Chapter 4

Social network analysis and cross-border co-operation in West Africa

Chapter 4 explores the theory of social network analysis and its applicability for cross-border co-operation in West Africa[1]. The objective of this chapter is to show how a formal approach to the study of networks can be applied in West Africa to better understand how policy makers co-operate across borders in the region. The chapter starts by discussing some of the fundamental concepts developed by social network analysis over the last decades, including centrality, embeddedness, and brokerage. It then examines the methodological challenges of network analysis and how it differs from other approaches, before highlighting some of the policy implications of social network analysis for West Africa.

Key messages

- An original feature of the report is its use of a relational approach to cross-border co-operation known as social network analysis that studies the social, economic and political interactions between individuals, groups and organisations.
- The ability to study both the individual autonomy of social actors and their structural constraints makes social network analysis a pertinent analytical tool to inform the development policies and programmes of local communities and non-governmental organisations.
- It can also contribute to the empowerment of marginalised actors by shedding light on the structural causes behind their marginalisation, and is thus increasingly used to show how development interventions affect local communities.

FUNDAMENTALS OF NETWORK ANALYSIS

An original feature of this report is that it uses a relational approach to cross-border co-operation known as social network analysis (SNA). SNA is a burgeoning field of analysis which is primarily interested in studying how the ties between actors serve as channels for flows of material and immaterial resources such as capital, information, advice or trust. Over the last decades, SNA has evolved from a relatively peripheral area of research to a formalised body of theories, concepts, and methods that help visualise the social ties between people and measure the ways in which their interactions produce network structure.

Thus far, the majority of studies using SNA have been conducted in Western Europe and North America, where the approach originated. In the rest of the world, the use of social network approaches to describe and model contemporary societal structures is much less widespread, even in the domains of social life that are the most relational by nature, such as trade, politics or cross-border co-operation. In West Africa especially, work on cross-border co-operation using SNA constitutes a marginal field of research compared with those that look at institutions and formal agreements as the principle drivers of policy activities.

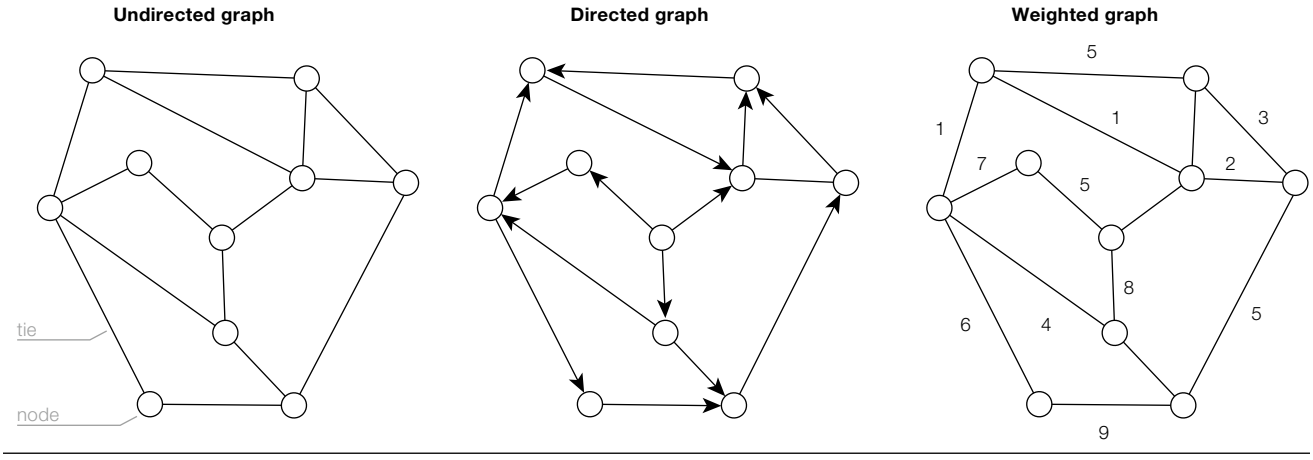
The formal study of social networks can be employed to understand the social, economic, and political interactions between individuals, groups, or organisations. Unlike other social

theories that are based upon a predefined social structure, SNA seeks to understand the origins, evolution, and impact of structure on social outcomes. SNA considers that the structure underpinning social relationships provides opportunities for or constraints on individual actions. In a network of policy makers, for example, it is assumed that the power of central actors to control information flows, give advice and orders, and influence policy outcomes comes from their structural position rather than from innate leadership capacities. Conversely, actors who operate on the structural periphery of a network must go through several of their peers in order to disseminate their ideas to the rest of the network.

