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Using social network analysis to profile organised crime

Anine Kriegler

Recommendations

1 Use SNA to gather and structure intelligence on criminal networks and to analyse complex relationships in which criminal networks are involved.

2 Move from first- or second-generation mapping methods to SNA when researching organised crime to avoid some of the limitations of existing approaches to mapping organised criminal networks, specifically simple dichotomies.

3 Be aware of the short-comings of the SNA method. Provide resources and training so that criminal intelligence operatives can gather and input the necessary data.

4 Minimise the shortcomings of SNA by supplementing it with context and analysis from external researchers.

5 Keep up to date with ongoing technological improvements.

Summary

Social network analysis avoids some of the limitations of existing approaches to mapping organised criminal networks. It focuses on fluid interactions among individuals and determines social structures empirically, rather than relying on theoretical classifications – thereby avoiding some of the pitfalls in traditional thinking about organised crime. However, it requires significant technical skill, time, and pre-existing expertise to generate and interpret an analysis. It also fails to account for the underlying social forces that may be crucial to network formation and functioning. It is a complex process that requires law enforcement and crime intelligence to partner with external researchers.

THIS POLICY BRIEF IS part of a series designed to assist policymakers, analysts, strategists and all who are concerned about contemporary organised crime to better understand the structure of networks involved in such crime in African cities. The series profiles the dynamic context in which crime networks exist and the strategic relationships that contribute to their resilience and to some extent determine the impact of their activities on governance.

The purpose is to support the formulation and implementation of policies and measures against organised crime that are comprehensive, more effective, and sustainable by providing practical advice and recommendations on mapping crime networks in their environment.

Social network analysis (SNA) can avoid some of the limitations of existing approaches to mapping organised criminal networks. It focuses on fluid interactions among individuals and determines social structures empirically rather than relying on a priori theoretical classifications. It therefore offers the major advantage of avoiding some of the pitfalls in traditional thinking about organised crime, i.e. of the theoretical distinctions between state and non-state, licit and illicit, etc. Using a sophisticated set of arithmetical techniques, SNA

converts large quantities of data on observable social forces into a neat image. This reveals patterns in the data not apparent to the naked eye and will allow for a movement beyond reactive policing to better understanding, anticipating and preventing organised crime. The method's weaknesses, however, include the fact that it requires significant technical skill, time, and pre-existing subject area expertise to generate and interpret an analysis. It also fails to account for the underlying social forces that may be crucial to network formation and functioning. The weight and complexity of the analytical burden will require that law enforcement and crime intelligence partner with external researchers. This policy brief attempts to support these contentions by means of a case study on the South African arms deal of the later 1990s.

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Network mapping in organised crime research

First- and second-generation approaches

Link analysis is a method in which criminal actors and the links between them are visually mapped in a graph, whether with pinboard and string or electronically, and has long been standard procedure among law enforcement and criminal intelligence agencies and others concerned with organised crime.[1] This, the manual or first-generation network approach,[2] usually involves the collection of data into a matrix and then the visualisation of 'who does what to whom, and with what frequency'.[3] But the utility of link analysis is limited by its inefficiency in working with large data sets,[4] its relative inability to reveal anything about the 'social mechanisms underlying such networks',[5] and its arbitrary and potentially misleading visual layout.[6] Still, it remains the norm in many Southern African criminal intelligence agencies.

A somewhat more systematic methodology, able to make more sophisticated observation of large and complex social structures, is found in the second-generation network approach,[7] which has become particularly popular for tracking terrorist groups and in the detection of money laundering since the events of 11 September 2001.[8] Second-generation software programs can produce graphics automatically or sometimes allow the analyst to drag nodes around to rearrange the network according to actors' perceived importance.[9] *Analyst Notebook*, *Netmap* and *Watson* are among the more popular computer programs among law enforcement agencies.[10] Like the first-generation approach, however, this software usually still relies on the human analyst to detect criminal relationships in the data, process these relationships into a form that the software can recognise, and interpret and make sense of the eventual results.[11] Many analysts therefore still use mapping software as simply a different way of presenting that which they already know, and gain little deeper knowledge about the structural forms, context and significance of the network being mapped.[12]

The third generation, which it is hoped will move beyond these limitations, is still in its infancy.[13] Some promising techniques, however, may well be found in social network analysis (SNA), and law enforcement has begun to adopt its methodologies.[14]

