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Social network analysis applied to illegal wildlife trade between East Africa and Southeast Asia

Jacopo Costa | March 2021
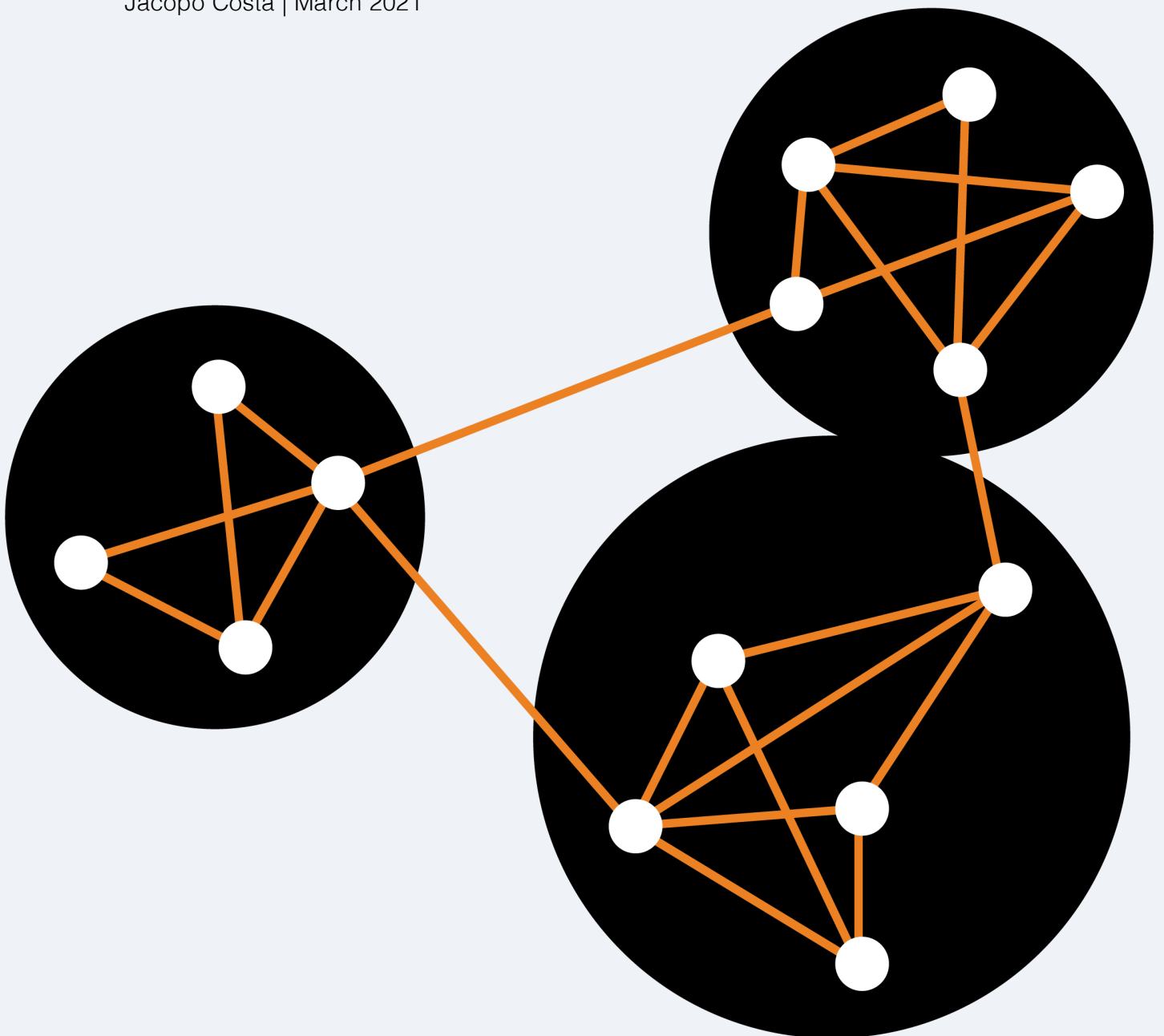
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About this report

This report is part of a multi-disciplinary project focused on intelligence-led action against financial crime in illegal wildlife trade (IWT). Under this project, the Public Governance division of the Basel Institute on Governance is leading research in East Africa that aims to contribute to the prevention and combating of IWT by developing a better understanding of the context-specific drivers of the trafficking and the role of criminal networks in sustaining such illicit strategies. The three main research questions are:

- Why does wildlife trafficking happen?
- How does wildlife trafficking happen?
- What can be done to curb it?