SNA assumes that policy actors will develop tactics and strategies to alter the structure of a network to their advantage, rather than alter the behaviour of other actors (Brass and Krackhardt, 2012). Network tactics are often based on the principle that it is easier to influence a person that is close and present at the same time. Because the probability of forming a tie is inversely proportional to the distance, *propinquity* is a fundamental principle of network strategies. Actors are also more likely to influence people that have similar attributes or behaviours, a principle known as *homophily* and summarised by the popular expression: "birds of a feather flock together" (McPherson, Smith-Lovin and Cook, 2001). Influence over other actors is also better exerted in a stable relationship, where actors have had the time to build confidence in one another, than in a conflicting configuration where uncertainty prevails. Finally, people are also influenced by social perceptions and tend to value those who are associated with well-connected people. Asked for a loan by an acquaintance, the financier Baron de Rothschild is alleged to have replied: "I won't give you one myself, but I will walk arm-in-arm with you across the floor of the stock exchange, and you soon shall have willing lenders to spare" (Cialdini, 2013: 45).

Over the last decades, SNA has developed a rapidly increasing number of statistical tools to formally describe, represent, and model social structures. The SNA approach looks at social networks as a finite set or sets of actors who are linked to one another by social ties. A bounded set of policy actors linked by a set of relations form a *policy network* (Knoke, 2012). If policy actors are interconnected by multiple policy networks dedicated to a common issue, they form a policy *domain*. Policy domains include fields such as agriculture, energy, health, defence, transport, that are particularly relevant to cross-border co-operation. The smallest social network, composed of only two actors, is known as a *dyad*, whereas a subset of three actors is called a *triad*. Actors between which ties can be measured form a *group* and can be visually represented with a graph where the distance between the actors is proportional to their social proximity; actors closely tied to each other will appear clustered. Ties between actors can be *directed,* when each link has a

Figure 4.1
Three different ways to visually represent social ties



direction pointing from one actor to another, or *undirected,* when the direction of the links between actors is unknown. Networks can be *weighted* when the ties connecting actors have a value, or *unweighted* when only the existence of ties is represented (Figure 4.1).

In a dyad, one of the most fundamental measures of the strength of a connection is *reciprocity*, referring to a situation within which two actors acknowledge that they are engaged in mutual interaction. Reciprocity constitutes a major concern for policy makers who often rely on interpersonal relationships with representatives of regional or national authorities in other countries to design, implement, and monitor cross-border policies. The introduction of a third actor in a dyadic relation renders it possible to explore *transitivity*, a principle that assumes that two actors connected to a third actor are likely to be strongly tied to each other. For example, if a policy maker from Togo develops ties to a Nigerian policy maker who is himself connected to a Beninese counterpart, it is assumed that the Togolese and Beninese policy makers will have a good chance of also being connected.

The importance of social actors is often deduced from their centrality. Because the notion of centrality varies according to the structural context in which actors are connected, numerous measures have been developed since the late 1970s (Freeman, 1979; Freeman, Borgatti and White, 1991; Borgatti, 2005; Everett and Borgatti, 2010). Among the most commonly used forms of centrality are degree, betweenness, closeness, and eigenvector centrality.

- *Degree centrality* is a local measure that refers to the number of ties each actor has. Actors with a high degree centrality are often regarded as powerful because they are surrounded by many other actors. In West Africa, traditional chiefs often have a high degree centrality, because they are usually the centre of a large network of family, ethnic, and allegiance ties within the local community.
- *Betweenness centrality* refers to the importance of bridging disconnected actors. It is a global centrality measure calculated on the entire network and based on the number of shortest paths between actors. Actors with high betweenness centrality usually bridge actors or groups that otherwise would be disconnected. SNA literature argues that these actors bridge "structural holes", i.e. areas of relative low density of ties (Burt, 1992). Many policy makers involved in cross-border co-operation play such a brokerage role, by bridging their own nationally-organised network of colleagues and the outside world.
- *Closeness centrality* is another global measure which refers to how close an actor is to all other actors. Actors with high closeness centrality are often found among high-ranking civil servants or counsellors who have the ability to influence the choice of leaders without being officially in charge. In northern Nigeria, for example, a committee of king makers is responsible for presenting a list of candidates to the state governor, who ultimately appoints new religious leaders, known as *emirs*.
- *Eigenvector centrality* indicates whether actors are central because they have ties to other central actors. Actors with high eigenvector centrality are well connected to the parts of the network that have the greatest connectivity. Elite members of state bureaucracies are examples of such actors because they have many connections to people that are also well connected.

