

Chapter III

Social Network Mapping Software: New Frontiers in HRM

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Abstract

Recent developments in social network mapping software have opened up new opportunities for human resource management (HRM). In this chapter we discuss how social network mapping information may provide critical inputs to managers for increasing the effectiveness of their HRM programs.

Introduction

In a knowledge-driven economy, returns on effective management of human capital are likely to exceed those available from more efficient management of financial and physical assets. In order to realize these returns, however, companies must go beyond notions of productivity and cost effectiveness, and

develop new approaches and management techniques to tap the knowledge, intellect, and creativity used to achieve these outcomes. Mapping and understanding social networks within an organization is an approach to understand how social relationships may affect business processes. Network perspectives build on the general notion that economic actions are influenced by the social context in which they are embedded and by the position of actors in social networks (Granovetter, 1985). Research on social networks indicates that network structure and activities influence employees and affect individual and organizational outcomes (Sparrowe, Liden, Wayne, & Kraimer, 2001), and provides motivation to explore this rich field for possible inputs in human resource management (HRM) activities. In this chapter we suggest ways in which social networks can be analyzed using network mapping software and how some the information derived can be used meaningfully for HRM.

What do networks within organizations look like? How do we efficiently construct and analyze maps of these networks? What effect do these networks have on HRM activities? What opportunities exist to use social network mapping information to improve HRM activities? These questions are significant for organizations that want to manage their social and human capital efficiently and effectively. Given that vigorous network activities usually take place within organizations, and that social capital may have a direct bearing on human capital management, it becomes important to examine how these social processes affect HRM activities. Recent developments in social network mapping software help organizations to discover and analyze network structures. While such software has been available for quite some time, only recently have high-quality tools become readily accessible to mainstream business users. Partly this is because of improvements in computing power (i.e., modern computers are more capable), but there has also been significant improvements in the functionality and usability of the software. Our discussion highlights the capabilities of some of these software applications, as well as their implications for various HRM functions.

What are Social Networks?

The social network theory (Uzzi, 1996; Ibarra, 1993; Granovetter, 1973, 1985) emphasizes that human decisions are, to a large extent, functions of the ties between people (Burt, 1992). Individuals obtain support, information, and

power from the network structure around them and from their position in the network. Factors that determine the influence of a social network on decision making include accessibility to network, network structure, the actors involved, and the location of the decision maker in the network (Burt, 1992).

While the influence of social networks within organizations has long been acknowledged, it is only recently that one could quantify and visualize social networks of substantial size. To understand the complexity of the task, let us consider the various structural measures that can be applied to social networks. Network structures refer to a definable set of relationships, which hold together a number of objects (or people) in juxtaposition with one another (Burt, 1992). These structures are characterized by relationships, entities, context, configurations, and temporal stability. Some of the indices and dimensions that express outcomes of network are:

- *frequency of interaction* among the contacts;
- *structural holes* or non-connectivity between contacts;
- *centrality*, which refers to the extent to which an individual could reach others in the network through a minimum number of links;
- *criticality*, which reveals the degree to which an individual's position was crucial to the flow of materials in the workflow network;
- *transaction alternatives*, which refers to whether or not redundancy was built into the system in terms of inputs to particular individuals and their output to others;
- *reachability*, which focuses on how many links a communication must flow through to get from one node to another;
- *connectiveness*, which refers to whether or not all of the possible linkages in an aggregate are being utilized;
- *inclusiveness*, which refers to the number of points that are included within the various connected parts of the network; and
- *density* of a network, which is defined as the number of relationships expressed as a proportion of the maximum possible number of relationships.

Clearly, with such a rich vocabulary of quantitative terms used to describe just the structure of a network, there is much more to network mapping and

analysis than constructing a few diagrams. Calculating even one measure manually would be quite tedious and error-prone. Thus, network analyses are almost always performed using specialized software, the subject of our next section.