Third-generation approaches: social network analysis

In the 1930s the psychiatrist Jacob Moreno, in trying to explain a spate of runaways from a girls' high school in upstate New York (and concretising Auguste Comte's 19th-century vision of 'social physics' and Émile Durkheim's idea of society as reflecting a biological organism with interrelated components, among others), developed the method of 'sociometry' for mapping individual's feelings toward one another in a 'sociogram'.[15] In 1967 Stanley Milgram asked 'random people to forward a package to any of their acquaintances who they thought might be able to reach [a] specific target individual' and found that most people were connected by six acquaintances – thus the famous phrase 'six degrees of separation'.[16] Drawing on these and other precedents, especially the methods of epidemiology,[17] this approach has over the last few decades been developed into an increasingly sophisticated set of arithmetical techniques to map and 'quantitise' relationships,[18] forming the field of SNA.[19]

This enthusiasm, which has spawned dozens of symposia, thousands of articles in numerous fields, a number of dedicated journals and an international interdisciplinary society, is understandable.[20] SNA releases social researchers from the constraints of the macro-level analytical framework of structural functionalism, with its focus on the 'edifice of formal groups, systems, and moral order which was seen as impinging upon people, socializing them, moulding their character, and determining their behaviour',[21] and which anthropologists in particular recognised was insufficient for describing the 'fluid social interactions of individuals and groups which they observed during ethnographic field research'.[22] Instead, it opened the space for a more dynamic, overlapping, cross-institutional

and micro-level understanding of social structure.[23]

But it was also a more fundamental development than just a shift in the level of analysis. This is because SNA derives 'social structure *empirically,* based on observed relationships between actors, rather than on *a priori* classifications'.[24] For network theorists, the primary 'stuff' of social life is the 'concrete webs of social relations that both embody and transcend conventional organizations and institutions'.[25] So, rather than labelling actors according to a predetermined characteristic or group membership and then examining interactions among groups, as is the typical, non-network approach, the social network analyst begins with an examination of relationships that exist among actors, and only then delineates and labels the groups that emerge.[26]

It is this, in fact, that has led to '[p]erhaps the oldest criticism of social network research … [that] it is "merely descriptive" or "just methodology"'.[27] Social network theorists argue, however, that their approach has a simple and cohesive theoretical core. Its central principles are the primacy of relationships, the ubiquity of actors' embeddedness in social networks (i.e. interdependency), the social utility of these connections, and the contention that the 'apparent complexity of social life' can be explained in terms of patterns of relationships.[28]

Based on these principles, relationships are categorised according to their content, direction and strength, and the relational properties of social networks can then be assessed according to their cohesion, their degree of centralisation, their range, their brokerage roles as regards other networks, etc. With this data, which is based on objective, observable social forces, the social network analyst is able to provide 'apparently "hard" data which [can] be plotted and even computerized', and neatly expressed in a sociogram.[29]

Caveats and limitations

As discussed in the previous policy briefs in this series, it is by now fairly broadly accepted that the traditional understanding of organised crime should give way to one that acknowledges the multifaceted ways in which it interacts with the state and the global market. SNA is particularly useful in that it steers the researcher or analyst away from simple dichotomies and towards a view of actors of all types engaging in numerous forms of relationships with one another. It reduces all the major paradigms dealing with the relationship between underworld and upper world to their most basic component – human relationships.[30]

> SNA reduces all the major paradigms dealing with the relationship between underworld and upper world to their most basic component – human relationships

SNA does, however, have some major disadvantages, both to organised crime researchers and more broadly. It encompasses many of the challenges of traditional statistical data analysis, for example, the time-consuming nature of data entry and coding and the difficulties of handling large data sets and dealing with untidy and missing data, and also requires that investigators be skilled and experienced in the use of an entirely different methodology.[31] Law enforcement agencies in Southern Africa rarely have the luxury of the extensive training and manpower that such an approach requires, and the dynamic nature of these networks makes outputs irrelevant if they take too long to produce.

Moreover, whereas SNA researchers in other fields typically rely on questionnaires and interviews,[32] it can be extremely difficult to obtain enough reliable data on clandestine networks to make statistical analysis feasible and results sufficiently accurate. The analyst should be acutely aware of the ethical hazard involved in making public assertions 'when there may be some questions about the reliability and accuracy of the sources of the data'.[33] Given that the very point of SNA is not to address general classes of actors, but rather to identify specific individuals, issues of confidentiality and research ethics are magnified.[34] And, at the end of this tortuous process, SNA's emphasis on mathematical graph theory and jargon may lead to a methodological overkill, often resulting in trivial results.[35] As the number of actors increases, sociograms quickly become difficult to read, looking more like elaborate graphic designs than useful law enforcement tools[36] and confirming 'the popularly held view that sociology is the discipline which sets out the obvious at great cost in an unintelligible language'.[37]