This report empirically answers the second research question and, in doing so, offers several promising avenues to answer the third.

1 Introduction

Illegal wildlife trade (IWT) is the illegal commercialisation of protected species including live animals as well as parts of dead animals, wood and plant products (Avis 2017; Lezhnev and Cakaj 2017; UNODC 2020). This report speaks to the illegal and commercial nature of the trade by contributing to efforts to understand and address the organised and financial crime elements that underpin it.

The research employs social network analysis (SNA) to study the structures, functions and mechanisms of criminal networks engaged in IWT along the East Africa and Southeast Asia supply chain. SNA is a type of analytical lens that focuses on understanding structural, relational and sociometric characteristics of networks, i.e. mapping networks created by social interactions between individuals and groups. Using this analytical and methodological framework, we have investigated IWT through the analysis of the criminal network surrounding a known wildlife trafficker based in East Africa.

The data used for the analysis has been received through law enforcement channels and contains primarily cell phone logs from members of the criminal network. Further triangulation of the data with independent and open-source information gives us a strong degree of confidence that it is indeed valid. At the same time, the analysis does not state that all the people identified through the cell phone data are personally engaged in IWT. For the purposes of the research, we are taking statements in the network's communications at face value. For example, when a node (individual) in the network indicates that a sale or another type of activity has taken place, we assume that is in fact the case. To protect the ongoing criminal investigations in several jurisdictions, we have taken measures to protect the identities and personal information of individuals and companies, extracting trends and typologies only for the purposes of this public report.

The Basel Institute on Governance has a strong interest in finding innovative ways to study and tackle IWT and the associated criminal networks as this (until recently neglected) field involves several of its topical areas of expertise. First, IWT is a high-value business – its profit levels lagging just behind drug, human and weapons trade (Avis 2017; Lezhnev and Cakaj 2017; UNODC 2020) – that enriches criminal organisations while damaging biodiversity, natural resource management, development goals and state security in Africa, Asia, South and Central America (Moreto 2016; Phelps et al. 2016; van Uhm 2018). Second, IWT is enabled by corruption, fragile institutions and weak rule of law. Third, IWT is global: it connects international buyers with goods sourced from faraway countries and is fostered by pervasive and cross-border criminal chains that seem to connect a multitude of local, regional and global actors.

Although there is a great deal of attention to these issues (Haas and Ferreira 2016; Rademeyer 2016; Patel et al. 2015; Latinne et al. 2020) and the prominent role that criminal networks play in enabling IWT is widely acknowledged, to date there have been very few examples where SNA has been applied to the study of wildlife trafficking networks (Baker 2020). The research upon which this report is based contributes in this regard, offering an analysis of the phenomenon of IWT through a network lens.

There are two important points arising from this experimental research that are relevant for policymakers, conservation organisations and law enforcement authorities as well as the academic community.

First, the qualitative and quantitative analysis of this specific case study sheds new light on how IWT happens and the characteristics of the criminal networks that sustain the illegal trade. Second, the research demonstrates the great potential of SNA as a practical tool for deconstructing structures, functions and mechanisms that characterise IWT. As criminal networks engaged in environmental crime become ever more sophisticated and smarter at hiding their illicit activities and their money, we strongly encourage the wider application of SNA in law enforcement investigations aimed at bringing them down.

2 Composition of the ego network

This report is based on the analysis of the personal network (ego network) of a wildlife trafficker (hereafter N1) who was based in country EA1.[1] This chapter explores the structural characteristics of the ego network, such as its geographical spread, the types of actors who are part of it, the various roles these actors play vis-à-vis IWT and their relationship with the main trafficker.

2.1 The ego network

Figure 1 depicts a graphic visualisation of the ego network built around the trafficker N1. This ego network is large in size, comprising 495 nodes. Of those, 286 nodes – equal to

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[1] See Annex A for further information on the research methodology. As explained, the countries are identified in the text through codes that are linked to their regional placement. East African countries are identified as EA#, West African as WA#, Middle Eastern as ME#, South-East Asian as SEA#, North American as NA#, European as EU#, North & Central African as NCA#.

