

Identifying Mafia Bosses from Meeting Attendance

Francesco Calderoni

Abstract Law enforcement agencies have frequently shown skepticism toward the results of the application of social network analysis to organized crime. Indeed, most studies to date have analyzed data (e.g. telephone intercepts) whose content was already well-known to the practitioners. Shifting the focus to data on mafia meetings, this chapter explores whether network analysis can identify the bosses in a large mafia network. The analysis relies on data from a large-scale investigation on the presence of the ‘Ndrangheta, a mafia from the Southern Italian region of Calabria. Operation *Infinito* identified several mafia families and tracked a number of mafia meetings. The results show that betweenness centrality is the most significant predictor of leadership in the mafia. A logistic regression model, using network measures as predictors, is able successfully to predict the position (boss or other) of 92 % of the individuals in the network. If supported by further studies, network analysis of meetings may provide law enforcement agencies with information useful for identifying the bosses of criminal organizations.

Keywords Mafia • Organized crime • Social network analysis • ‘Ndrangheta • Statistical analysis

1 Introduction

Since its first appearance, social network analysis of organized crime has been associated with the idea of its operational exploitation for law enforcement purposes [1, 2].

On the research side, the idea that organized crime may be better understood as a network rather than a hierarchical and structured organization is not new in the

F. Calderoni (✉)

Università Cattolica del Sacro Cuore and Transcrime, Milan, Italy
e-mail: francesco.calderoni@unicatt.it

literature. The reaction against the alien conspiracy approach, which suggested analyzing organized crime as a bureaucratic organization, with a formal hierarchy and with detailed rules for its functioning, soon led to alternative hermeneutic perspectives leaning towards more flexible and informal mechanisms. For example, Albin argued that organized crime is “a system of loosely structured relationships” mainly based on patron-client relations [3]; the works of Ianni suggested that mafia-type organizations should be better understood as social systems based on shared social cultural and ethnic relations. He explicitly mentioned network analysis, as “an anthropological tool that is used to chart social interactions” [4]. Ianni analyzed a number of Puerto Rican and African American criminal groups as networks, although the application was quite distant from current use. Overall, although the concepts of network and network analysis were recurrently evoked to describe the functioning and structure of organized crime, there were very limited empirical applications using network analysis methods [4].

On the law enforcement side, since the mid-1970s there has been growing attention to the processing and analysis of intelligence data on organized crime. In this regard, link analysis (visual representation of the structure of a criminal group performed through manual or computer-assisted drawings) was increasingly applied by law enforcement agencies, and a private industry offering methodologies and training courses quickly developed [2, 5, 6]. Link analysis made it possible to “establish the relationships that exist among individuals and organizations from bits and pieces of available evidence” [5]. It became increasingly popular thanks to the development of intelligence software. The step from link analysis to social network analysis was relatively short [2, 7, 8].

Academic interest in organized crime networks gradually met with attempts at network analysis by law enforcement agencies. From the first half of the 1980s onwards, the first applications of network analysis to organized crime already suggested possible applications to law enforcement action [6, 7, 9]. Lupsha argued that effectively combating organized crime required a shift to the strategic analysis of groups and operations, including network analysis as an “essential and necessary step” (1980). One year later, FBI special agent Davis provided a first hypothetical example of the application of network methods to a criminal organization adopting some basic network concepts, such as density and centrality, with a fictional criminal organization [9]. In the following years, some studies advocated the application of network methods to criminal organizations [1, 2, 8, 10–13]. However, most of these now “classic” contributions, albeit with some exceptions (e.g. [6]), did not engage in the empirical analysis of criminal groups. Not surprisingly, only 12 years ago Coles [14] still complained about the “failure by criminologists to adopt Social Network Analysis techniques and concepts in the investigation of criminal networks, particularly of organized crime”.

Only in the last decade has the use of network analysis in the study of organized crime seen significant developments. Since the beginning of the 2000s, academic interest in this specific field has greatly increased and contributed to opening new research directions in the study of criminal organizations [15–34].

Despite the increase in empirical applications, and despite the fact that some law enforcement agencies have started to apply network analysis in their criminal investigations, the method is not yet established as a standard instrument in law enforcement tactical and strategic analysis. Many law enforcement operators are still skeptical in regard to the application of network methods in organized crime cases. According to most of these operators, the current applications of network analysis are not likely to provide everyday investigations with critical advantages. This is because, in long-lasting investigations, the police and the prosecution normally have extremely detailed knowledge about the case. Each suspect is constantly monitored, her/his background is scanned, and telephone calls and emails are frequently intercepted. Network analysis could hardly offer any additional knowledge to operators working daily on the case. Network analysis can assist a researcher in reconstructing a network and in making sense of the structure and functioning of a criminal organization. While these analyses have provided unprecedented academic insights into the structure and functioning of criminal organizations, the risk is that current applications may be of limited interest to law enforcers. More often than not, scholars identify as the most important individuals, the best targets for network disruption, the “usual suspects” that law enforcement has already identified.

The limited operational implications of current applications of network analysis to organized crime should not lead to the conclusion that the method is useless. In fact, network analysis of organized crime is still in its infancy, and new developments may be generated by the advancement of the methods and increasing familiarity with them of scholars and practitioners [35, 36].

The reasons for the limited interest in network analysis by law enforcement may be due to two different reasons.

First, most network analysis studies have focused on individual judicial cases, with the result of an overlap with the information already gathered by law enforcement. From this perspective, one possible direction of evolution is the application of social network analysis across different investigations [37]. This development may have a geographical and a chronological dimension. From the geographical perspective, network analysis may merge investigative data from different investigations or jurisdictions and provide an overall picture which otherwise might be too complex or difficult to achieve. One such application has demonstrated that network structure and positioning may significantly change when different cases are merged [38]. From the chronological perspective, some criminal organizations such as mafias are particularly resilient, and last for years notwithstanding constant law enforcement action. The application of network analysis to different investigations on the same group may provide strategic information about the development and structure of a single criminal organization through time.