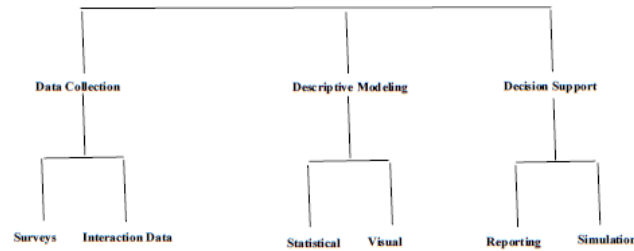
Social Network Mapping Software

Figure 1 summarizes the common features of network mapping software. Most social network analysis software supports at least one of three functions: data collection, descriptive modeling, and decision support. Data collection is the most fundamental requirement. Generally, the input data takes on one of two forms, depending on the focus of the analysis. For perceptual or egocentric data, the traditional method is to survey individuals about themselves (age, gender, etc.) and their relationships to others in the organization. If the objective is to provide a one-time or occasional snapshot of the network, such methods can work very well. However, for more frequent analyses, an alternative method is to collect interaction data (e.g., adjacency matrices) based on some measure of activity between people in the organization. The data is then input to the software through some sort of import utility. In some cases, the import utility can be used to collect activity data from e-mail servers, instant messaging gateways, and other “watering holes” in cyberspace.

Descriptive modeling, the second function, is used to “map” the structure of the network. Quantitative models use descriptive statistics (e.g., centrality, criticality, etc.) to measure global or local properties of the network. For example, IKNOW (2003) can calculate measures of centrality and prestige for demographic groups within a larger network. Similarly, UCINET (2003) provides dozens of analytical models, ranging from measures of criticality, cohesion, inclusiveness, and similar quantities, to more advanced procedures like correspondence analysis and multiple regressions. Visualization models are also useful, particularly when looking for useful patterns (e.g., centers of control) in the network structure. Two of the most common visual models are network “graphs” (NetVis, 2003) that look like stick and ball models used in chemistry classes and clustering diagrams (UCINET, 2003) that use tree shapes called “dendrograms” or colored scatter plots to group individuals within the network.

The last and most advanced function of social network software is to provide

Figure 1. Social network mapping software classification



decision support to those who seek to alter or manage the social network itself. Providing that the data collection process is sufficiently automated, customized reports can be used to detect trends or unusual activity in the network. They may also be used in so-called what-if analyses, where the network is analyzed under various scenarios. Since in principle any descriptive model can be used as the basis for the report, virtually any package will support this functionality to some degree. A somewhat more sophisticated use of such longitudinal data is simulation (SIENA, 2003), which tries to predict the evolution and long-term behavior of the network given certain network parameters. Typically, these parameters are estimated from several snapshots of the interaction matrices.

A representative sample of the available software packages taken from the INSNA Web site (INSNA, 2003) is presented in Table 1. IKNOW (2003) is a Web-based package that uses surveys to elicit network data. It is free for noncommercial use, but you must contact the developer for a commercial license. InFlow (2003) and NetForm (2003) are offered as part of consulting services by the developers and include a formal methodology for conducting network analysis. NetVis (2003) and SIENA (2003) are free packages targeted at researchers that support advanced statistical features like simulation. UCINET (2003) is similarly advanced, but requires a commercial license.

As even this small sample demonstrates, social network software is quite a diverse lot, ranging from relatively simple network mappers to comprehensive methodologies to cutting-edge research tools. Further, each tool has its strengths and weaknesses, making the choice of which to use somewhat

Table 1. A sample of social network software

	IKNOW	InFlow	NetVis	NetForm	SIENA	UCINET
Data Collection						
Surveys	X	X	X	X		
Import Utility		X	X		X	X
Descriptive Modeling						
Statistics	X	X	X	X	X	X
Graphs	X	X	X	X		X
Decision Support						
Custom Reports	X	X		X		
Simulation			X		X	
Software						
Vendor	Univ. Illinois	Orgnet.com	Netvis.org	NetForm	Tom Snijders	Analytic Technologies
Platform	Web	PC	Web	PC	PC	PC
Free Download	Yes	No	Yes	No	Yes	Evaluation
Licenses	Free	Commercial	Free	Commercial	Free	Commercial
Paid Support Available	Yes	Yes	No	Yes	No	Yes

dependent on individual needs and resources. If your needs are extensive and you have the budget to afford it, then you may want to consider software like InFlow or NetForm that are backed by consulting organizations. Similarly, if you can't afford consulting services and do not want to scale the learning curve of the more advanced tools like SIENA or UCINET, then you may want to opt for the simplicity of a tool like IKNOW or NetVis which, once installed, requires very little maintenance or training.