But there is also a more fundamental weakness inherent in the SNA approach. Its very empiricism makes it a clumsy tool for understanding 'the social forces underlying long-term processes'.[38] Knowing which individuals are linked by which relationships into a criminal network does not necessarily make clear the significance of the dynamics of policy and social norm, spatial and temporal determinants, or the underlying nature of the organised crime problem overall.[39] An isolated, technical SNA approach can only lead to a very incomplete understanding of social behaviour. Used in conjunction with 'other research methods and forms of conceptualisation', however, it can be an invaluable tool.[40] Given human, financial and time constraints in many law enforcement

agencies, full analysis of SNA outputs will likely require the cooperation of external researchers and academics who can provide the necessary contextual and theoretical expertise.

Case study

To illustrate these points, we include here the outcome of an SNA approach to the South African arms deal, a massive and complex arms acquisitions process of the late 1990s, which raised allegations of corruption that resulted in a number of criminal cases. Using Paul Holden and Hennie van Vuuren's book, *The devil in the detail: how the arms deal changed everything*[41] and Eduardo Salcedo-Albarán's *Vortex Relationship System* software, we mapped all the major relationships involved that could have facilitated corruption. Even after the effort it took to rationalise and condense all this data into book form, organising, coding and inputting it into the software took well over a hundred hours of work.

The result reduces hundreds of pages of text to a single image. Each yellow point or circle (or 'node') in Figure 1 represents an actor. The nodes are diverse, including massive defence industry bidders, smaller sub-contractors, state-owned enterprises, cabinet ministers, presidents, business people, police officers, consultancy firms and charities. Their importance in the network is

