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Social Network Analysis: A Distinctive Research Approach in the Social and Behavioral Sciences

[1]A.P. Senthil Kumar, [2]Getu Ambaye Teshale, [3]Manoj Mathew

Abstract

This article attempts to provide an overview of the Social Network Analysis (SNA) in the mainstream research endeavors in the social and behavioral sciences. The study describes the conceptual, theoretical and substantive foundations of social network analysis as research methodology. SNA is an interdisciplinary research methodology in exploring a wide range of topics, issues and problems across various disciplines. The study of social networks is a powerful research tool for the discovery of a wide range of human behaviors and problems. The article also discusses some of the dilemmas and controversies that revolve around the methods of SNA. Lastly, the article suggests about the potential usefulness of SNA for scholars, researchers, policy-makers and practitioners engaging in addressing the multifaceted human problems across various disciplines in general and social sciences practice in particular.

Key Words: *Actors, Networks, Social Capital, Social Network Analysis*

I. Introduction

This article is about the concept and use of Social Network Analysis (SNA) that can be applied to study a wide range of issues and problems across various disciplines in the social and behavioral sciences. Apparently, there were some practical reasons that inspired the authors to produce and/or write this article. In the first place, the doctoral thesis of the second author was conducted based on the application of social network analysis. After completing his doctoral program, the author has also made book review on *Analyzing Social Networks* written by co-authors namely Borgatti, Everest & Johnson (20013). These readings have inspired the author to read additional materials for producing this article which is aimed at drawing the attention of scholars and researchers in realizing the usefulness of the methods of SNA.

[1]*School of Social Work, University of Jigjiga, Ethiopia*
[2]*Department of Social Work, University of Gondar, Ethiopia*
[3] *Independent Researcher, Kerala, India*

There are fundamental terms distinctive to the methods of SNA. In this regard, the huge literature on social networks often touches on the diverse terms that are helpful in designing SNA as research methodology. For instance, terms such as actor/node/point/agent refer to social entities such as persons, groups, organizations, society, and country (Borgatti, Everest & Johnson, 2013). In addition, terms such as tie/link/edge/line/arc/vertex represent networks among actors in a network. In social network principle, actors and their actions are viewed as interdependent (not atomized individuals). These linkages can be used to interpret the social behavior of the people involved in them (Wasserman & Faust, 1994).

The methodological relevance of SNA is partly seen from the theoretical foundations of SNA that have been drawn from the various academic disciplines. Social network analysis is regarded as distinctive in terms of designing the research, formulating the research questions, collecting, analyzing and visualizing the data. The theoretical perspectives that underpin SNA are relational. The methodological approaches in designing SNA are also relational. The nature of social network data is relational. SNA is also based data gathered through the particular techniques. The article reveals that SNA is an interdisciplinary research methodology in exploring a wide range of topics, issues and problems across various disciplines in the social and behavioral sciences.

The article is, therefore, organized into the following parts. The first part provides the theoretical roots as well as the substantive foundations that give particular emphasis to the mathematical foundation of SNA. The second part shows the merit of the study on SNA as a distinctive research approach by giving due emphasis to the unique methods employed to generate social network data. The third and fourth parts outline some of the dilemmas and methodological challenges inherent in designing SNA as methods of research respectively. The last part wraps up with the conclusion that brings together a range of issues and problems demonstrating SNA as an emerging research approach that can be employed across various disciplines.

II. The Conceptual and Theoretical Roots

The study attempts to bring together the conceptual, theoretical and substantive foundations of social network analysis and essentially concentrates on describing the relevance of SNA in the mainstream researches in the social and behavioral sciences. The essence of social network analysis is about networks among different actors. Social network is simply defined as a set of actors and the ties among them (Duijn & Vermunt, 2006). Social networks are generic that involve the various dimensions of human behaviors (Pescosolido, 2007). The most common definition of social networks is a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the persons involved (Mitchell, 1969). This definition is widely used by network analysts from different fields of studies, including researchers in the field of migration studies. As opposed to the attributes of individual persons, social network analysis is about social ties among actors (individuals or groups or organizations or communities or societies at wider level (Marsden, 1990).