Second, most existing studies have analyzed data from telephone interceptions. While these data enable scholars to examine the communication flows within a criminal network, they offer much more additional information to the law enforcement agencies and the prosecution. Wiretapped conversations provide important evidence for both the investigation and the trial phase, particularly in organized crime cases, where most criminal activities are without victims, or the

victims may fear retaliation if they report to the police. Academic exploration of network dynamics on the basis of intercepted communications is unlikely to add any value to the information already gathered by the authorities. Furthermore, in most jurisdictions, the possibility to intercept the personal communications of suspects requires a number of conditions. Typically, it is restricted to serious offences for a limited period of time. Lastly, in order to proceed, the police and/or the prosecution may need a court order, which usually requires them to provide substantial evidence about the criminal activities.

In this regard, one possible development could be the application of network analysis approaches to different types of data more easily accessible even in the preliminary stages of a criminal investigation.

The analysis of the meetings of the members of a criminal network may be an example of such an approach. Frequently, law enforcement agencies can more easily control individuals' movements and meetings than their communications. For example, procedural requirements to shadow suspects or monitor public places (e.g. bars, restaurants, parks) are less constraining. The application of social network analysis to meeting data may provide insights into the functioning of a criminal network, with a limited investment not only in terms of procedural requirements but also in financial terms.

The analysis of meeting attendance may prove particularly effective in combating traditional organized crime groups, such as mafias, owing to their characteristics. First, the mafias have a formal structure with an established hierarchy. Formal affiliation is an important passage which provides the initiates with a new social status [39, 40]. Attendance at mafia meetings may be indicative of an individual's affiliation. Furthermore, some meetings may be reserved for only a few affiliates, especially when criminal activities are discussed. Second, mafias have a social structure which is embedded in family and kinship connections [41, 42]. Law enforcement may easily extend the analysis to social events such as religious ceremonies (e.g. baptisms, weddings, funerals) and family celebrations (e.g. birthday parties). Third, the most active and visible members of mafias and other organized crime networks may take precautions against over-exposure in telephone communications in order to reduce the risk of interception. They may manage the criminal activities through their status or more indirect forms of control [22, 31]. Individuals that make most use of the telephone may be middle-level criminals, who then report to the bosses. The analysis of meetings may penetrate these countermeasures.

Despite the possible advantages of the analysis of meetings, to date no study has applied network analysis methods to organized crime meeting patterns.

This chapter addresses this gap by exploring individuals' attendance at meetings within a large mafia organization. The aim is to show how the network analysis of meetings can successfully predict which individuals are the bosses of the mafia. The analysis is based on a single case study of a law enforcement operation (Operation *Infinito*) against the 'Ndrangheta, an Italian mafia from Calabria, Southern Italy.

Section 2 of this chapter provides background information on the 'Ndrangheta, focusing on its internal organization, which is a necessary basis for the prediction

exercise. Subsequently, [Sect. 3](#) describes the case study and the methodology. [Section 4](#) presents and discusses the results. The [Sect. 5](#) concludes.

2 The ‘Ndrangheta

Historically, the ‘Ndrangheta originated in the nineteenth century, or even earlier according to some sources [43, 44]. Until recent years, in Italy and abroad, the ‘Ndrangheta has received less attention than Cosa Nostra, which is widely considered to be the archetypical mafia organization [45]. Yet some recent events have brought the Calabrian organization into the world media spotlight.¹ Since then, foreign law enforcement agencies and institutions have increasingly paid attention to the ‘Ndrangheta.²

The ‘Ndrangheta has shown a remarkable capacity to establish its presence outside Calabria. Despite years of denial and minimization, its presence in the North of Italy is by now acknowledged as a fact [58, 59]. Moreover, a number of sources report the presence of this mafia in various foreign countries (e.g. Australia, Canada, Germany and the Netherlands) [57, 60–62].

Numerous factors have favored the spread of the ‘Ndrangheta outside Calabria. They include the migration of Calabrians in search of better living conditions; the establishment of profitable connections for criminal trade; the demand for criminal protection by some legal entrepreneurs; the need to evade prosecution; and mafia wars [63, 64].

Another important factor in the ‘Ndrangheta’s success may have been its complex social and organizational structure. Blood and community ties, rituals, affiliation ceremonies, mythology and a hierarchy comprising a number of formal

¹ The first event was the so-called ‘Duisburg massacre’ of 15 August 2007, when six people of Calabrian origin were murdered in Duisburg, Germany, in connection with a decade-long blood feud between two ‘ndrine [46–49]. Investigators found evidence of an affiliation ritual in the pocket of one of the victims (the remnants of a burned holy image), which further confirmed the tight relation between the massacre and the ‘Ndrangheta [50]. Second, on 30 May 2008 the President of the United States designated the ‘Ndrangheta a significant foreign narcotics trafficker (to date, the only Italian mafia) and included it on a special list, thus prompting a number of sanctions by U.S. authorities [51, 52]. Third, two exceptional law enforcement operations mounted on 15 July 2010 led to the arrest of more than 300 people and brought the ‘Ndrangheta to international media attention [53–56]. The first investigation (Operation *Il Crimine*) focused on Calabria and for the first time recorded the secret annual ‘Ndrangheta meeting at the Sanctuary of Our Lady of Polsi. The second operation (Operation *Infinito*, the case study of this chapter) highlighted the stable presence of the ‘Ndrangheta in Milan (the capital of Lombardy, Italy’s second largest city and its main economic and financial center).