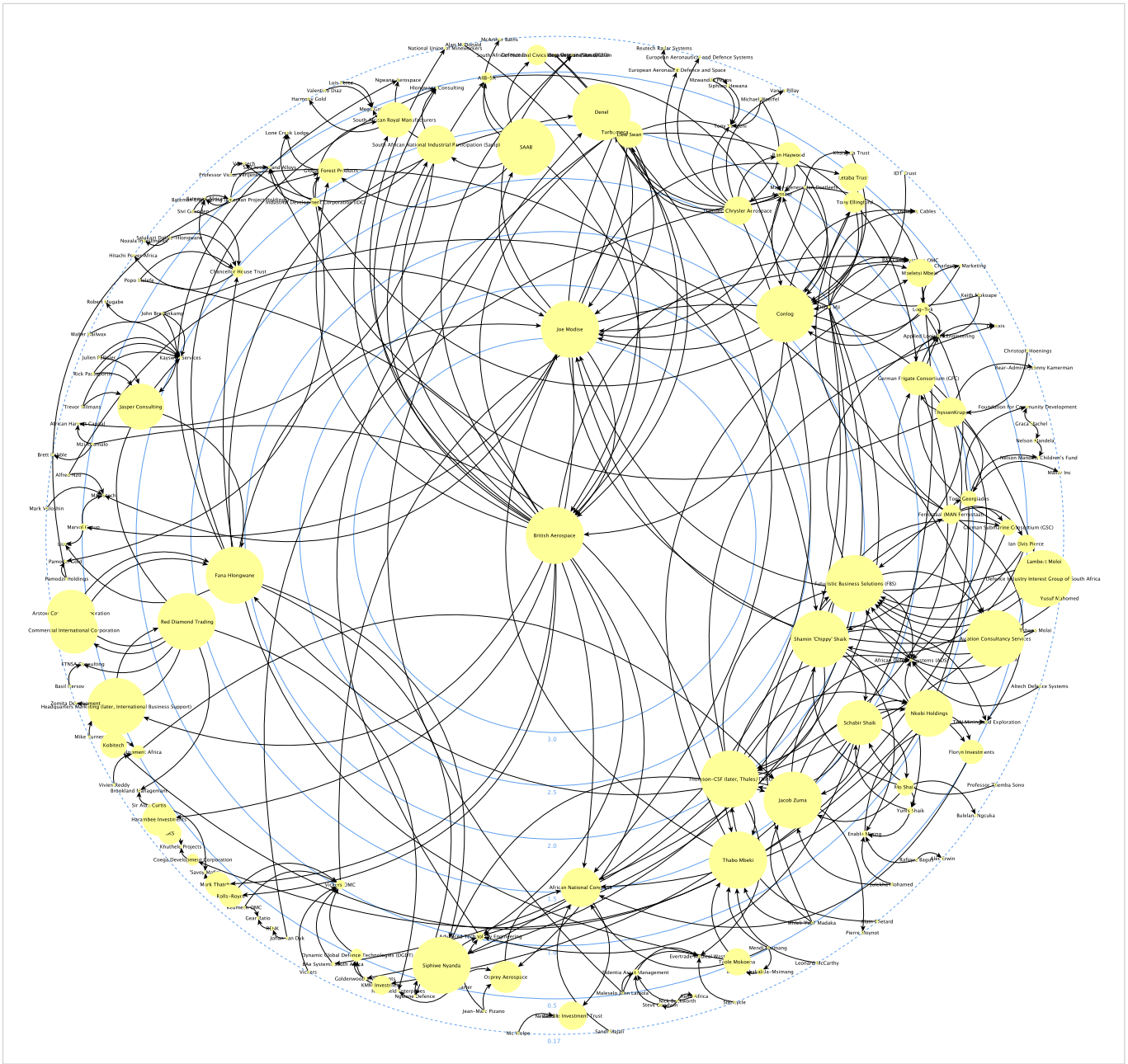

Figure 1 Outcome of an SNA approach to the South African arms deal

reflected by their position (a more central position in the graph reflects a larger number of connections, with the blue concentric circles representing an index of this measure) and their size (a larger node size reflects greater significance in terms of linking parts of the network that are not connected through other relationships). Each line connecting two nodes (or 'edge') represents a relationship.[42] These represent roughly thirty different types of relationship between the first named actor (X) and the second (Y), such as that 'X was a senior decision maker in Y', 'X gave money or other financial benefit to Y', 'X was friends with Y', 'X gave strategic benefit to Y', 'X was related to Y' and 'X hoped to enter into business with Y'. The arrowheads on the edges indicate the direction of the relationship.

The resulting impression can look chaotic. There are 174 nodes and 292 edges in a bewildering tangle. At the centre of this complex network is British Aerospace, one of the major arms deal contractors. The first thing to note about this is that, despite this network's bull's-eye-like layout, physical centrality in this network is *not* a reflection of who is the boss, or who has the most influence, or who benefits the most, or who initiated the corruption, or anything else; it simply reflects an agent's *number of relationships* as relevant to the network. What it does highlight, however, is the actor's systematic embeddedness in the network. British Aerospace has twenty separate relationships through which it is able to share resources (information, money, influence, etc.) with other actors. Its connection to this network is diverse, unlikely to have come about by coincidence, and represents a broad range of influence.

The second important aspect to the British Aerospace node is its size. It is among the largest, meaning that it connects a large number of actors that are not otherwise connected. Node size is thus an inverse measure of redundancy. If this actor were to be removed, a large part of the network would be disconnected from the rest. Significant resources (again, information, money, influence, etc.) would – at least temporarily – be unable to reach large parts of the network. But there are also nodes of equivalent size far further from the centre. Towards the top of Figure 1 is the node representing the actor Denel, the South African state-owned defence technology enterprise.

Despite having only five relationships in the network, this node is as large as British Aerospace's and would, if removed from the network, result in an equivalent amount of resource disruption. This is in contrast to the node representing the major sub-contractor, African Defence Systems, in the fourth quadrant (bottom right). Despite being linked to the network via eight relationships (three more than Denel), this node is tiny, meaning that although at least eight other actors are connected through it, they are also connected through other nodes. Similarly, the node representing the businessman Diliza Mji, just to the right of Conlog in the second quadrant (upper right), has nine relationships, but barely registers as a point. This means that the removal of these actors, despite their number of connections, would not significantly disrupt the flow of resources in the network.

Numerous other factors are revealed by the SNA approach that are not reflected in the graphical output. Having categorised the relationships, it is possible to determine which relationship types were the most common in terms of facilitating the potentially corrupt transfer of resources. What we find is that the most common relationship type, accounting for 17 per cent of the relationships, is 'X was a senior decision maker in Y'. This relationship category includes being a chairperson, a member of the board, a CEO, a director, etc. The second- and fourth-highest-ranked relationship categories are 'X wholly or partially owned Y' and 'X was a key shareholder of Y', covering 14 and 11 per cent of the relationships, respectively. This supports the conclusion that the dominant means for facilitating potentially corrupt resource transfer was through corporate relationships.