EMBEDDEDNESS AND BROKERAGE

Recent research conducted in a variety of disciplinary and geographical contexts has shown that social capital results from the combination of embeddedness and brokerage (Burt, 2005; Fleming, King and Juda, 2007; Uzzi, 1996; Narayan, 1999; Woolcock and Narayan, 2000; Everton, 2012). Embeddedness refers to the inclusion of actors in a tight community of friends, colleagues or kin, whereas brokerage refers to the ability to establish relationships beyond one's own community. Studying a sample of entrepreneurial households in

Uganda, Rooks et al. (2012) show, for example, that the most innovative entrepreneurs are simultaneously embedded in a cohesive group while being able to create diverse external contacts between actors that are not themselves connected.

A strong degree of embeddedness establishes trust between peers and reduces the risks associated with social, political and economic activities. Strongly embedded actors are therefore regarded as very central, in the sense that they are surrounded by a large number of other actors with whom they frequently interact to exchange information, obtain financial resources or communicate orders. However, this structural position is not without disadvantages as strongly embedded actors may lack brokerage ties that would allow them to reach external resources, such as new ideas and information.

Brokerage can generate value in three different ways, according to Spiro et al. (2013). Firstly, brokers can transfer resources between two disconnected parties. This structural position is routinely used by regional authorities involved in cross-border policies who act as a bridge between their own state and neighbouring countries. Secondly, brokers can facilitate match making between two actors to the benefit of each other, notably in polyglot regions where multilingual policy makers are able to bridge actors that would otherwise not be able to communicate effectively. Finally, brokers can co-ordinate the activities of third parties without creating a direct relationship between them, which reinforces their dependence on the broker. Freelance negotiators are used to playing this role, by mediating between governments, political parties, and other non-state actors.

CENTRALISATION AND NETWORK TOPOLOGY

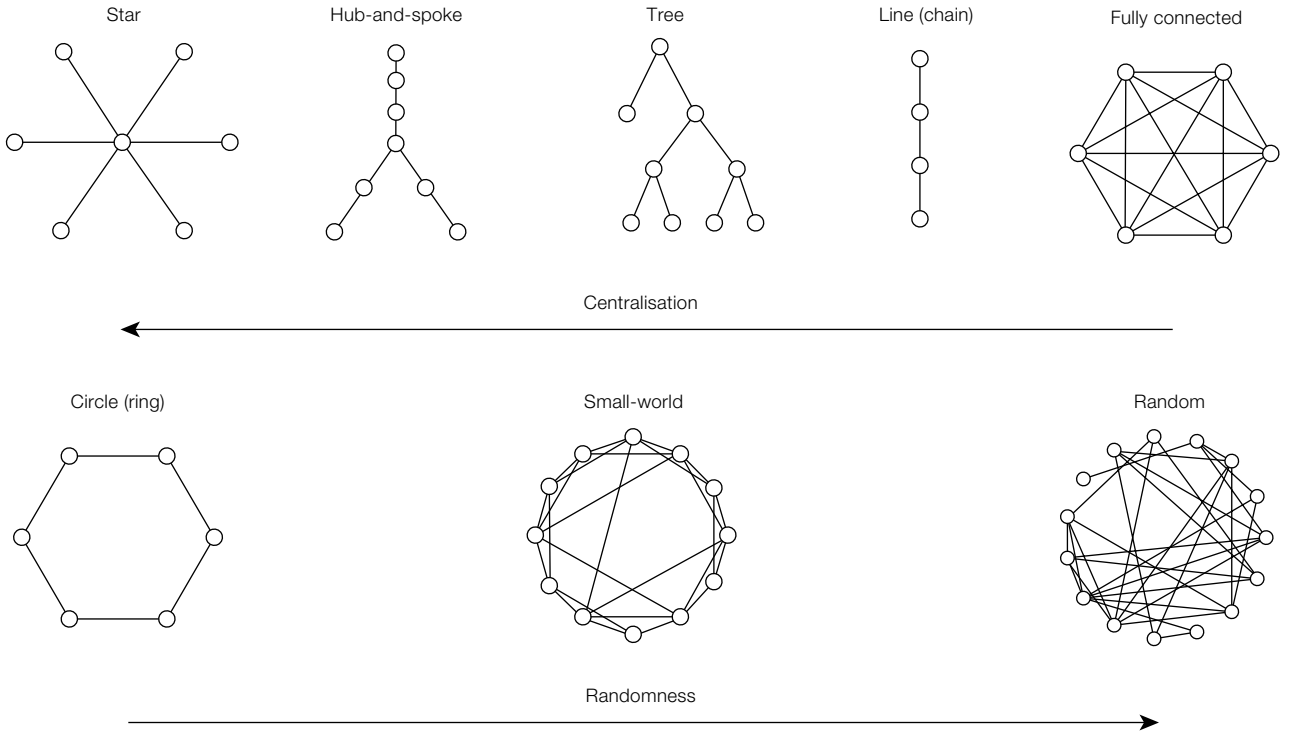
Social networks can greatly vary in size, complexity and shape. Such diversity has important consequences for social actors, whose autonomy is often constrained by the general structure of the entire network; small, clustered networks do not establish the same interpersonal relationships as large, decentralised networks, for example. Determining the variation in centrality that exists between actors can help distinguish between different categories of networks.