² For example, in 2011, the Dutch Police issued a report on the ‘Ndrangheta, arguing that “no reliable statements can be made about the organizational structure in the Netherlands. It is likely that the ‘Ndrangheta also applies the structure it uses in Calabria and elsewhere in the world in the Netherlands, which means that there are one or more *locales* that organize criminal activities” [57].

ranks (*doti*) and offices (*cariche*) strengthen trust among the members, even at a great distance from the motherland [40, 57].³

The organization of the ‘Ndrangheta revolves around blood kinship [40, 63]. It is very common for men of the same family to join the organization, unlike original Cosa Nostra, where the “family” was in fact a group of individuals who were rarely consanguineal kin (there was even a rule against accepting more than two blood relatives into a Cosa Nostra family) [40, 65]. One or several ‘Ndrangheta families, frequently connected by marriage, godfatherhood and similar social ties, form a ‘*ndrina*. The ‘*ndrine* from the same area may form a *locale*, which controls a specific territory [66]. This social structure reinforces the cohesion of the criminal group, reducing the risk of betrayal.⁴

The ‘Ndrangheta also has a complex internal hierarchy made of ranks (*doti*) and offices (*cariche*) [40]. Competition for advancement in the hierarchy is fierce, and concern about his criminal career is a constant element in the life of a ‘*ndranghetista*. Affiliates frequently discuss matters relating to ranks and positions. Information on the formal organization is fragmented, despite the discovery of written “regulations” and the accounts of collaborators with justice describing the rules of the organization [40, 44, 68]. The ‘Ndrangheta continues to evolve, and the number of ranks and offices has increased, possibly due to internal pressure to climb the mafia career ladder.

In general, every affiliate holds a specific rank (*dote*) within the organization. The ranks are a sort of internal career advancements for the members. Indeed, the *dote* indicates each affiliate’s status within the ‘Ndrangheta.⁵ While the lower levels have remained constant over the years, recent decades have seen the creation of new higher ranks [40]. As a result, members are today divided into two main tiers: the higher society (*società maggiore*) and lower society (*società minore*), with multiple ranks within each society [40]. Before associates formally join the ‘Ndrangheta, they are called *contrasto onorato*. After their initiation, they start within the lower society, which includes affiliates with lower ranks (*picciotto*, *camorrista*, *sgarrista*). The higher society comprises members who have reached higher ranks (*santa*, *vangelo*, *quartino*, *tre quartino*, *quintino*, *associazione*, and other ranks discovered in recent investigations).⁶

³ Indeed, neither Cosa Nostra nor the Camorra have established a stable organized presence outside their regions. They have instead adopted more flexible structures. During the “golden age” of the twentieth century, only a few Cosa Nostra families were based outside Sicily [65]. A study on the Camorra *La Torre* clan highlighted that its presence in the Netherlands and Scotland was associated with money laundering and participation in illegal markets. However, the core business of the group (criminal protection) remained in the region of origin [27].

⁴ As proof of this, very few *pentiti* (collaborators with justice) come from the ‘Ndrangheta, as opposed to the Sicilian Mafia or the Neapolitan Camorra [45, 67].

⁵ The award of a new rank is a very important moment for a ‘*ndranghetista*. It is usually celebrated with a dinner or a party with the closest affiliates. Higher ranks can only be awarded by top-ranked individuals, with the agreement of the most prominent figures in Calabria.

Each locale has a number of formal offices (*cariche*) with specific functions. Offices are assigned to higher-ranked affiliates. The boss of the *locale* is the *capobastone* or *capolocale*. The *contabile* (accountant) is responsible for the common fund of the *locale*, the *crimine* (crime) oversees criminal, and particularly violent, actions, and the *mastro di giornata* (literally “master of the day”) attends to communication flows within the *locale*. Information is incomplete as to the ranks, with investigations uncovering new offices and functions. In general, however, the number of offices is small, possibly to avoid overlaps among competences. For example, one internal rule requires every affiliate to state the names of the individuals holding the three main offices (the *copiata*) in his *locale* (*capobastone*, *crimine* and *contabile*) whenever he presents himself to members of other groups.

3 Methodology

Attendance at mafia meetings has been largely unexplored in the literature. This chapter focuses on the relation between meeting attendance and hierarchy in the ‘Ndrangheta, exploring whether network positioning can predict who the leaders of the mafia are. The objective is important for a number of reasons. First, the identification of the bosses of a criminal organization is one of the main goals of both scholars and law enforcement agencies [31, 38]. Second, a number of sources report that the ‘Ndrangheta replicates its complex internal organization also outside its region of origin [40, 57, 61, 62, 69]. The results of this study may be of help in analyzing the structure of the ‘Ndrangheta in other areas.

As argued in the next sub-sections, the case study conducted in this chapter is especially helpful for the objective of the analysis: it concerns the presence of the ‘Ndrangheta in Lombardy, a Northern Italian region far from Calabria. Further, the specific focus of the investigation reported was to provide reliable information about the internal hierarchy, independently from the patterns of participation at the meetings.

3.1 Case Study

This study focused on one large judicial case, Operation *Infinito*, named after one of the new ranks in the ‘Ndrangheta discovered during the investigation. The case concerned the establishment of several ‘Ndrangheta *locali* in the area around Milan, the capital city of the Lombardy region, Italy’s second largest city and economic

⁶ The evolution of the rank of *santa* clearly illustrates the impact of internal competition on the formal hierarchy. The rank defines what is called *La Santa*, an inner circle of affiliates created during the 1970s. Initially, the *santa* was the highest rank in the ‘Ndrangheta, accessible to no more than thirty-three individuals. A *santista* could enter into contact with freemasonry, politics and entrepreneurs and even betray lower affiliates if this was in the organization’s higher interest. Nevertheless, in subsequent years, new and higher ranks emerged, and today the *santa* is only the first rank of the higher society [40].

capital. The data sources included a number of judicial documents, from law enforcement agency reports, through pretrial detention orders, to first and second grade judgments.