This is not surprising, given the nature of the arms deal – this image does not describe a network of drug dealers, terrorists or gang members, but a network of corporations (57 per cent of the actors), private business actors (24 per cent), bureaucratic or state-owned enterprise actors (9 per cent) and political actors (8 per cent). What it does reveal is the fact that although direct transfer of financial benefit (i.e. bribery) accounted for 13 per cent of the relationships, a cumulative 42 per cent of the relationships that could have facilitated the corrupt transfer of resources were through more insidious, institutional means.

This means that the direct bribery that has in the aftermath been the focus of most of the public scandal and legal action constitutes a far smaller proportion of the potential corruption than do complex conflicts of interest around directorships, employment and share contracts. Acknowledging this could have a major effect on the formation of anti-corruption policies and strategies. Another interesting feature of this network is that of the 72 human actors (i.e. not corporate), 69 were male and only 3 were female.

None of these factors has been immediately obvious in the data, and collectively they represent the tip of the mathematical iceberg in terms of insights to be drawn from the SNA approach. Even so, however, this approach does

not capture a number of things. Firstly, it presents as static and concrete a dynamic process that spanned many years. In the absence of a time slider, which massively complicates data entry and coding and the technology for which is still only narrowly available, there is no sense of the development or trajectory of this network and of which relationships preceded and may have resulted in which others. Indeed, finding ways to efficiently represent time is an ongoing battle for social network analysts.

Even given that this network developed in response to a particular event (the arms deal), mostly existed only for those few years and is thus less compromised by the lack of a time variable than are most illicit networks, this is essentially a narrative that has been turned into a photograph. Some of the relationships were not concurrent, and the world of post employment was a fairly common instrument of corruption.

> The existence of a relationship and even the relationship type are not always a useful measure of relationship significance in the context of the network

The image's second weakness is that it sheds no light on the nature and seriousness of the corruption involved in each relationship. Some of the players at the visual peripheries involved in corruption to the value of millions of rands and were highly influential in their parts of the network.

Similarly, the fact of two actors being cousins may be far more significant to the transfer of resources than the same relationship between another pair. In short, *the existence of a relationship and even the relationship type are not always a useful measure of relationship significance in the context of the network.* Some of these factors could to some degree be reflected with different line colours or weightings for the different edges, but this would involve a great many more hours of work with the data and would likely still fall short of demonstrating the *significance* of what is reflected.

A similar issue is that the image does not indicate which actors were involved with the state-based procurement process, and therefore susceptible to electoral or other political censure. Again, this can be quite easily addressed by colour-coding nodes according to actor type.

This is, however, an imperfect remedy. Not only would it mean adding even more visual chaos to an already complex image, but it may also expose the down side to SNA's most attractive feature. In freeing the researcher from the constraints of macro thinking, a focus on social structure and the membership of theoretically significant groups, these features are not easily brought back into the analysis. This graphical output may even be obscuring the most meaningful implications of this network. In the Holden and Van Vuuren book the data reflected here was preceded by two full chapters of historical, social, political and individual context, and the narrative was interspersed with discussion of the ways in which these structures determined both the fact and form of the corruption.[43]

Understanding South African defence minister Joe Modise's role in this network would certainly be facilitated by more clearly indicating the nature of the relationships in which he was involved and by making clear his institutional role as minister of defence, but even this would not reflect his unique place in South African history and society. This relative blindness to broader forces and individual contexts might not present an obvious problem for the outcomes-oriented field of law enforcement and is no less a problem in the older link analysis methods.

It is only in coming to grips with these factors, however, that crime intelligence can begin to move beyond reactive policing to anticipating and preventing organised crime. SNA will facilitate this only inasmuch as it is done in partnership with external researchers and experts.

Notes

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About the author

Anine Kriegler has a master's degree in international relations from the University of Cape Town and a second master's degree in criminology from the University of Cambridge. She is working as a research associate with Open Secrets, a project funded through the Institute for Justice and Reconciliation by the Open Society Foundation for South Africa.

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ISS Pretoria
Block C, Brooklyn Court,
361 Veale Street
New Muckleneuk,
Pretoria, South Africa
Tel: +27 12 346 9500
Fax: +27 12 460 0998
pretoria@issafrica.org

ISS Addis Ababa
5th Floor, Get House
Building, Africa Avenue,
Addis Ababa, Ethiopia
Tel: +251 11 515 6320
Fax: +251 11 515 6449
addisababa@issafrica.org

ISS Dakar
4th Floor, Immeuble Atryum
Route de Ouakam,
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Tel: +221 33 860 3304/42
Fax: +221 33 860 3343
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ISS Nairobi
Braeside Gardens,
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Lavington, Nairobi, Kenya
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Fax: +254 20 266 7198
nairobi@issafrica.org

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