The conceptual and theoretical roots of SNA can be seen from the links the concept of social network to various disciplines such as social anthropology, sociology, economics, and mathematics, health, management and computer sciences (Borgatti, Everest & Johnson, 2013; Wasserman & Faust, 1994). The notion of networks of relationships has historical roots in the works of prominent social thinkers in sociology and anthropology. Marx (cited in Marin & Wellman, 2010) held that society is not merely an aggregate of individuals. Rather, it is the sum of the relations in which individuals stand in relation to another. Durkheim (cited in Marin & Wellman, 2010) sees that the essential element is not the number of persons subject to the same authority but the number bound by some form of relationships. Simmel (cited in Pescosolido, 2007) began with the classic statement that society arises from the individual and the individual arises out of certain associations and institutions.

According to Marin & Wellman (2010), Simmel discusses the ideal configurations of social networks, commonly referred to as a pre-modern form of concentric circles and the modern form of the intersection of social circles, which resembles to what Durkiem identifies as mechanical (in traditional societies) and organic (in modern societies) social solidarities. Since then, individual researchers from various disciplines such as social psychology, social anthropology, sociology, computer sciences, and mathematics especially graph theories have contributed to the advancements of social network analysis as a distinct methodology (Freeman, 2004). Prominent figures such as Moreno (social psychology), Gluckman, Mitchell, and Boissevan (social anthropology), Granovetter, Freeman, and Rogers (sociology) have contributed to the advancement of the concept of social networks. There is plenty of evidence to suggest that social network analysis is a flourishing enterprise (Borgatti, Everest & Johnson, 2013).

2.1. Mathematical Foundation

One of the distinctive features of SNA is related to its mathematical foundation which in turn is related to the applications of graph theory and matrix algebra. The formal properties of graphs are used to represent the characteristics of networks. Graph theory has been used in SNA as a means of formally representing social networks (Wasserman & Faust, 1994). It gives us mathematical operations that provide a vocabulary to denote and label many social network structures and social network properties can be quantified and measured based on the algebraic and graph theoretic models (Borgatti, Everest & Johnson, 2013).

Graphs and matrices in SNA have conventions and rules to represent network data (Wasserman & Faust, 1994). A graph is sometimes called a sociogram which is composed of nodes or actors or points connected by edges or relations or ties. A graph may represent a single type of relations- simplex or more than one kind of relation-multiplex type of social ties. Again, a graph may be directed and non-directed graphs to represent the directionality of relationships in a social network in terms of whether it is reciprocal or not. Matrix, on the other hand, is a rectangular array formed into rows and columns that represent relationships among actors in a network. The simplest and most common matrix is binary that is represented with zeros and ones indicating the presence or absence of relationships between actors in a network (Hanneman, 2009). In doing so, both one-mode and two-mode network data can be represented and visualized using a graph and adjacency matrix (Freeman, 2004).

One of the biggest advantages of social network analysis is that it can be visualized through the application of the software that enhances deeper understandings of social networks. Kirke (2009) underscores the point that social network analysis has a well-developed statistical packages and computer programs such as UCINET including the graphic imaginary and of networks. Freeman (2004) also described social network analysis as drawing heavily on graphic imaginary that relies on the use of mathematical and computational models. Social network analysis also involves various computational algorithms such as hierarchical clustering; multidimensional scaling and correspondence analysis that are used to uncover cohesive subgroups in a network.

III. Methods of Network Data Collection and Analysis

Social network analysis is regarded as distinctive in terms of designing the research, formulating the research questions, collecting, analyzing and visualizing the data. Social networks are a set of social relationships surrounding an individual, which stem from different contexts such as family, work place, neighborhood, associations, religious community, school, and online-community (Borgatti, Everest & Johnson, 2013). Designing research that involves social network data collection and analysis is a complex venture (Hanneman, 2009; Marsden, 1990). Essentially, there are two basic approaches in designing research related to social network analysis (Hanneman, 2009; Marsden, 1990). One of these approaches is variously termed as the whole networks, socio-metrics or community networks. This network approach is interested more in the structural features of social networks of a bounded group in a particular context or setting. The other one is ego-centered network approach which consists of a focus individual (focal subject)| termed as ego and a set of individuals who have ties to ego (Hanneman, 2009; Marsden, 1990).