The history of *Infinito* dates back to 2006 and the launching of several criminal investigations of the 'Ndrangheta in Lombardy. These were subsequently joined and concluded in 2010 by the Antimafia Prosecutor's Office of Milan and the Carabinieri (a national law enforcement agency). On 13 July 2010, the authorities arrested more than 160 individuals. At the time of writing, the trials are still ongoing.⁷

The main concern of *Infinito* was the evolution of a special 'Ndrangheta structure called *la Lombardia* (Lombardy in Italian) and of the person charged with its management, the *Mastro generale della Lombardia* (general master of Lombardy). Although information about the functioning of this body is still unclear, it seems that *la Lombardia* was a sort of coordination chamber among the *locali* based in Lombardy, but also with a role in relations between these and the main *locali* in Calabria. At the beginning of the investigation, N161 was the leader of *la Lombardia*.⁸ However, he showed excessive autonomy from the powerful Calabrian *locali* by pressing for greater independence for the Northern groups in the management of criminal activities and the award of ranks and offices. As a reaction, the *locali* from Calabria ordered his murder, which took place on 15 July 2008, in a bar in San Vittore Olona, a town about 30 km from Milan. After N161's murder, the dominant Calabrian families decided to suspend the office of *Mastro generale della Lombardia* and appointed a temporary manager, N099. Eventually, after machinations concerning occupancy of the vacant office, N157 was appointed as *Mastro generale* on 31 October 2009.

One of the salient characteristics of Operation *Infinito* is that the main charge is the offence of mafia-type association (Article 416-bis of the Italian Criminal Code). This offence criminalizes participation in any association, whatever its origin, which uses the so-called mafia method.⁹ The key elements of the mafia method are: (a) the intimidatory power deriving from the strength of the associative bond, (b) the condition of subjection and (c) of *omertà* or silence, which are both consequences of the mentioned power. Due to this specific criminal charge,

⁷ The Court of Milan issued two first-grade judgments on 11 November 2011 and 6 December 2012, convicting most of the suspects. On 23 April 2013 the Court of Appeal of Milan confirmed the convictions of the first judgment. Further appeals and the third-grade trials at the Cassation Court of Rome will follow in the next months.

⁸ The study coded each individual in the court order as N001, N002, etc. to prevent identification.

⁹ Article 416-bis para 3 of the Italian Criminal Code: "The association is of a mafia-type when the participants use the power of intimidation, which arises from the association, and the system of subordination and *omertà* (code of silence) that arises from it, to commit crimes, or to obtain—directly or indirectly—control over economic activities, public procurement or concession contracts, or to obtain unfair profits for themselves or for other people, or for the purpose of impeding or jeopardizing the free exercise of the right to vote or to gain votes for themselves or others upon elections".

Infinito sought to demonstrate the stable presence of a mafia-type association in the area around Milan. The account of the struggle for the office of *Mastro generale della Lombardia* and reconstruction of the hierarchy of the *locali* in the area were crucial in proving the existence of a mafia-type association. Consequently, most of the investigative activities, from background checks to wiretaps and surveillance, focused on describing the organizational structure of the 'Ndrangheta, with a particular concern to chart the hierarchy of *la Lombardia* and the different *locali* present in the region.¹⁰

The most important source for this study was the pretrial detention order issued by the preliminary investigation judge (*Giudice per le indagini preliminari*, henceforth GIP) of Milan upon request by the prosecution [70]. This is a judicial document with the function of restricting the suspects' freedom, and in particular of remanding some of them in custody or pretrial detention. In Italy, detention orders are issued towards the end of criminal investigations, when the prosecution has gathered sufficient evidence to request the remand in custody or other pretrial restrictions against the suspects.¹¹ From a comparative perspective, these court orders are broadly similar to arrest warrants in other jurisdictions. The Italian law requires the judge to motivate his/her decision. For this reason, the documents provide a wealth of information for the analysis of criminal groups and their criminal activities. They report personal details of the suspects (e.g. name, birth date, residence, citizenship) and of the crimes (for every crime, e.g. extortion, they record the date, the place, the participants and the *modi operandi*). They also provide details on the structure of the organization, the roles played by each member, and the evolution of the group during the investigation. Furthermore, the documents report excerpts from telephone conversations intercepted during the investigation and detailed information about meetings among the suspects observed or reconstructed by the investigators.

The court order of Operation *Infinito* consisted in more than 700 pages providing abundant information for the analysis of the organizational structure of the 'Ndrangheta in Lombardy. The wealth of information and the focus of the investigation made *Infinito* useful for analyzing the relation between the hierarchy and individuals' positions within a meeting network. The use of judicial documents as secondary sources for the analysis of criminal organizations is common. Indeed, in recent years an increasing number of studies have used similar sources to study criminal organizations and mafias, applying network analysis, content analysis and other quantitative methods [15–23, 25, 27–34, 71–73].

¹⁰ The investigation also uncovered a number of other crimes, ranging from extortion to usury, from corruption to the infiltration of public procurement.

¹¹ In the Italian criminal justice system, criminal investigations actually finish sometime after the arrest of the most dangerous suspects, once the prosecution has wrapped up the evidence and formulated the indictment (*richiesta di rinvio a giudizio*).

3.2 Data Gathering

3.2.1 The Meeting Network

The court order of Operation *Infinito* provided information on a large number of meetings among members of the criminal network. Some of these meetings occurred in houses, private premises (e.g. warehouses) or cars, others in public places (e.g. bars, restaurants or public parks).

The study analyzed and coded each meeting mentioned in the court order.¹² In total, the document provided information on 308 individuals participating in 574 of such meetings. The number of participants per meeting varied considerably, with a minimum of 2 and a maximum of 25 identified individuals. In most cases, the law enforcement agencies were able to identify all or most of the participants in any meeting.