HRM and Social Network Mapping

Social network theorists have discussed how networks provide access to information and knowledge (Burt, 1992). Flow of information, power, and status are the three major outcomes from social networks and the network position of an individual or a group facilitates this flow (Sparrowe et al., 2001). From the HRM perspective, information on knowledge, power, and status flow can be input for effective management of people. HRM activities like recruitment and selection, performance management, training and development, communication, employee relation, and compensation can use this information for better decision making. Flow of knowledge tells us how human, social, and

intellectual capital are generated within an organization (Ibarra, 1993). Power and status flows help HR managers to identify sources of motivation and greater productivity. Thus, visualization of social networks and measurements of network properties within an organization reveal information that may lead to new frontiers in HRM functions.

Before the advent of network mapping software, subjective assessments of social processes were made by supervisors and managers. However, recent research reveals that supervisors' assessments do not correlate with either the perceptions of the actual incumbent, or with critical work outcome measures (Marchese & Delprino, 1998). Network mapping provides visual as well as statistical representation of network structures and the actual flow of information, providing a much-needed quantitative tool for this type of information. Depending on the type of software used, this information can be collected over time for several different occupants of a position so that a generic picture of the 'social' requirements of the position emerges. Equipped with this information, the manager can make a better-informed decision about how to manage people within an organization. While we certainly do not wish to imply that objective data is better than subjective assessment, there is a case for numbers and pictures from actual data supplementing qualitative judgments for greater accuracy in decision making.

Table 2 shows the type of information relevant to HRM from social networks mapping and how they can be possible inputs in HRM processes. Social networks within an organization can reveal information related to a *job*, an *employee*, a *group* (team, department, unit, etc.), or the whole *organization*. We discuss input from social network mapping to each of these levels within the organization and the impact of this information on HRM functions. In doing so, we follow our classification of social network software (Table 1) and discuss data collection methods and the descriptive statistics that are relevant for the HRM functions and are inputs to decision-making processes.

Information Relevant to the Job

Social network mapping can be a valuable source of information for social interaction activities associated with a job or position. Recent research has highlighted that even for a 'technical' position like webmaster, organizational and management skills are critical and can make a difference in performance (Wade & Parent, 2002). Social interaction is a major requirement in organiza-

Table 2. HRM and social network mapping

HRM practice	Input from social network mapping			Use in HRM			Organization related
	Data collection	Descriptive modeling	Decision support	Job related	Employee related	Group related	
Recruitment and selection	Temporal and snapshot, periodical, infrequent	Frequency, centrality, structural holes, centrality	Identify patterns, detect outliers, patterns, prediction of skill requirements, forecasting models	Identify interpersonal/organizational skill requirements, cross-functional skill requirements, leadership skill requirements	Match social profile for internal selection	Skill demand analysis, select group members	Organizational skill demand analysis
Training and development	Temporal, periodical, frequent	Centrality, criticality, connectiveness, structural holes	Prediction of skill requirements, forecasting models	Identify current and future training requirements, succession planning	Identify training candidates, career planning	Culture building, consensus building	Organizational communication
Performance management	Temporal, ongoing	Frequency, centrality, criticality, transaction alternatives, reachability, inclusiveness, density, social profile	Normative models	Set normative targets for organizational skills, identify or build redundancies	Evaluate against targets, identify high performers	Optimize reachability and inclusiveness, facilitate goal-sharing and team work, maximize efficiency	Set organizational targets, balance efficiency and flexibility among inter-unit work
Employee relations	Snapshot, based on requirement	Frequency, centrality, criticality	Negotiation models	Identify critical positions for maintaining harmonious relations	Identify critical/central candidates for negotiation/consensus building	Identify critical/central groups for negotiation/consensus building	Monitor overall employee relations patterns
Compensation and benefits	Temporal, ongoing	Structural holes, centrality, criticality, connectiveness, inclusiveness	Identify patterns in information flow	Measure the social component of a job for determining compensation	Identify motivating factors for an individual	Identify groups for similar compensation patterns	Architecture for compensation and benefit management