Centralised networks are composed of a small number of actors with many ties and tend to be efficient in terms of co-ordination, because information, orders and resources can be more easily transferred from central actors to the rest of the network. The star network – represented in Figure 4.2 – in which peripheral actors have no ties between each other, is the most extreme example of a centralised network. Its opposite is the fully connected network, a decentralised structure where every actor is connected to every other actor, which proves resilient to threats because of the redundancy of ties. Other network topologies include the hub-and-spoke network, a centralised network in which information and resources move along spokes towards a central actor, and the tree network, a hierarchical structure commonly found in military organisations.

Decentralised networks are structured in such a way that no single actor can achieve a dominant position. This type of network is particularly relevant for cross-border co-operation where a multiplicity of actors representing different institutional levels and countries makes it difficult to envisage the existence of centralised structures. This is the case in Europe, where decentralised networks have been observed (Walther and Reitel, 2013; Dörry and Walther, 2015). The line network, which is made up of a chain of actors, is a decentralised structure, as is the circle network where each actor is only connected to an adjacent actor. Circle networks become more complex when numerous ties are added, evolving towards small-world networks, wherein most actors can be reached by others through a small number of steps even if they are not immediate neighbours; or random networks, which do not exhibit any regularity (Figure 4.2). As networks evolve from circles to small-worlds, their randomness increases.

Many social networks are functionally different as their structures are a function of their overall purpose. For example, social

Figure 4.2
Examples of network topologies



Sources: adapted from Baker and Faulkner (1993), Watts and Strogatz (1998)

networks that aim to recruit people are often fully connected and do not rely on brokers because their main objective is to reach the largest number of potential recruits, whereas fund-raising networks rely much more on brokers who can connect distant investors (Leuprecht and Hall, 2014). An illustration of how the topology of networks can vary depending on the specific roles of the actors is provided by the Ayadi et al. (2013) study of informal trade across Tunisia's borders. The study shows that the organisation of trade differs significantly depending on whether trade takes place across the country's borders with Algeria or Libya. Trade with Algeria is mainly organised through a linear chain of actors that connects wholesalers with transporters and storage owners on the Algerian side. Close family and cultural ties on both sides of the border then facilitate the crossing of goods to another storage owner in Tunisia before the goods are delivered to internal Tunisian markets. In contrast, the organisation of trade on the border with Libya is more circular than linear. Once Tunisian wholesalers order a certain quantity of goods from Chinese, Turkish, or Libyan suppliers, the goods are received by Libyan agents who arrange for these to be transported to border entrepôts and stored until a Tunisian transporter comes to pick them up. The merchandise is then stored in a Tunisian entrepôt and delivered to a Tunisian wholesaler, who will finally reimburse his financier, if needed, and sell the goods to the final customers.