Given the specific focus of the investigation, most of the meetings reported in the court order were true ‘Ndrangheta meetings. These had the purpose of discussing criminal activities or matters relating to the life of the various *locali* (e.g. affiliations, attribution of ranks and offices) or of the structure *Lombardia* (including the vicissitudes of N161, his murder, the suspension of the office, and the appointment of N157 as the new *Mastro generale della Lombardia*). For example, on 31 October 2009, the law enforcement managed to film a ‘Ndrangheta meeting in Paderno Dugnano, a town approximately 10 km from the center of Milan. The meeting took place in a social club for elderly people dedicated to the names of Giovanni Falcone and Paolo Borsellino, two judges killed by Cosa Nostra in 1992. The purpose of the meeting was to appoint N157 as the new *Mastro generale*. Twenty-three men sat at a horseshoe-shaped table, having dinner and conversing. The temporary manager N099 gave a speech and proposed N157. Thereafter, all the bosses of the *locali* approved the candidate, whose appointment was celebrated with a toast.

In general, the vast majority of the participants were ‘made members’ of the ‘Ndrangheta, further proof of the mafia-related nature of the meetings. In some cases, however, the authorities were unable to verify the actual affiliation of some individuals owing to a lack of information. These men may have been actually affiliated with the organization or associates not yet admitted into the ‘Ndrangheta, or external individuals who might participate or otherwise in the criminal activities of the mafia. Moreover, the law enforcement classified some individuals as not affiliated to the organization. Also in these cases, the persons concerned may have had personal (e.g. family, friendship) or business (either legal or illegal) connections with the ‘Ndrangheta.

The analysis was conducted on meetings with at least four participants. The selection was designed to focus on the most important interactions among the

¹² The study coded each meeting as E001, E002, etc., recording the meeting’s time, place and participants.

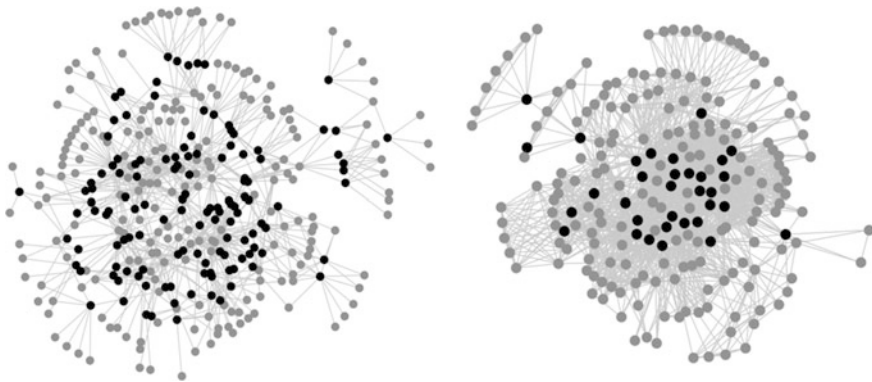


Fig. 1 The infinito 1-mode and 2-mode networks. (In the *left* graph, *black* nodes are meetings, *grey* nodes are participants. In the *right* graph, *black* nodes are the bosses, *grey* nodes are other individuals)

members of the ‘Ndrangheta, with removal from the sample of the smallest meetings. Indeed, the objective of the study was to verify if and how attendance at mafia meetings could reveal the ‘Ndrangheta’s internal hierarchy. The inclusion of the smallest mafia meetings might have biased the sample towards those individuals more intensely controlled by law enforcement, e.g. because their cars were wiretapped. This kind of selection is frequent in studies taking a social network approach to criminal groups [15, 18, 22].

The sample of selected meetings comprised a total of 215 individuals participating in 129 meetings. Interestingly, while the sample included only 22 % of the total 574 recorded meetings, it also comprised nearly 70 % of the total participants. The number of participants per meeting ranged from four to 25 identified individuals. The majority of meetings had four ($n = 47$), five ($n = 19$) or six ($n = 22$) participants, while 41 meetings had seven or more. Of the 215 individuals in the sample, 99 attended only one meeting, 29 two meetings, 65 3–10 meetings and 22 more than 10 and up to a maximum of 38 meetings (Table 1).

Participants and meetings were entered into a two-mode, affiliation matrix (left graph in Fig. 1). From this, a one-mode, valued and undirected adjacency matrix was computed (right graph in Fig. 1), recording each individual’s co-participation in meetings with any other individual in the network. The affiliation matrix enabled the calculation of a number of social network measures (all based on a binary matrix, except for valued degree centrality). All network analysis operations were performed using the Ucinet 6 [74].

Compared to previous social network analysis studies, mostly focused on telephone communication flows, the analysis of coparticipation in meetings has different implications. Telephone conversations usually occur between two subjects, and only exceptionally among more than two. Moreover, telephone conversations imply a direct exchange of information between the participants. By contrast, meetings generally involve several people, in this case at least four due to

Table 1 Meetings per number of participants and individuals per meetings attended

Participants per meeting	No of meetings	Meetings attended	No of individuals
4	47	1	99
5	19	2	29
6	22	3–10	65
7+	41	11+	22
Total participants	129	Total meetings	215

the sample selection. Coparticipation in a meeting does not necessarily imply a direct exchange of information among all those present. Rather, in the context of a hierarchical criminal organization such as the ‘Ndrangheta, meeting attendance may relate to the status of each subject, implying that each member has a position granting him access to other affiliates and, in some cases, to the bosses of the organization.

Given the lack of previous literature on meeting attendance networks, the analysis adopted an exploratory approach and calculated the centrality measures most frequently used in the literature. These include degree (calculated on both binary and valued matrix), betweenness and closeness centrality, three classic measures of centrality developed by Freeman and frequently used in the literature on criminal networks [38, 75, 76].¹³ Other measures are eigenvector centrality (calculated on the binary matrix), an adaptation of degree taking into account the degree of a node’s contacts (i.e. neighborhood) [38, 77] and the clustering coefficient, a measure of the level of interconnection among a node’s neighborhood [38, 78, 79].¹⁴ Table 2 summarizes the minimum, maximum, mean, and standard deviation for each variable.

