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Network Theory

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ABSTRACT

There has been an increasing interest in organization theory field towards network theory and methodology during the recent years. Most important journals in this field published a special issue concerning the organizational networks. Social embeddedness theory of Granovetter (1985) can be seen as a milestone for the widespread usage of social network methodology in the field of economics and management. Network research methodology has gained importance to measure the social capital of the organizations (Bordieu, 1983 and Coleman, 1988) for understanding institutional effects in an organizational field (DiMaggio and Powell, 1983; Galaskiewicz and Wasserman, 1989) and to map resource dependency relations between organizations (Pfefer and Salancik, 1978). Networks research methodology can also be used to determine some micro issues in organizations like coalition groups, cliques, social capital formation tendency of the actors. The purpose of this paper is to provide information to the potential researchers about basic aspects of social network theory, usage areas in organizational research field for analyzing social networks mostly organizations.

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Introduction

A social network is a social structure made of nodes which are generally individuals or organizations. It indicates the ways in which they are connected through various social familiarities ranging from casual acquaintance to close familial bonds. The term was first used by J. A. Barnes in 1954 (in: *Class and Committees in a Norwegian Island Parish*, "Human Relations"). Networks are everywhere, from the microscopic cell to the planetary system.

A social network consists of a set of actors also known as nodes and the relations also known as "ties" or "edges" between these actors (Wasserman & Faust, 1994). The nodes may be consisted of individuals, groups, organizations, or societies. The ties/edges may fall within a level of analysis (e.g., individual-to-individual ties) or may cross levels of analysis (e.g., individual-to-group ties). There can be many kinds of ties between the nodes. In its most simple form, a social network is a map of all of the relevant ties between the nodes being studied.

Network researchers have discussed a broad range of types of ties. These types mostly include communication ties (such as who talks to whom, or who gives information or advice to whom), formal ties (such as who reports to whom), affective ties (such as who likes whom, or who trusts whom), material or work flow ties (such as who gives money or other resources to whom), proximity ties (who is spatially or electronically close to whom), and cognitive ties (such as who knows who knows whom).

Network researchers have distinguished between strong ties (such as family and friends) and weak ties (such as acquaintances) (Granovetter, 1973, 1982). This distinction can involve a multitude of facets, including affect, mutual obligations, reciprocity, and intensity. Strong ties are particularly vulnerable when an individual seeks socioemotional support and often entail a high level of trust.

Weak ties are more valuable when individuals are seeking diverse or unique information from someone outside their regular frequent contacts. Ties also may be nondirectional or vary in direction. They may also vary in content, frequency (daily, weekly, monthly, etc.), and medium (face-to-face conversation, written memos, e-mail, instant messaging, etc.). Finally, ties may vary in sign, ranging from positive to negative.

The shape of the social network helps to determine a network's usefulness to its individuals. Smaller, tighter networks can be less useful to their members than networks with lots of loose connections (weak ties) to individuals outside the main network. More "open" networks, with many weak ties and social connections, are more likely to introduce new ideas and opportunities to their members than closed networks with many reverse ties. In other words, for instance a group of friends who only do things with each other already share the same knowledge and opportunities. A group of individuals with connections to other social worlds is likely to have access to a wider range of information. It is believed to be better for individual success to have connections to a variety of networks rather than having many connections within a single network. Similarly, individuals can exercise influence or act as brokers within their social networks by bridging two networks that are not directly linked (called filling social holes).

Social networks have also been used to examine how companies interact with each other, characterizing the many informal connections that link executives together, as well as associations and connections between individual employees at different companies. These networks provide ways for companies to gather information, deter competition, and even collude in setting prices or policies. Power within organizations, for example, has been found to come more from the degree to which an individual within a network is at the

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center of many relationships than actual job title. Social networks also play a key role in hiring, in business success for firms, and in job performance.

Social network analysis (also sometimes called network theory) has emerged as a key technique in modern sociology, anthropology, Social Psychology and organizational studies, as well as a popular topic of speculation and study. Research in a number of academic fields have showed that social networks operate on many levels, from families up to the level of nations, and play a critical role in determining the way problems are solved, organizations are run, and the degree to which individuals succeed in achieving their goals. It is necessary to take a look at these theories to understand the implication field of this alternative research methodology. Thus this paper will be looking for core principles, theories, key concepts, measures, resources, constraints and theoretical roots of the network theory to understand the implication field of this alternative research methodology namely network theory.