tional skills. Therefore mapping of the 'social' interaction requirements of a job helps managers learn more about it and may provide critical information that constitutes the job description of a position, either formal or informal. Data collection for such information may be periodical, although temporal data is needed to get a stable pattern for the social aspect of the job.

Job-related information provided by social network mapping can be of several types. What is the level of interaction requirement of the job in relation to other jobs/positions at the same or different organizational levels (frequency of interaction)? Complex interaction patterns would reveal a higher requirement of people-related skills, while sparse interaction may indicate either technical/specialized skills or lower skill requirements. Structural holes — that is, the distance between the network contacts — is also relevant for describing a position. Are the network contacts far apart or close together? Far-flung networks may indicate cross-functional interaction requirements, sometimes across hierarchical levels, while tightly knit networks indicate homogeneous work groups. Centrality of the position is yet another critical dimension that indicates requirement for leadership abilities because the incumbent may need to exercise more decision-making capabilities if most of the contacts in the network are referring back to this position often. All this information provides critical input for recruitment and selection processes, and helps in choosing the 'right' candidate for a job.

Job-related information provided by social network mapping can be used for training and development purposes as well — to identify current and future training requirements for a job. For example, central and critical jobs have greater requirement for interpersonal training. Effective succession planning, an emerging critical HRM activity (Burke, 1997), can also benefit from network information on jobs. Jobs that are more central and critical in a network would require more planning for succession in case of turnover/retirement of the current incumbents. Network-based decision support tools may help to set normative targets for a job used in performance management processes. For example, transaction alternatives, a dimension of networks, show redundancies in the system in terms of input to particular individuals and their output to others. Redundancies need to be optimized because of the trade-off between efficiency (low redundancy) and flexibility (high redundancy). Performance management processes need to incorporate these trade-offs in their normative targets for job performance. In yet another function of HRM, employee relations, identification of central and critical jobs would help in determining better negotiation strategies, as well as assist in maintaining a harmonious

relationship. Management can focus their efforts on these jobs, and achieve greater efficiency in employee relations. Finally, network information related to job can also be an input for compensation and benefit management processes. By measuring the social component of a job, managers get an opportunity to reliably incorporate the social components in their compensation design.

Information about the Person

Who does an individual interact with? Are they strong or weak ties? Are they static or dynamic ties? What types of information flow through these ties? Are there power and status flow through these ties? How can the network determine performance outcomes? These are some of the questions that can be answered by social network mapping at the individual level. This information can be an input for several HRM functions that aim to motivate people to give their best and to improve productivity and creativity.

For example, different network positions represent different opportunities for an individual to access new knowledge. An employee's network position reveals his/her ability to access external information and knowledge. By occupying a central position in the intra-organization network, an employee is likely to access desired strategic resources. Such resources will fuel the individual's innovative activities by providing the external information necessary to generate new ideas. If an organization can identify the individuals who occupy central positions in networks through social network mapping, then more targeted efforts can be directed towards these individuals in developing them for greater creativity and productivity.

At the same time, the innovative work of the organization will benefit from direct access to the knowledge residing in the individual. Knowledge is usually distributed unevenly within an organization (Ibarra, 1993) because it is difficult to spread it across different individuals where preexisting relationships among people are absent. Indeed, innovative ideas are often the result of interaction among groups and team members. To foster innovation, information and knowledge should be deliberately distributed. A network of people provides channels for distributing information and knowledge that as to stimulate and support innovative activities. Therefore a central network position is associated with innovation outcomes within an organization (Tsai & Ghoshal, 1998). An individual occupying a more central position in the network is likely to produce more innovations.