3.2.2 The Hierarchy

Given the focus of the investigation on proving the existence and the organizational structure of the ‘Ndrangheta in Lombardy, law enforcement dedicated particular attention to the identification of the bosses.

The investigation identified the individuals who led the coordination chamber *la Lombardia*, with the office of *Mastro generale della Lombardia*. The first in office during the observed period was N161, followed by N099 as a temporary manager, until the appointment of N099.

¹³ Closeness was measured so that the most central nodes had the highest scores.
¹⁴ The clustering coefficient is strongly influenced by the size of a node’s neighborhood. With a high number of direct contacts, it is less likely that they will be densely connected. For this reason, the clustering coefficient is always presented along with the number of pairs (i.e. the number of possible combinations among a node’s direct contacts).

Table 2 Descriptive statistics of the variables

	Min	Max	Mean	St.dev.
Leader	0.0	1.0	0.2	0.4
Meetings attended	1.0	38.0	4.0	5.0
Degree (normalised)	1.4	38.8	8.8	7.5
Valued degree	3.0	221.0	31.1	38.4
Betweenness (normalised)	0.0	15.2	0.7	2.0
Closeness (normalised)	24.0	59.0	39.8	6.8
Eigenvector (normalised)	0.0	32.0	6.6	7.1
Clustering coefficient	0.3	1.0	0.8	0.2
Number of pairs	3.0	3,403.0	294.3	520.8
Mafia charge	0.0	1.0	0.5	0.5

The law enforcement also carefully charted the hierarchy of each *locale*. The court order report gave detailed information on 17 *locali* in Lombardy and the membership of each of them. The investigation identified the heads (*capolocale* or *capobastone*) of each *locale* and, in the majority of cases, also the other main officers (*caposocietà*, *contabile*, *crimine*). The law enforcement and the prosecution based their assessment of the offices in each *locale* on different sources. These included evidence from previous investigations and trials, but also and more frequently wiretaps of conversations and meetings among members of the 'Ndrangheta. The offices within each *locale* were frequently discussed by the wiretapped suspects, also due to the particular period of tension which followed the murder of N161 and the competition for appointment as new *Mastro generale della Lombardia*.

In Operation *Infinito*, identification of the 'Ndrangheta bosses was based on direct evidence concerning the mafia's internal hierarchy. Two grades of trial further confirmed the evidence on the organization's internal hierarchy in Lombardy. For these reasons, the assessment of the hierarchical positions within each *locale* is not based on individuals' activities and appears to be the most reliable depiction of the organization's formal hierarchy. In other studies, reconstruction of the internal hierarchy has relied on the evaluations of the law enforcement agency or the court, or on individual tasks or roles in criminal activities, or on content analysis of the conversations [15, 17, 18, 31, 38, 79]. By contrast, in this study the independence between identification of the bosses by law enforcement and their positioning within the network of the meetings offers an interesting opportunity to explore how social network measures may contribute to the identification of mafia bosses.

The analysis coded each individual's office within the 'Ndrangheta. It created a dichotomous variable assessing whether each subject held one of the main offices (either head of the *locali* or the other main offices) in *la Lombardia* or within the *locali* of the 'Ndrangheta in Lombardy or not. As a result, among the 215 individuals in the sample of meetings, 33 had a leadership office and 182 were simple members of the 'Ndrangheta ($n = 135$), unidentified ($n = 43$) or not formally affiliated ($n = 4$).

3.3 Statistical Analysis

The statistical analysis consisted of two steps.

The first step involved preliminary bivariate analyses to discover possible network patterns specific to ‘Ndrangheta bosses. It compared the means of the network variables across the groups of the bosses and the other individuals and the Pearson’s correlation coefficient among the variables. Given the non-normal distribution of network measures, the comparison between the mean scores of bosses and other individuals used the Mann–Whitney U test, a non-parametric test which allows comparison of the mean values of non-normal variables across two independent samples.

The second step was to conduct a logistic regression model to verify whether network measures were able to identify a criminal leader in the *Infinito* network. The dependent dichotomous variable was the hierarchy (with leader = 1 and other = 0). As already mentioned, the law enforcement agencies carefully identified the criminal leaders by various means, including previous investigations and judicial cases and wiretaps of conversations minutely describing the offices within each *locale* in Lombardy and the overall structure of the *Lombardia*. This assessment was independent from the observation of meeting attendance. No individual was classified as a leader due to attendance at a specific meeting, since the court would have dismissed any such argument for lack of evidence.

Independent variables were individual network measures and two controls (Table 2). The first was the number of meetings attended for each individual. To control for a possible prosecution bias, a dummy was included (mafia charge) in order to assess whether each node was charged with the offence of mafia-type association (data extracted from the court order). Given the exploratory nature of the analysis, the model used a stepwise selection method.

3.4 Limitations

Studies based on judicial sources are inevitably biased by the strategies of law enforcement. In fact, the special focus of Operation *Infinito* provides a valuable opportunity to analyze the formal hierarchy of the ‘Ndrangheta and its relation with meeting attendance. As discussed above, various elements suggest that the classification of the offices was particularly accurate and, more importantly, independent from the observation of the meetings.

The judicial investigations may have partially covered the criminal group and this may have affected the reliability of the network measures. Even in a large operation like *Infinito*, the authorities identified only a limited number of members for a few *locali*. This problem is common to most network studies on criminal organizations, and it requires particular care in handling the data. Nevertheless, there are reasons to believe that this has not affected the results of this study. Some studies have found that criminal network measures are strong even if randomly

tested for missing data [38, 80]. Furthermore, *Infinito* was a long and thorough investigation specifically aimed at identifying the most important individuals in the ‘Ndrangheta in Lombardy, and the first- and second-grade judgments confirmed the charges brought against the suspects. The risk that possible missed or excluded individuals may have radically changed the structure of the network is relatively low. Indeed, Berlusconi tested the robustness of degree and betweenness centrality across different phases of the judicial process (wiretap records, arrest warrants, and judgments) and argued that “arrest warrants and judgments seem to be reliable data sources to identify key players regardless of whether a large proportion of peripheral nodes is missing” [32].