An ego network consists of a focal node together with the nodes they are directly connected to alter plus the ties. What distinguishes personal networks from other types of social networks is the boundaries of the network members are unconstrained- that is, we do not typically constrain the list of alters to members of a particular group, such as alters from an office or church Hanneman, 2009). With personal networks we are interested in studying the effects of any kind of relationship on the ego, and so we allow the ego to tell us which people are in the network (Marsden, 1990). Whole networks, on the other hand, are social groups that most people would agree with the group, and sometimes know the size of the group (Borgatti, Everest & Johnson, 2013).

3.1. Network Data Collection Techniques

Social network analysis has typical methods of mapping and measuring relational data drawn from actors of various types. The name generator and name interpreter questions are typical questions designed to elicit data used to map and measure the interactional and structural features of social networks (Wasserman & Faust, 1994; Borgatti, Everest & Johnson, 2013). Name generator is a typical question designed to elicit data about lists of network members. Terms such as alter, actors or close persons or network members can be used interchangeably in representing the network data related to the lists of members. Name interpreter, on the other hand, is designed to assess the ego's relationships with other members in a social network. The name generator and name interpreter

techniques are together used to gather data related to the size of social networks, how alters know each other, how frequently do ego interact with alters, the means of communication used in the social networks (Borgatti, Everest & Johnson, 2013). Regarding network size, Marsden (1990) noted that there are two different interview methods for measuring the network size: recognition based on a list of members and direct estimation of size with respondents rather than analysts performing aggregation of networks.

In SNA, there are two forms of network data (Wasserman & Faust, 1994). One-mode is on a single set of actors and ties among them. The other is two-mode data which is also termed as affiliation or membership data. The two-mode network data emphasizes on membership of individual actors to the institutions and associations. The Two-mode or affiliation network data contains information, not on interpersonal networks as one-mode, rather dichotomous network variables in terms of membership in the different types of social networks (Borgatti, Everest & Johnson, 2013; Wasserman & Faust, 1994).

3.2. Network Data Analysis

One of the distinctive features of SNA is reflected data analysis. In the first place, SNA is based on relational data gathered from actors of various types. Social network data which is amenable to multiple levels of analysis represent the interactional and structural features of networks (Borgatti, Everest & Johnson, 2013). The data analysis can be undertaken at dyadic, triadic, clique or subgroups or community levels. Hierarchical clustering, correspondence analysis and core-periphery analysis are also used to represent the structural features of social networks. The data analysis involves the various forms of transformations such as transposing matrices, symmetrizing, and dichotomizing, imputing missing values or, combining relations/nodes and extracting subgraphs that are often applied to network data (Borgatti, Everest & Johnson, 2013).

In SNA, there are different ways of breaking down larger network (problem) into a series of smaller ones or changing the problem to analyze ties among clusters of nodes (Borgatti, Everest & Johnson, 2013). This can be made through various techniques such as combining relations or merging nodes and extracting subgroups within a general network system. The data analysis also involves various conventional methods or techniques used for representing and visualizing social networks. Social network analysis involves the visualizations of network data through the application of the software that enhances better understandings and interpretations of social network data.

IV. Substantive Evidences

There have been a wide range of issues and problems that enhanced the enthusiasms of scholars and researchers to study social networks. The methods of SNA has commonly been applied to study the roles of networks in a range of issues and problems across various topics including circulation of goods and services, flow of information, diffusion of innovations, and diffusion of epidemics or diseases and so on. SNA has also been applied to the study of linkages between personal networks and employment outcomes, labor market outcomes, job search

out comes, labor migration and its influences on migrants' decision making process (Wasserman & Faust, 1994). Dating back to the 1960s, social network-based research in Africa was carried out by scholars from the western world in connection with urbanization process involving rural-urban migration (Barnes, 1969; Boissevain, 1974; Epstein, 1969; Mitchell, 1969). Social network-based research in Africa is related to urbanization process and provides protection, cooperation and communication to improve the chances for adaptation. In this regard, the roles of social networks for coping with urban problems and challenges have been better studied in Africa.