COLLECTING AND ANALYSING NETWORK DATA

SNA can be conducted on a large variety of written and oral sources. These sources include existing lists of actors, newspaper articles, and archives; administrative, communication or criminal records; key informants, or stakeholders directly engaged in social networks

(Marsden, 2012). When the size and composition of a population is known, the existence of social ties between actors is more easily investigated through questionnaires, interviews and participant observation, than when little is known about network memberships. In the latter case, drawing the boundaries of the surveyed network can be challenging when dealing with interdependent actors as the degree of separation is usually minimal in small-world networks (Barabási, 2003). Therefore, determining who can reasonably be identified as belonging to a network and who cannot is a central issue and a decision that is particularly difficult to make when actors do not belong to formal organisations.

While held in high esteem across many research fields, random sampling is not viewed as an appropriate sampling technique within SNA. This is because randomly selecting actors from the total population would cause a large number of relevant connections to be ignored. Therefore, snowball sampling techniques are used as an alternative to randomisation to identify new economic agents from among a subject's existing acquaintances (Frank, 2012). Snowball sampling does not assume that actors in a network are consciously aware of their interaction with the network, nor does it take account of preconceived boundaries set out by the surveyor. It is particularly adapted to the study of actors such as policy makers, who don't necessarily belong to a single institution, and whose number and activities are difficult to evaluate from a surveyor's perspective.

A snowballing survey will typically begin by identifying the first wave of interviewees, who will be asked to name people they are related to in particular ways (family, friends, neighbours, colleagues, members of an organisation), people they can trust or rely on, or people they feel close to. A number of related data such as age, gender, or education can be collected simultaneously. Several subsequent waves of interviews can then be conducted with the people identified during the first wave of interviews until the same names start to appear again and again, indicating that the boundaries of the network have been reached. A very high response rate – greater than 80% – ensures that the survey is not negatively affected by missing data points (Koskinen et al., 2013).

If a survey of the entire population of a network cannot be achieved, an alternative is to focus on individual networks, known as ego networks, which consist of a focal actor (ego) and the actors to whom the focal actor is directly connected, plus the indirect ties among these connections (called alters). Ego network analysis is particularly adapted for understanding if an actor is surrounded by a dense cluster of connections, if he or she can benefit from structural holes that separate subgroups of actors, and if their connections share similar characteristics (Everett and Borgatti, 2005).

Because structural analysis considers the ties, rather than the attributes of the actors as its main unit of analysis, it violates basic assumptions of independence, non-random sampling, and unknown distribution of variables. In order to deal with the fact that actors engaged in social networks are, by definition, not statistically independent, a set of statistical tools has been developed for constructing tests of significance that differ from traditional econometric tools (Contractor, Wasserman and Faust, 2006). The most popular probability models that take into consideration dependencies are known as Exponential Random Graph Models (ERGMs). These are based on dependence assumptions that can be specified and estimated from observed network data (Robins et al., 2007).

SNA can be employed alongside other qualitative or quantitative approaches. For example, the degree to which an individual is connected to others can be used as an independent variable in econometrics. Research on social networks in Africa has mostly focused on economic rather than political or policy outcomes. Studying informal entrepreneurs in Burkina Faso, Berrou and Combarnous (2011), for example, found that social networks enhanced manufacturing and trade by connecting entrepreneurs who had different social statuses, and by providing them with greater numbers of suppliers and financial support. In Kenya, the social connections between micro-manufacturers and traders favour the adoption of new technologies and the production of higher quality products (Akoten and Otsuka, 2007), whereas in Ethiopia the density of ties between micro-enterprises positively affects the sales and skills of manufacturers (Ishiwata et al., 2014). Furthermore, in South Africa and Ethiopia, social connections

enhance employment opportunities by helping match workers and firms in countries where informal recruitment procedures are based on word of mouth (Schöer, Rankin and Roberts, 2012; Mano et al., 2011).

State-business relationships are also crucial for the economic performance of traders (Walther, 2014, 2015a). In West Africa, small traders use their social ties with state representatives, politicians, and security officers to facilitate the passage of their goods across national borders (Kuepié, Tenikue and Walther, 2015). Social ties with local religious leaders seem to have a negative effect on business profits, however, due to the expenses resulting from social obligations. This last example illustrates one of the negative economic consequences of being overly embedded in a closed network.