Core Principles of the Network Theory

The network approach spans a broad range of disciplines, including sociology, social psychology, mathematics, political science, communication, anthropology, economics, and epidemiology. There is no single formal statement of the network perspective in the literature. Yet, there are certain core ideas that all or most network scholars would likely endorse. Barry Wellman (1988) has identified 5 fundamental principles that provide some underlying intellectual unity to the network approach.

First, behavior of people is best predicted by examining not their drives, attitudes, or demographic characteristics, but rather the web of relationships in which they are embedded. That web of relationships presents opportunities and imposes constraints on people's behavior. If two people behave in a similar fashion, it is likely because they are situated in comparable locations in their social networks, rather than because they both belong to the same category (e.g., both are White women).

Second, the focus of analysis should be the relationships between units, rather than the units themselves or their intrinsic characteristics. It is for sure that nothing can be totally understood in isolation or in a segmented fashion.

Third, analytic methods must not hinge on the conventional assumption of independence. A population or sample is defined relationally rather than categorically. Therefore, interdependence among units is thought to be assumed.

Fourth, understanding a social system requires more than only aggregating the dyadic ties. The flow of information and resources between two people depends not only on their relationship to each other but also their relationships to everybody else. For example, it matters whether two people who communicate with one another are embedded within a cluster of individuals who also talk to one another, versus embedded within two separate clusters that otherwise do not communicate in reality (Burt, 1992).

Fifth, groups sometimes have fuzzy rather than firm boundaries. The building blocks of organizations are not discrete groups but rather overlapping networks. Individuals generally have cross-cutting relationships to a multitude of groups.

Applying these five principles to small groups, a network study focuses on relationships between components in the group system—individual-to-individual ties within a group,

individual-to-group ties, or group-to-environment ties—rather than on features of these component

Key Concepts and Measures of the Network Theory

Networks can be viewed at three analytical levels. The first is the ego network, consisting of all a node's direct contacts. Although this is the simplest level, it can be quite informative. The second level is the overall network which includes all actors and relationships within a particular domain. If the ego network describes one's immediate social neighborhood, the overall network describes the larger topography of a region. At the third level if the overall network describes topography, then network position identifies an actor's coordinates within that topography.

Before describing specific network measures, two general caveats should be noted that the first is the meaning of different network measures depends entirely on the nature of the relationships being mapped which can include friendship or hatred, corporate alliances or corporate lawsuits. Second, networks are often "multiplex" meaning that different kinds of relationships often overlap.

Network analysts developed several useful measures;

Distance: A basic measure in a network is the length of the shortest path between two actors, known as the geodesic or simply distance. A famous experiment by Stanley Milgram, that everyone and everything is six or fewer steps away, by way of introduction, from any other person in the world, so that a chain of "a friend of a friend" statements can be made to connect any two people in a maximum of six steps. It is also known as six degrees of separation.

Centrality: It describes how important an actor is in a system and is the most common measure of network position. The simplest measure of centrality is degree or how many direct contacts one has. Analysts distinguish between in-degree (how many ties flow toward you) and out-degree (how many ties flow outward from you). A second measure of centrality is closeness which describes how far all the other people in the network are. A third centrality measure is betweenness. This asks for how often am I on the shortest path between any two other people in a network. Another last measure of centrality is eigenvector measure that is if degree asks do I have many friends who themselves have many friends.

Clustering and Structural Holes: Clustering asks in short, are your friends also friendly with each other. Thus, a network that bridges structural holes will provide network benefits that are in some degree additive, rather than overlapping. An ideal network structure has a vine and cluster structure, providing access to many different clusters and structural holes.

Equivalence: Although each of us likes to believe that our situation is unique, network analysis emphasizes that many occupy similar locations in social systems. Two actors are structurally equivalent to the extent that they share the same pattern of relationships with other actors in a network.

Density: While clustering refers to ties among an ego network, density describes the extent to which all actors in an overall network who might be connected really are. More formally, density is the percentage of possible relations in a network that are actually observed.