The contribution of social networks have been linked to agricultural productivity or transfer of agricultural knowledge, diffusion of epidemics or diseases (Rogers, 2003), supports for illness (Wellman, 1881), influence migration or migrants of various forms and types (Bruhn, 2011). Social networks have also been linked with economic prosperity (Putnam, 1993), lower crime (Crow, 2004), higher educational attainment (Colman, 1988), health and quality of life (Wellman, 1981) and poverty reduction (Rosas, 2001). According to Granovetter (1973), dense social ties have been shown to promote the psychological adjustment of people in disaster situations. Dense networks help to reinforce a sense of positive social identity and belongingness. According to Colman (1988), network closure and multiplicity are key ingredients of social capital rich social networks. In this regard, Wellman (1981) noted that: bounded and solidary networks seem to enhance the ability of the relatively powerless to conserve and control their existing internal resources essential for coping with life challenges.

More importantly, there are substantive evidences that deal with the contribution of social networks to community development endeavors. Currently, building network and social capital is considered to be an aspect of community development practices. One of the pillars of strengths-based approach to community development is building social capital. According to Gilchrist (2004) a networking approach (building social capital) is important for community development practices. Gilchrist (2004) further noted that the activities are termed as meta-networking strategies for community development practices. For community development workers, the networking approach is important for community organizing, neighborhood-building and engaging in other community actions. It is the strengths-based approach to sustainable development that can be attained through building of the social capital of individuals, groups and communities (Gilchrist, 2004).

In addition, network methodologists have given due emphasis to certain socio-economic and socio-cultural factors that play roles in defining the nature and forms of the social networks. Socially significant attributes such as, language, gender, race, religion, ethnicity, and class determine network formation (Borgatti, Everest & Johnson, 2013). The analysis of network composition considers the sample attributes including gender, and religion of actors in a personal social network. With the advancement of SNA, researchers and network methodologists have also improved substantially our knowledge about the different types of social networks. Understanding the different types of social networks is important to understand how the design and study social network can be made in a particular context. The network methodologists make major forms of distinctions between the different types of social networks such as formal and informal social networks (Putnam, 1993); vertical and horizontal social ties (Rosas, 2001); bonding, bridging and linking social ties (Putnam, 1993); place-based and place-independent social networks (Piscosolido, 2007); one-line (cyber networks) and off-line social networks (Borgatti, Everest & Johnson,

2013); strong and weak social ties (Granovetter, 1973) as well as identifying the social network types such as family, kin, neighbors, co-workers, co-members of associations (Borgatti, Everest & Johnson, 2013). Methodologically, such typologies can help making operationalization of the network-based research design in context.

Given the advancement of SNA, the relationship between social networks and geographical places has been examined (Bruhn, 2011). Geographical proximity plays roles for social network formation. The principle of propinquity that relates to the neighborhoods and workplace contexts is also another network factor. In the theory of social networks, factors related to place or space is important. Closeness is an essential component of trust in that closeness stimulates trust, compared to distance, which inhibits trust (Cox, 2009; Crow, 2004). Place or space describes people living in geographic proximity, which makes establishing relationships easier than establishing relationships with those who live in a far place. Economic classes also determine the formation of social networks and play roles in the reproduction of classes in a society that relates to Bourdieu's view of social networks. The social network factors also enable to classify social ties into bonding, bridging and linking type of relationships (Putnam, 1993; Bourdieu, 1986).

V. Dilemmas and Controversies

Despite the growing interest of recognizing the relevance and potential usefulness of SNA that relate to a wide range of issues and problems, there are some dilemmas and controversies revolving around the concept of social networks. The methodological dilemmas are linked to the two major points. The first issue is related to the debates revolve around the complex nature of social networks particularly on the type of networks that can be judged to be stronger or weaker in a particular context. Broadly speaking, social networks can be stronger or weaker in several different ways as articulated from study conducted by Bridge (2002): 1) in terms of the number of people in the network; 2) the extent to which the people in the network have overlapping interactions; 3) the degree of geographical concentration or dispersion of the network population; 4) the extent to which the relations between network members are characterized by equality and reciprocity; 5) the impact of the broader social setting within which the social capital and network is located.