4 Results and Discussion

The bivariate analysis of the hierarchy and individual network measures highlighted a common pattern. The small set of ‘Ndrangheta bosses participated in the meetings more frequently (Table 3).

On average, the bosses of the ‘Ndrangheta participated in meetings approximately 4.5 times more than other individuals (11.7 vs. 2.6 respectively). Other network measures generally replicate this relation, although to a different extent. The measure with the least difference was closeness centrality (ratio of 1.3 times), while the most remarkable disparity was in betweenness centrality, where bosses had a 14.7 times higher mean.

These results reveal a specific pattern in the meeting network. Bosses obviously take part in a higher number of gatherings. This comes as no surprise, since their role requires them to be present at events important for the organization. Also network measures show more intense participation by the leaders. The measures of direct connectivity (degree, valued degree and eigenvector centrality) are strongly correlated (all coefficients above 0.85, Table 4). There is not much difference between the total number of a node’s coparticipants in meetings (degree) and the number of coparticipations (valued degree) or the centrality of the coparticipants (eigenvector). In fact, the ratio between the mean scores of degree and eigenvector centrality is lower than the ratio between meetings attended. This indicates that the two measures are less able to capture the bosses’ behavior in the network than the simple observation of the number of meetings. Indeed, the more meetings that one individual attends in a given group, the less likely it is that he will meet new people. Valued degree centrality (i.e. the number of a node’s coparticipations) has the same ratio as the participation in meetings. Also this figure is rather intuitive, since as the number of meetings attended increases, so will the total number of encounters with any other subject (correlation coefficient of 0.94, Table 4). Bosses have less clustered neighborhoods than other nodes (0.5 vs. 0.9 respectively), suggesting that they may play a connecting function. However, this may be due to the sheer difference of the sizes in the neighborhoods of the two groups (an average of 1,081 pairs for bosses and 151 for others), since the clustering

Table 3 Mean number of meetings and centrality measures by hierarchy

	Bosses	Others	Ratio bosses/others
Meetings attended	11.7	2.6	4.5
Degree (normalised)	20.0	6.7	3.0
Valued degree	90.7	20.3	4.5
Betweenness (normalised)	3.5	0.2	14.7
Closeness (normalised)	48.1	38.3	1.3
Eigenvector (normalised)	16.2	4.8	3.4
Clustering coefficient	0.5	0.9	0.6
Number of pairs	1081.5	151.6	7.1

The differences of the means are statistically significant at $p < 0.001$ (Mann–Whitney U test)

Table 4 Pearson’s correlation coefficients among the main variables

	Variable	1	2	3	4	5	6	7	8
1	Meetings attended	–	0.822	0.940	0.789	0.688	0.681	–0.742	0.862
2	Degree (normalised)		–	0.940	0.635	0.869	0.946	–0.725	0.940
3	Valued degree			–	0.699	0.789	0.854	–0.710	0.951
4	Betweenness (normalised)				–	0.522	0.480	–0.624	0.714
5	Closeness (normalised)					–	0.866	–0.658	0.754
6	Eigenvector (normalised)						–	–0.570	0.863
7	Clustering coefficient							–	–0.642
8	Number of pairs								–

All correlations are statistically significant at $p < 0.01$ level

coefficient generally decreases as the number of pairs increases (the higher the number of possible dyads among a node’s contacts, the less dense its neighborhood is likely to be).

The scores of betweenness centrality are the most interesting. They show a remarkable difference between the two groups, which is not immediately attributable to participation in more meetings. Rather, the distance in the scores of betweenness may be a signal that the bosses participated in the network with the purpose of pursuing a particularly strategy in their meeting attendance.

The logistic regression model successfully predicted the hierarchical position for 92.6 % of individuals (66.7 % for bosses and 97.3 % for others). The Hosmer–Lemeshow test for goodness of fit indicated that the model fitted the data acceptably (X^2 15.343, $p < 0.53$, df 8).¹⁵ Nagelkerke’s R^2 of 0.641 revealed a good capacity of the predictors to identify the leaders.

¹⁵ The Hosmer and Lemeshow’s (H-L) goodness of fit test divides subjects into deciles based on predicted probabilities, and then computes a X^2 from observed and expected frequencies. Differently from the standard X^2 test, the null hypothesis for the H-L test is that the two distributions are equal. Non-significant results accept the null hypothesis and suggest that the model correctly fits the data, since the predicted and observed frequency are statistically similar.

Table 5 Results of the logistic regression (dependent variable: bosses/others)

Predictor	B	SE	p	Odds ratio	95 % CI	
Valued degree	0.036	0.009	0.000	1.037	1.018	1.056
Betweenness (normalised)	0.942	0.280	0.001	2.565	1.482	4.439
Constant	-4.261	0.544	0.000	0.014		

The stepwise selection retained only valued degree and betweenness as independent variables (Table 5). Betweenness centrality had an odds ratio of 2.565 (95 % confidence interval 1.482–4.439) with $p < 0.001$, indicating that a higher value of this measure increases the probability of identifying a leader (approximately +150 % per unit increase of betweenness, keeping the variable valued degree constant). Valued degree also had a positive influence on the leadership (OR 1.037, 95 % CI 1.018–1.056, equal to an increased probability of being a boss of approximately +4 % per unit of valued degree, irrespective of the value of betweenness).