Centralization: The final network level measure is centralization which captures the extent to which some actors in a system are well connected and others are not.

Theoretical Roots of the Network Theory

How do network scholars explain why people create, maintain, dissolve, and possibly reconstitute network ties, and

who is likely to form ties with whom? There are multiple schools of thought or “families of theories” (Monge & Contractor, 2003) within the network perspective that approach this question from different vantage points. Generally these include theories of self-interest, theories of social exchange or dependency, theories of mutual or collective interest, theories of social embeddedness and social capital.

There is a large school of network researchers who come from a rational self-interest paradigm. These scholars assume that people form dyadic and group ties in order to maximize their personal preferences and desires. The rational self-interest school within network research can be traced back to the work of sociologist James Coleman (1988). Coleman showed how, from two-actor interactions, with each actor operating out of self-interest, emerges the basis for a social system. When each actor is trying to maximize his or her individual interests, each is at the same time constrained because he or she is unconsciously embedded in an interdependent relationship with the other. That relationship causes limits on both actors’ behavior and mediates the extent of self-seeking. These limits are counterbalanced by the increased access to resources each actor gets via the other. Individuals consider the creation of ties as a personal investment in the accumulation of social resources or “social capital.” From a self-interest perspective, individuals expect to use this social capital (Coleman, 1988, 1990; Lin, 2001) and get returns on their investment in the form of opportunities from which they can profit. For instance, Burt (1992, 1997, 1998, 2001) argues that “structural holes” in a network provide an opportunity for individuals to invest their social capital. Individuals fill a structural hole when they make efforts to connect two or more others who are not directly connected to the network. The return on their investments accrues from their ability to “broker” the flow of knowledge and information between those who are not directly connected.

A second school of network researchers draws upon theories of social exchange and dependency. George Homans (1950) was a forebear of the social exchange school. Homans believed that people establish ties to others with whom they can exchange valued resources between each other. Whether a relationship will be sustained over time will depend on the payoffs to each of the two parties gained. With exchange theory, Homans sought to link the micro to the macro levels of analysis and show how the social structure arises from these one-on-one interactions. Richard Emerson (1972a, 1972b) enlarged the focus of exchange theory to look beyond the dyad at the network of relationships in which the dyad is embedded. Emerson examined exchanges and power dependencies at both inter individual and intergroup levels. Emerson argued that when individuals or groups exchange valued resources, this is made possible due to a large-scale network of relationships. Unlike theories of self-interest, individuals’ motivation to create ties with others is not based on maximizing their personal investments. Oppositely, individuals’ motivation to ties creation is based on their ability to minimize their dependence on others from whom they need resources and maximize the dependence of others who need resources they have ability to offer. A social exchange calculus is often believed to be an optimum strategy to manage these dependencies. These dependencies, social exchange theorists argue, constitute the glue that binds a group together.

A third influential network perspective draws on theories of mutual interest and collective action. Its main idea is that

“mutual interests and the possibility of benefits from coordinated action” (Marwell & Oliver, 1993, p. 2) often outweigh individual self-interests. Public goods theory, first articulated by Samuelson (1954), is one of the best developed theories of collective action. It was developed to describe the economics of collective versus private ownership of material infrastructure such as parks, bridges, and tunnels. More recently, it has been extended to explain the collective production and ownership of intellectual property (such as ideas documents, decisions). Public goods theory seeks to describe the conditions under which group members contribute to the creation and maintenance of public goods so that everyone in the collective will be able to benefit from them. A crucial focus has been the role of communication networks in creating and maintaining these public goods. The idea of mutual interest or collective action suggests that individuals will create ties and coalesce into groups not because it maximizes the self-interest of any individual within the group or even the exchange value between individuals in the group. Instead, the motivation to forge ties and form a group is to maximize their collective ability to leverage resources and mobilize for collective action in their environment.