Network information that profiles the social capabilities of individuals may be used for effective selection, for training and development, for matching them with positions, as well as to grow them within an organization. Effective utilization of social skills would enable the firm to achieve better productivity. Fulfillment of social needs of individuals will increase the probability of retention of the individual. For performance management processes, individuals can be assessed reliably against normative targets set through established patterns of interaction. This would be a significant improvement over subjective assessments of organizational and social skills, and may help reduce costs associated with alternative evaluation processes like 360-degree feedback. In employee relations activities, identification of central and critical individuals helps management to focus efforts towards negotiation and harmony. Networks of these individuals can be reached quickly and effectively through them. Exercise of control in difficult situations can also be accomplished using their network leverage. For compensation and benefit management processes, the social profile of an individual helps managers to identify some of the factors that would motivate him/her. Therefore, customized compensation and benefits may be designed to match each individual's preferences.

Information about Groups

Social network mapping information is most relevant for management of groups or units within an organization. Although there is an increasing recognition that groups and teamwork are essential for organizational success, to date we know little about how to best manage social activities within a group. Network mapping helps by providing some answers to questions like:

- Is the group formal or informal (compare mapped interactions with organizational design)?
- Do members of the group change?
- How does the group operate?
- Are interactions frequent or sparse?
- Who occupies the central position, the group leader or somebody else who is socially more powerful?
- Do most of the interactions within the group occur during projects or do the social interactions continue in between projects too?

Structural holes, which are non-connected distances between contacts in a network; connectiveness, which refers to whether or not all possible linkages in an aggregate are being utilized; density, which is the number of relationships expressed as a proportion of all possible linkages — are some of the main parameters of network information that are useful for management of groups. A network showing large structural holes indicates either a less cohesive group or a diverse group in terms of functional or cultural background. This will impact the skill demand analysis of the group, selection of members for the group, as well as culture and consensus-building exercises that can be applied to the group. Connectiveness is a relative concept, and the optimal level of connectiveness is different for different groups. Centrality of a group and its connectiveness, both within the group and with other groups, can provide significant input for training of the group members. For example, cross-training is expected to increase connectivity. Similarly, density of interaction may indicate the homogeneity/heterogeneity of the group culture, which is an important input for group intervention processes.

Performance management implications of network information of groups are the most significant. Mapped patterns allow managers the scope to optimize reachability (how many links a communication must flow through to get from one node to another) and inclusiveness (number of points that are included within the various connected parts of the network) for greater efficiency in communication within groups. This facilitates management of performance by effective sharing of goals, and by fostering efficient team work. Employee relations efforts are also aided by improvement of communication channels for reaching out to groups. Moreover, network information helps management to identify critical and central groups for negotiation and consensus building. For compensation management, network mapping helps the management identify groups, either formal or informal, for whom compensation and benefit packages should be homogeneous. Research indicates that employee dissatisfaction arises most from perceptions of inequitable compensation (Mowday, 1991), compared to referent others in the organization. Network mapping provides information on who these referent others are so that the cause of dissatisfaction may be addressed.

Information about Organization

At the organizational level, network mapping provides an overall picture of network patterns within the organization. Although it may get extremely

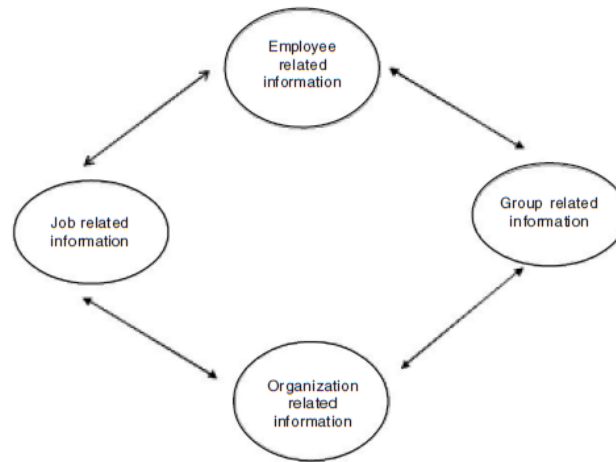
complex and difficult to interpret these networks, there is quite some usefulness for this information. Apart from showing the social culture of the organization, network mapping identifies the communication pattern within the organization. Does the CEO communicate with the managers and the employees? If so, what is the frequency? What is the pattern of interaction of managers with employees? Can employees, in general, cross hierarchical, functional boundaries to get the work done? Is knowledge shared among employees? These are some of the challenging but critical organizational questions that network mapping can shed some light on.