SNA can also be combined with more qualitative approaches that look at the locally situated ethnographic, historical, geographical and institutional contexts in which social networks are embedded, as well as at the significance which actors attribute to their relationships. A formal approach to the study of networks has much to gain from the integration of qualitative information to explain why certain ties have been created between actors, how these connections have evolved over time, what the exact nature of these ties is, and how they are perceived by the actors involved. Qualitative interviews with policy makers are particularly useful to understand the success and challenges of cross-border policies or the difficulties of establishing ties across borders.

POLICY IMPLICATIONS

The ability to study both the individual autonomy of social actors and their structural constraints makes SNA an excellent alternative analytical tool to inform the development policies and programmes of local communities and non-governmental organisation (NGOs). Very few people are able to comprehend their own structural position in a social network without a proper visualisation of the entire network. Therefore, people tend to behave according to what they believe their social network to be, rather than an objective representation of their network. Because perceptions strongly determine power, the actors with the best perception of networks are likely to be more influential than those who only have a partial overview of the connections that exist beyond their immediate friends, allies or business partners. Formal approaches that map social ties provide a visualisation of the structural position of marginalised actors, groups and organisations which can often be difficult to ascertain when numerous actors are involved. This is particularly true of cross-border policy networks in which the existence of a national boundary adds an additional distance between the actors.

SNA can contribute to the empowerment of marginalised actors by shedding light on the structural causes behind their marginalisation. In sub-Saharan Africa and Asia, participatory approaches to SNA have been used by several international organisations, including the World Bank, the International Fund for Agricultural Development and the International Food Policy Research Institute of the United Nations to empower marginalised actors in the fields of agriculture, natural resource management, and health (Schiffer, 2012). In the basin of the White Volta in Ghana, a dedicated network mapping tool was used to understand and improve water governance among representatives from several public agencies, NGOs and traditional authorities (Schiffer, Harwich and Monge, 2010). This approach helped the actors to better understand what their goals were, if these goals were co-operative or conflicting, how the actors influenced one another and how the network could evolve to improve water governance in the region. The study found that exchanging information and providing advice was crucial for developing influence among stakeholders, and that the existence of several overlapping governance systems reduced the efficiency of fisheries management.

SNA is also increasingly recognised as a useful approach to understanding how development interventions affect local communities. For example, the World Bank (2012) has used network tools to evaluate the impact of some of its activities on agricultural productivity in

India and China. Network analysis can also help identify relevant issues that hinder community development, visualise the complexity of actors engaged in the resolution of issues, and represent the relationships between the issues themselves. Indeed, Boutilier (2011) shows that SNA can be used to visualise the consequential links between the positive and negative impacts expected from the construction of a dam in a very arid region. Using a participatory method for mapping social networks in northern Nigeria, Schiffer, Mustapha and Mustaph (2012) found a gap between policy design and implementation of maternal health and newborn survival activities, resulting in high numbers of normally preventable deaths. The network approach showed that the gap resulted from conflicting power strategies between two groups of influencers. While representatives of the health ministry were responsible for writing the budget, politicians outside of the health field were in charge of the actual disbursement of funds.

Compared with other approaches, SNA brings undisputable added value to the study of social structures and related policy interventions. Its main strength is its ability to determine the extent to which relationships affect social, economic and political dynamics. Rather than assuming that social actors are isolated players that can be sampled at random, SNA considers that each and every actor counts when it comes to understanding social structure, because what makes social actors important are the ties that bind them to the rest of the network and not just their individual attributes. SNA also provides a realistic visualisation of social organisations that is often impossible to determine by simply relying on organisation charts or official club rosters. Instead of dividing societies into several groups according to pre-determined categories and studying the social characteristics of each, SNA considers all stakeholders involved in a particular event or domain, it maps their ties, and only then identifies how the network is divided into subclusters. This makes SNA an analytical and policy tool that is particularly well suited to understanding fluid and indistinct social organisations, such as ethnic or tribal groups, informal traders, and policy makers involved in cross-border co-operation.

NOTE

1 *Portions of this chapter draw from a working paper by Walther (2015b).*

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