Social embeddedness as the major concept of new economic sociology shows us a world shaped by the social networks consists of interaction patterns between individuals and organizations. If we assume economic action is socially embedded, this idea will lead us to reinterpret the main concept regarding business life and economy. Demand and supply, transactions between parties, financial decisions and the structure of competition between actors is determined by social networks in the case of high level of embeddedness. Uzzi (1999: 481) states that “the possibility of access to the credits and the costs of obtaining these credits highly depend on embedded relations.” Thus, an important central position in a social network provides competitive advantage by increasing opportunity to reach vulnerable resources (Gnyawali and Madhavan, 2001: 432). When sociologists carried embeddedness argument to organizational level analysis; it has been showed that the social structures have an effect on economic outcomes like fixation of prices, elimination of small firms and flow of information regarding to production installation standards for production (Rao, Dawis and Ward, 2001: 268). In general, social embeddedness approach assumes economic actors are embedded in social relations and cooperative networks with changing degrees (Uzzi, 2004: 320)

Social capital concept has become popular since it first used by the social scientists Bordieu (1983) and Coleman (1988). There are a number of definitions and publications in the literature concerning social capital, but the most recognized version is the concrete and abstract benefits that can be gained through mutual network relations based on familiarity or friendship (Gargulio and Benassi, 2000: 184). Several authors made different definitions about the concept according to their area of interest. Tsai and Ghosal (1998: 464) used the concept to define relational resources that can be useful for the development of individuals in the society; whereas Paxton (1999:89) defined the concept as an approach which is based on the idea of providing resources via social ties between individuals and groups; Bueno, Salmador and Rodriguez (2004:557) described the concept as current and potential benefits that can be gained through network of relationships formed by an individual or a unity; social capital known as the position of an actor in a structure consisting of

network relations and describes how some actors become privileged with the help of network ties according to Burt (2005:4).

Social capital might be embedded in biggest social groups (countries), organizations and even in the smallest ones like families (Kostova and Roth, 2003: 301). In business life, social capital can sometimes determine a worker's and a firm's success. The number of personal ties of an individual and collection of all workers' social relationships in an organization can be used to gather demanded information and to reach crucial actors in business life to influence their decisions. Social capital may have various micro and macro level benefits. According to lots of numerous researchers' social capital effects professional success, helps individuals during the job search and application process, simplifies transfer of resources between departments in organizations, strengthens the relationships with the suppliers and ensures inter-organizational level learning (Bueno, Salmador and Rodriguez, 2004: 558). This concept forces us to reconsider organizational level performance indicators. Organizations which have broad social networks can gain a huge competitive advantage by using social ties to affect external environment for their own benefit. A board member who has strong social ties with the political authorities can create an effect on the legal regulations to the benefit of the organization.

Social capital is not an asset owned by the individuals or organizations, whereas it's a commonly used asset of an organization and its members (Leana and Buren, 1999:540). Recruitment or promotion of individuals who have a broad social network to the managerial positions can increase social capital of the organizations. But, this strategy doesn't guarantee that the workers show great intention to share their network resources for the organization's benefit. In the relevant literature, managers are seen as the organizational actors mostly lean on their social ties to conduct their business. Managers not only bring their expertise and experiences to the organizations but also their assets gained through social relations (Gargulio and Benassi, 2000: 183).

Network Theory for Organizations

The studies about inter organizational networks have started forty years ago and it has taken the attention of a large number of researchers during the last quarter of the century (Monge and Contractor, 2001: 41). Organizations, like individuals also try to expand their social networks to gain more power in their field. The reasons and the conditions of tie formation between organizations have been the fundamental research topics concerning inter organizational networks (Oliver, 1990: 241). Mutual cooperation based relationships between organizations usually start with low trust, less risky, small and official interactions (Ring and Van De Ven, 1976: 25). These interactions turn into embedded relations with passing time and the members of the network gather considerable amount of information about skills, trustworthiness and appropriateness of others during this period (Gulati and Gargulio, 1990: 1440). Organizations form social ties with the others by supplier relationships, resource flow, and membership to trade unions, employees who are acquainted with the others working in different organizations, interlocking directorates and strategic cooperation.

