analyzing and applying these dimensions to important groups of people within an organization, knowledge creation and sharing can be improved (Cross *et al*, 2002).

Monitoring and Supervision

The management initiatives in an organization have a purpose and measuring the outcome of such initiatives is essential for assessing the effectiveness and efficiency of initiatives taken by organizations. SNA helps to measure the network outcomes and provides a framework for collecting and analyzing data that are useful in planning and monitoring of changes in network operations and thus the overall outcomes. SNA is a potential tool for participatory monitoring and evaluation as it is able to show the relationship between individuals, groups and

organizations over time and their respective contributions to the outcome of various organizational initiatives. SNA has often been used by the leaders to find ways and means to manipulate the network, to use it in a traditional and controlling way (Wheatley and Frieze, 2006). As the number of networks increases, there are more resources available to groups in the organizations, and thus monitoring such networks will be a herculean task. However, by applying SNA network monitoring and supervision can be made easy (Gibbson and Durga, 1999). SNA allows managers to visualize and understand the myriad of relationships that can either facilitate or impede knowledge creation and transfer and thus analyses the causes for outcome experienced by the organizations against management initiatives.

Ethical Issues

SNA methodology needs active participation by the employees of an organization in surveys pertaining to various issues as listed in the above discussions. Through such surveys when depicted through SNA software, the response of the employees and their relationship dynamics and organizational commitment level are exposed. Hence, there is every risk for the employees through their response to be amenable for possible reciprocities by the authority or management of the organizations. There is also a possibility of worsening of horizontal and vertical network relationships among the peer group or employees and the management, as a result of revealing the responses for further decision making. Such disturbed relationships may become a hindrance for organizational performance, competitiveness and profitability. Hence, there is a need to protect the responses of employees towards various surveys through SNA methodology. Such onus rests on the shoulders of HRD practitioners. Application of SNA in HRD demands immediate development of ethical guidelines for social network research in organizations, because organizations in future may increasingly make decisions influenced by the network analysis research that will have powerful repercussions on the individual employees and in protecting the network research enterprises from backlash by respondents as a result of poor treatment and being shut down by the authority. Harm to the employees may be avoided by thoroughly disguising the data, so that management cannot take action against the individuals and the participation of individual employees may be made voluntary. Another possible problem may be from the employees i.e. once they know that their personal attributes in a given organizational climate viz, performance or credibility or relationship etc, is going to be exposed, they may exhibit dramatized social behaviour and misleading questionnaire or interview responses (Borgatti and

Molina, 2003). The data from dramatized social behavior may mislead the results and the follow-up initiatives.

Conclusion

SNA has been emerging as one of the key methodologies in many of the arenas of social sciences. HRD, relatively a new social science domain continues to explore new techniques, while shifting its focus from individual to groups and processes that occur in organizations for achieving the goals effectively. The increasingly rich experience of SNA from the platforms set on various social science issues viz, organizational learning, development of leadership roles, identification of opinion leaders and contact personalities, diffusion of innovation through networks and its efficiency, information auditing and evaluation of information management, assessing the training transfer climate, manipulating and monitoring the network relationships, participatory monitoring and evaluation of work processes in organizations etc, may provide SNA a strong base and strength to be recognized as organizational network analysis (ONA) and to become one of the most significant techniques to be used in the HRD domain by the practitioners for strategic management in organizations to acquire competitiveness. However, there arises a need towards formulating ethical guidelines in utilizing SNA as a HRD tool with respect to safeguarding employees from potential harm and preventing them from exhibiting deliberate changed organizational behaviour. It is also imperative to understand that thorough understanding of applications of SNA methodology in various HRD issues need in-depth and issue-based studies and communication among various journals related to social sciences. Hence, the aim of this paper is to seed the idea of application of SNA as a useful methodology to approach analysis of HRD issues.

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