Research has already highlighted the significance of intra-unit network ties in spreading knowledge and best practices (Tsai & Ghoshal, 1998). Organizational units differ in their internal knowledge, practices, and capabilities. Networks of inter-unit links allow organizational units to access new knowledge from each other and may increase their cost efficiency through dissemination of "best practices" within organizations. The centrality and criticality of a unit in the intraorganizational network may determine the unit's access to different knowledge, thus affecting its ability to recognize and respond to new market opportunities.

The HRM outputs that can be derived from network mapping information at the organizational level are organizational skill demand analysis for recruitment and selection, organizational communication patterns for training need analysis, organizational target setting for performance management processes, balance between efficiency and flexibility among inter-unit workflow, monitoring of overall employee relation patterns, and ascertainment of an overall architecture for compensation and benefit management.

Complementary Network Information at Difference Levels

Although social network maps can be constructed and analyzed at different levels within the organization, and the information is useful for individual HRM processes, the best usage of network data are complementary and symbiotic. Consistent with the 'configurational' approach to HRM (Delery & Doty, 1996), this view is represented diagrammatically in Figure 2. The configurational view proposes that HRM activities are most effective when applied in

Figure 2. Use of social network mapping information at different levels

‘bundles’ where practices are synergistic with each other. We assert that information from social network mapping can also be applied in ‘bundles’. Information at the job-, employee-, group-, and organization-level can be used interactively in HRM decision processes.

Discussion

In this chapter we have discussed a new use of information technology in management of people: the use of social network mapping software for making better-informed decisions in HRM. The advent of user-friendly, yet advanced network mapping software has prompted us to enquire how this software can provide meaningful information for HRM processes. We have classified the functionality offered by the software into data collection, descriptive modeling, and decision support, and have discussed how each of these functions can provide information relevant to HRM functions. We have identified four levels of information usage in HRM related to a job, to a person, to a group or unit,

and to the organization as a whole. For each of these levels, we have explored how the information obtained from social network mapping can translate into HRM input and assist in more informed decision making.

The contribution of this chapter lies in opening up a whole new way of looking at HRM decision making. Traditionally, the informational content for social processes within an organization is assessed subjectively, through perceptions of individual managers or supervisors. Social network mapping software permits a radical change in assessing the social interaction within organizations. Through visual mapping as well as statistical modeling, the software can provide precise, relevant quantitative data for the network interactions. We have explored the intersection of this technology and HRM activities to inquire how it can assist decision making in HRM.

We feel that such application of social network mapping software would be especially beneficial for managers at all levels. For the supervisor or HR manager looking to fill a given position, studying the network interactions of current or previous holders of that position can greatly aid in selecting candidates with the “intangibles” desired for success. Similarly, for a manager investigating the behavior or performance of a particular employee, taking a snapshot of activity around the employee can greatly aid understanding. At the group or department level, network models may help to identify synergies or other strong linkages between the groups. Finally, at the enterprise or organizational level, a survey of the social network may help to explain certain phenomena discovered through benchmarking studies of other firms. For example, if a firm is an early adopter of advanced communication technology, one might expect it to have fewer layers of communication between decision makers (i.e., improved reachability) which could permit the firm to have a “flatter” organizational structure.

However, technology is not an end by itself, it is an enabler. By no means do we imply that technology can replace the human judgment element in decision making. The applicability of social network mapping software is limited by the capability of the decision maker. Nonetheless, tools like visualization and descriptive modeling do make the task easier. The learning curve for using the software and interpreting the results is relatively low compared to other extensive database management or knowledge management packages. We can conclude, therefore, that social network software has the potential to be a convenient and effective input for HRM processes.

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