There are many other reasons of the organizational attempts to form a network of relations with the others. Organizations show tendency to form network ties with the others when the resources are scarce and they have difficulties to obtain them from their external environment (Oliver, 1990:

250-251). Hammond and Glenn (2004: 26) emphasize that information exchange as an important motive that forces organizations to form social relationships with other organizations and the information coming through different parts of the network provides their adaptation to the environmental changes. Network ties are thought to create opportunities for the organizations to communicate and monitor others' responses (Kraatz, 1998: 622). So, it is possible to indicate that network ties serve as a mechanism for the organizations to decrease the level of uncertainty by carrying the information on others' actions in their environment. Burns and Wholey (1993) found that hospitals which are located in a central position of the inter organizational network adapt to the innovations faster than the others. In summary, organizations which are more central in the networks have an opportunity to control the organizational field compared with the less central ones (Koka, Madhavan and Prescott, 2006:722).

Resource dependency theory (Pfefer and Salancik, 1978) which focuses on dependency relationships between organizations has many similarities with network theory. To cope with uncertainty, organizations usually form ties with the others that have required resources and skills which may help them to manage their environment and to meet their needs (Gulati and Gargulio, 1999: 1440). Mutual social relationships of the organizations with important suppliers, customers, strong brokers and decision makers may create an environment of trust and decrease level of dependency to the external environment. A second approach which has gained popularity in sociological inquiry of the markets, defends that the ties between actors are not solely provide resources, they also transfer knowledge containing clues about legitimacy (Podolny, 2001: 34). Some of the authors are claiming that inter organizational network studies may provide important tools for neo institutional theory (DiMaggio, P. J. and Powell, 1983). Besides reaching information about latest innovations and new organizational design alternatives the employees who have direct or indirect relationships with the colleagues in other organizations may also have an idea concerning acceptable and not acceptable behaviors in their institutional environment (Galaskiewicz and Wasserman, 1989: 456). High level of embedded relations in an organizational field is a sign of pressures over organizations towards institutional isomorphism. Leblebici and others (1991) found that organizations show no intention to adapt to the dominant organizational practices in less embedded fields and they can adapt to new practices more easily independent from institutional effects. So, network ties of the organizations' are crucially important to increase legitimacy and status, to live in a concrete and more certain environment (Baum and Oliver, 1991: 189).

In micro level organizational research, social network analysis can also be used in various fields. Network analysis can be an important tool to determine the potential leaders and to validate some leadership theories. The central locations in an intra-organizational network may represent existing and potential leaders. Network research can also be used to explain distribution of power in organizations in terms of information control. Ordinary employees who position themselves as strong brokers in an organization can be sometimes as powerful as top managers. Network research can bring new insights to the concept of motivation. Isolates individuals who are located at the periphery of the network represents people deprived of social needs. Those, who excluded from the social

structure, can be found by using network analysis and the causes which lead to other's reaction can be searched.

Types of Network Organizations

Miles and Snow describe three main types;

Stable Network: A large core firm creates market based linkages to a limited set of upstream and/or downstream partners.

Dynamic Network: Independent business elements along the value chain form temporary alliances from among a large pool of potential partners.

Internal Network: Organizational units buy and sell goods and services among themselves at prices established in the open market.

Bennett Harrison proposes a typology emphasizing differences in overall network; Networks in craft type industries: In these forms, work is organized around specific projects and involves the temporary cooperation of varying combinations of skilled workers.

Small firm led industrial districts: These network forms include the northern Italian industrial districts.

Geographically clustered big firm led production systems: These forms include the well-known Asian examples of keiretsu as well as connections that have developed between central assembly firms and multitudes of small suppliers.

Strategic Alliances: Alliances of this type are increasingly found among firms of all sorts.

Network Theory Resources and Constraints

Participating in a network benefits members by providing opportunities for the sharing of various kinds of resources. Several recent studies of network effects on firms have shown that these resources may include financial (Ingram and Inman, 1996; Keister, 1998), institutional (Baum and Oliver, 1991), knowledge and information resources, as well as a host of other resources in the network (Ingram and Inman, 1996). On the one hand, the structured opportunity for resource sharing may benefit members by improving their financial performance (Berg et al., 1982; Keister, 1998), increasing their survival chances (Baum and Oliver, 1992; Ingram and Inman, 1996; Ingram and Baum, 1997) and enhancing their innovative learning capability (Gemser et al., 1996; Dyer and Nobeoka, 2000). On the other hand, membership in a network in and of itself may limit members from discovering opportunities and information outside the network and may limit the local adaptability of the firms (Ingram and Baum, 1997).