The second source of controversy is linked to the concept of social capital. Principally, the controversy is due to the complex nature of social capital as reflected in its definition and the associated outcomes. Methodologically, there is natural affinity between the idea of social capital and network analysis. Social capital is a relational capital. There is consensus on the issue that social capital inheres in and derives from social networks of people. The absence of a relationship implies the absence of social capital. Social capital is viewed as the capacity of individuals to gain access to available resources by virtue of their membership in social networks. In this regard, Burt (1992) developed measures of social capital based on the presence or absence of certain types of social ties in an egocentric social network. Nevertheless, there is lack of understanding the connection between social networks and social capital.

In addition, there is lack of clear understandings on the methods of analyzing social networks within the contexts of the current debates that revolve around the concept of social capital. The divergent sources of the debates as articulated from the study conducted by Bridge (2002) tend to rely on: 1) on whether social capital is the capital of individuals or collectivities; 2) the positive and negative contribution of social capital; 3) which type of social capital is more important for particular purpose or action and 4) whether social capital is currently declining or not declining in the western world.

VI. Methodological Challenges

Designing the network-based research has some challenges that must be considered. One of the challenges in network-based studies is related to understanding the change and continuity of social networks over time. Attempts have been made to move toward designing network dynamic studies that often raise difficult questions of defining when the relationships start, change, and end (Marsden, 1990). There is also another related debate that revolves around the concept of social capital in terms of whether social capital is currently declining or not declining. Most of the existing empirical studies of social networks often present social networks as a static phenomenon (Borgatti, Everest & Johnson, 2013). Evidence indicate that social networks are not inherently static, rather changing over time. However, there are other notable evidences that indicate social networks are not static (Pescosolido, 2007). In this regard, Boissevain (1974) points out that social networks continually change as people drop-out, divorce, die, relocate, or choose to become disconnected. In sum, the paper indicates that mapping and measuring social network dynamics is methodologically very problematic and challenging.

VII. Conclusion

The article has made clear that the methodological foundations of SNA have been drawn from various disciplines such as anthropology, sociology, management, mathematics, and computer and health sciences. Empirical evidences also indicated that SNA has been applied to understand a wide range of issues and problems such as circulation of goods and services, flow of information, diffusion of innovations, and diffusion of epidemics or diseases and the like. SNA has also been applied to the study of linkages between personal networks and employment outcomes, labor market outcomes, job search out comes, labor migration and its influences on migrants' decision making process. The article further describes that SNA have been linked with economic prosperity or economic development and good governance, lower crime, higher educational attainment, health and quality of life. With the advancement of technology currently, online networks are also being studied from different perspectives and outcomes. Nevertheless, there have been ample evidences pointing out the negative function of social networks evident in terms of creating social exclusion and social discrimination. Evidences of network-based studies show that social groups that are vulnerable to social exclusion are homeless people, elderly people, the long-term unemployed and disabilities.

7.1. Recommendations

The article demonstrates that there are ample opportunities to apply SNA to a wide range of problems or researchable issues across disciplines in the social and behavioral sciences. Hence, the study suggest that social network theories, concepts, methods and techniques need to be considered in teaching methodological courses in the social sciences in general and social work in particular. Currently, there is a growing interest in SNA among researchers, planners, policy-makers and even donors for various purposes. Within the current development discourses that building the social capital and social networks of individuals, groups and communities are viewed as one of the agendas of sustainable development. Social networks and social capital are important partners for participatory approaches to community development endeavors. Social capital that can be viewed as the personal networks, norms and levels of trust that facilitate access to and control of resource roughly available on a particular context. Social capital can also be understood in terms of the social resources and connections that an individual has at his/her disposal.

More importantly, SNA has a unique opportunity to the field of study in social work and social development. One of the defining features of social work profession is the importance of human relationships that considers the importance of social networks. The methods of SNA, therefore, fit in some of the major social work perspectives and methods. In the first place, social network data can be gathered from different actors at different levels in the general social system. Social network data can also be amenable to different levels of analysis. In this regard, SNA fits in the person-in-environment or ecological perspectives or systems theory which assumes that everything is connected. In addition, SNA fits in the strengths-based approach to social work practices particularly related a networking approach for community development practices. SNA can be applicable to undertake community-based research, establishing university-community partnership and enhancing civic engagement for various development programs and practices.

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