The results demonstrate that the analysis of meetings within an organized crime group can successfully identify the ranks of the participants. In particular, betweenness centrality is the measure which best captures the leadership positions within the network. In this case, betweenness measures the capacity of bosses to meet individuals who do not meet each other on other occasions. This is consistent with the specific role that individuals with important offices within the ‘Ndrangheta may fulfill. The mafia leaders are responsible for important decisions about the activities of their *locale*, or the organization as a whole, and for a number of formal or “ceremonial” activities, including attendance at special events. For example, ‘Ndrangheta bosses may participate in high-level meetings reserved for leaders, or they may visit other *locali* as a sign of respect. The inclusion of valued degree centrality in the model is more intuitive. Bosses tend to meet other participants more frequently. Valued degree is strongly correlated with other direct connectivity variables (number of meetings attended, binary degree centrality, and the number of pairs). This is a natural consequence of the fact that, in the network, the ‘Ndrangheta leaders participated in more meetings.¹⁶

The important role of betweenness is partially in line with the existing literature on criminal networks. Betweenness centrality reflects a brokering role within a criminal network, i.e. the capacity to bring people, resources and information together. Brokering skills are extremely important for a successful criminal career in a number of illegal markets and activities [38, 81, 82]. While brokering is frequently an element crucial for success, it does not necessarily mirror status leadership within a criminal group. In larger and more structured criminal groups, like mafias, the internal organization may have several layers. Some evidence of such a differentiation is provided by a study on two ‘Ndrangheta-related networks

¹⁶ Test logistic regressions including betweenness centrality and the other direct connectivity measures yielded results very similar to those of the model presented above.

involved in drug trafficking. In the two networks, high betweenness centrality was associated with individuals directly coordinating drug smuggling operations. These nodes were not the bosses of the two groups, but middle-status traffickers actively involved in the operational management of the drug trade. The criminal leaders (identified through content analysis of the communications intercepted) remained distant from everyday activities to reduce the risks of detection and arrest [31].

The difference between the results of the two drug trafficking networks related to the 'Ndrangheta and Operation *Infinito* may be due to the types of crimes and network. When engaging in criminal markets, mafias adapt to market rules, adopting more flexible organizational structures [39]. The formal organization usually plays a marginal role, and management of the traffic is delegated to middle-status members, who may see this as a career opportunity within the group. These characteristics of the traffic also emerge in the network of communications among the criminals [31]. *Infinito* focused on the establishment of the 'Ndrangheta in the area around Milan, and demonstrating the organization's structure was the main objective of the prosecution. The meetings reported in the court order rarely addressed drug trafficking issues, but rather internal organizational matters. Most of the other offences were extortion, corruption and loansharking, crimes associated with a stable and structured criminal organization [27, 83]. The difference between drug trafficking and operations associated with a mafia's organizational management may explain why, in the latter, betweenness centrality better identifies the bosses. The meeting network mirrors the "institutional" life of a branch of the 'Ndrangheta, where hierarchy (ranks and offices) is an important issue, object of frequent discussions and occasional disputes. Mafia bosses cannot delegate to other middle-level players some of the most important tasks relating to the organization's internal functioning, and this includes attending certain meetings. For this reason, the meetings in *Infinito* may reflect the fundamental tasks of the bosses more closely than do studies analyzing telephone communications and drug trafficking.

To return to the problem of research, i.e. that most results of network analysis of organized crime are useless for operational purposes, exploration of mafia meetings has some practical implications. The examination of meetings within a mafia may contribute to the identification of potential bosses. The prediction may be useful for selecting the individuals on which to concentrate law enforcement resources, which are frequently limited by definition. It may prompt increased surveillance, background checks, and other actions to verify the prediction. In *Infinito*, the authorities invested a significant amount of (human and financial) resources to: collect preliminary evidence sufficient for judicial authorization to wiretap the suspects; successfully intercept and maintain surveillance on telephone lines and place bugs; gather, listen to and interpret (members of the 'Ndrangheta normally speak Calabrian dialect) thousands of audio recordings. While it is true that these activities were necessary to record some mafia meetings, in some cases it

may be possible to monitor known members, record who they encounter, and build a sort of snowball-like network of meetings. This may eventually provide predictions on the leadership positions within the network.

5 Conclusions

This chapter has demonstrated that the analysis of meeting attendance within a criminal network can provide interesting insights into its internal organization and hierarchy. Particularly, social network analysis measures can predict the rank of the participants and who the bosses of the group are. This approach may have useful practical implications for law enforcement activity, which may analyze meeting attendance under a new light. However, the study is only a first exploration of organized crime meetings, and it is too early to generalize the results. Additional studies should focus on meeting patterns to verify whether the results are confirmed in the case of both mafias and criminal groups of other types.

Research might also focus on how the position within a meeting network may influence the judicial outcome of a case. The literature, mostly based on communication networks, argues that high betweenness may make it possible to maintain control over the criminal activities but also to minimize direct involvement and risks. Some studies have pointed out that high betweenness centrality gives individuals better chances of avoiding detection and arrest [25, 38, 76]. By contrast, in some other cases, betweenness does not effectively protect against law enforcement action, although this may be due to high correlation with direct connectivity measures such as degree centrality [34, 79]. Exploration of the impact of network positioning in meetings might clarify this point from a different perspective. This may be important for two reasons. First, because individuals with high betweenness control criminal activities more indirectly, this condition may protect them against law enforcement action. Second, since brokers are key players in criminal organizations, it is important to verify whether they receive an adequate punishment.

To verify whether network analysis of meetings can have operational implications, it may be necessary to test the capacity of network measures to identify the ranks within a mafia during an investigation. Alternatively, it may be possible to order the meetings chronologically and verify how many weeks and meetings yield significant successful predictions. This may show whether it is possible to make reliable and successful predictions with a relatively limited sample of meetings. If possible, the network analysis of meetings may equip law enforcement agencies with an operational intelligence tool for identification of the bosses of a criminal organization.

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