Financial Resources

In some instances, networks believed to enable firms to gain access to capital necessary to sustain firm operations and invest in firm growth. One specific instance in which this may occur is when networks substitute for formal financial systems and give firms access to otherwise scarce resources and unaffordable business opportunities (Keister, 1998). Rather than, relying on banks for capital, members can take advantage of the opportunity to share financial resources in their own network of firms. Because financial resources are shared within the network, where firms have more information about each other, transaction costs are likely to be lower (Khanna and Rivkin, 2001). Financial resources are especially relevant in emerging markets where formal financial infrastructures are not well established (Khanna and Palepu, 1999).

Institutional Resources

Institutional resources result from the legitimacy and status of the organizational network as a whole. By

association, members are accorded the legitimacy and status of the network to which they belong. For example, a consumer's uncertainty about a new product's quality may be decreased if the consumer learns that a member of a highly reputable network produces this product. These resources can help increase the survival chance as well as the financial performance of the members (Khanna and Palepu, 1999). For example, Ingram and Baum's (1997) study of chain affiliation of Manhattan hotels during 1898-1980 suggests that a hotel that joins a high-status hotel chain meaning its high status. As a consequence, consumers' uncertainty about the quality of the hotel's service is decreased and the survival chances of the hotel are increased.

Knowledge and Information Resources

Knowledge and information resources of a network refer to the collective knowledge owned by all firms within the network. The network connections can be a mediator for disseminating both existing and newly acquired knowledge so that all members can quickly access it. In a study of diffusion of Total Quality Management (TQM) practices, Westphal et al. (1997) found that hospital networks were an important medium for the transmission and diffusion of TQM practices among hospitals. As a result of such diffusion networks, the learning/innovative capability of the members was increased. Ingram and Baum (1997) also found that hotel chain networks facilitate knowledge transfer and learning among members and increase the survival chances of the members. Similar effects have also been reported in supplier networks of automobile companies such as Toyota (Dyer and Nobeoka 2000). In Toyota's vertical network, common identity and strongly interconnected ties between Toyota and its suppliers as well as among suppliers themselves facilitate knowledge sharing and learning providing its members learning and productivity advantages over non-members.

Constraints

Although networks provide opportunities for firms to share different resources, they may also constrain members and contribute to their negative performance. First, being a member of a network may lock a firm into the existing relationships (Nohria and Garcia-Pont, 1991; Gomes-Casseres, 1994) and disable it from joining another network. Second, network membership may expose the firm to the risk of unwittingly transferring valuable knowledge and proprietary information to competitor firms in the network (Doz and Hamel, 1998; McEvily and Zaheer, 1999). Third, being a member of a network may compel a firm to adhere to norms and practices that meet the lowest common need of the firms. These practices and strategies may not be the most suitable ones for every member's circumstance (Ingram and Baum, 1997; Westphal et al., 1997).

Conclusion

While formal reporting relations, as shown in an organizational chart, are crucial and structure certain kinds of communications, how work is actually accomplished usually has more to do with informal relationships and interactions among employees, particularly in knowledge-based organizations and organizations that have followed recent trends toward flatter more flexible structures. Yet informal relations are largely invisible. Employees are aware of their own relationships and a few others, but they don't have a coherent overview of the social structure of the organization. Research has shown that unit managers who know more about the networks of the people under them have more profitable units (Krackhardt, 1987), but the research also shows that

managers vary widely in the accuracy of their network perceptions, and even the best are not very good (Krackhardt, 1990; Casciaro 1998).

Organizations are facing design and performance issues as their environments, markets, products and service offerings, and stakeholder relationships have become more complex. It has been well established that network analysis can be used to describe work groups, organizations, business webs, and other purposeful networks where both tangible and intangible value exchanges support the achievement of specific outcomes. One goal of the organization design is to have a balance between the technical, political and cultural domains.

Networks are relevant in each of these domains. Network theory and research can help organizational scholars to bring an explanation to the business life which might shaped by the dynamic social interactions between the actors. This paradigm may also be helpful to understand how some countries, organizations or individuals become successful only by increasing their social capitals. But, this alternative research approach requires further extensive theoretical and empirical efforts of enthusiastic researchers.

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