57.7% of the total – have primary (direct) connections to the trafficker. Primary connections are established by the observation of instances of direct communication with N1 by calls, SMS or instant messaging chats. The weight (intensity) of their respective relations with N1 ranges from 1,067 instances of contact with the highly connected node N2, to a large number of nodes with only 5 instances of contact in the dataset. [2]

The remaining nodes in the network, amounting to 210 or 42.3% of the total, have secondary (indirect) connections to the trafficker. These are individuals whose personal information appears in the interactions but for whom instances of direct interactions with N1 were not encountered. The research findings indicate that the division of labour and strategic needs – such as the necessity to cover geographical spaces and operative functions – determine the nodes' geographical placement (Gottschalk 2010).

The quantitative and qualitative analysis of the data suggests that nodes are mainly based in three regions: East Africa, West Africa and Southeast Asia.[3] As we can see in Table 1 and in Figure 2, the biggest part of these nodes – 245 nodes, a percentage of 49.4% – are located in East Africa. In the region, they are mostly placed across five countries (EA1, EA2, EA3, EA4 and EA5) and operating mostly in capitals, large cities and trade hubs.
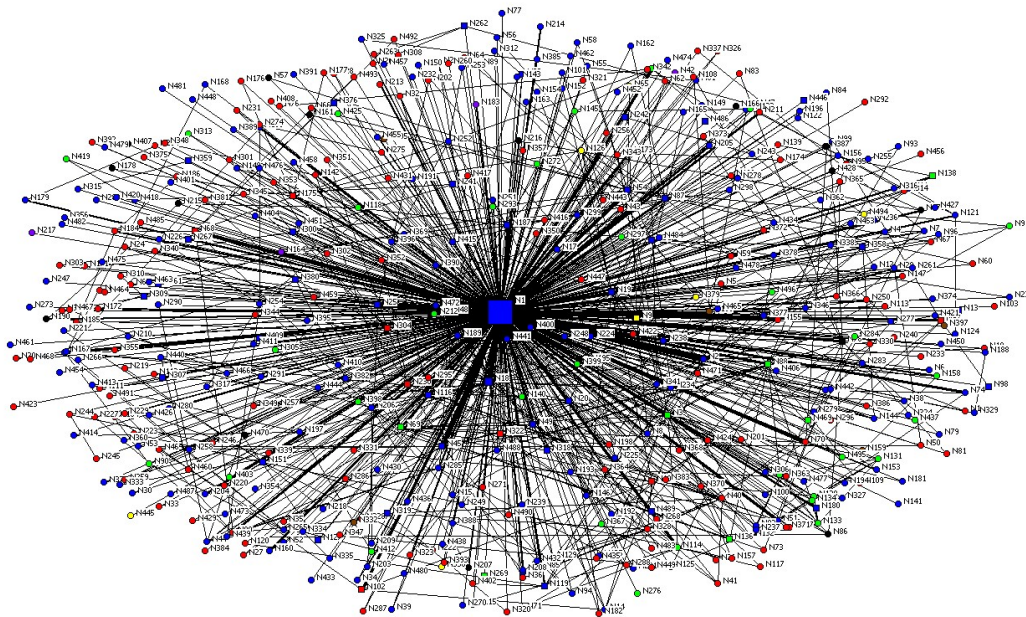
Figure 1: Graphic visualisation of N1's ego network

The next geographic region of relevance to the network is West Africa, where 177 nodes – amounting to 35.7% of the total – operate. These nodes seem to operate in the biggest

cities in five countries (WA1, WA2, WA3, WA4, WA5). Southeast Asia – with 43 nodes – is the third most relevant region – accounting for 8.7% of the nodes – where a large capital city (SEA1) seems to play a particularly relevant role in the global supply chain. North America, with 15 nodes representing 3% of the total, comes next in geographical relevance followed by the Middle East, where 7 nodes or 1.4% of the total were identified in one particular country (ME1).

The large majority of the nodes – 441 or 88.9% of the total – can be tracked back to one single country of operation based on their telephone number area codes and usage of only one number, indicating a more local projection of their activities. The remaining nodes – 55 nodes or 11.1% of the total – use phone numbers of two or more countries, suggesting their roles entail a regional or global dimension.

Regions	N. of nodes (connections)	Percentage of total nodes	Colour / shape
East Africa	245	49.4	Blue
West Africa	177	35.7	Red
Middle East	7	1.4	Yellow
Southeast Asia	43	8.7	Green
North America	15	3.0	Black
Europe	4	0.8	Purple
North & Central Africa	5	1.0	Brown
Total nodes	496	100.0	

Nodes' mobility	N. of nodes	Percentage	
Sedentary nodes	441	88.9	Circle
Nomadic nodes	55	11.1	Square

Table 1: Nodes' operational fields
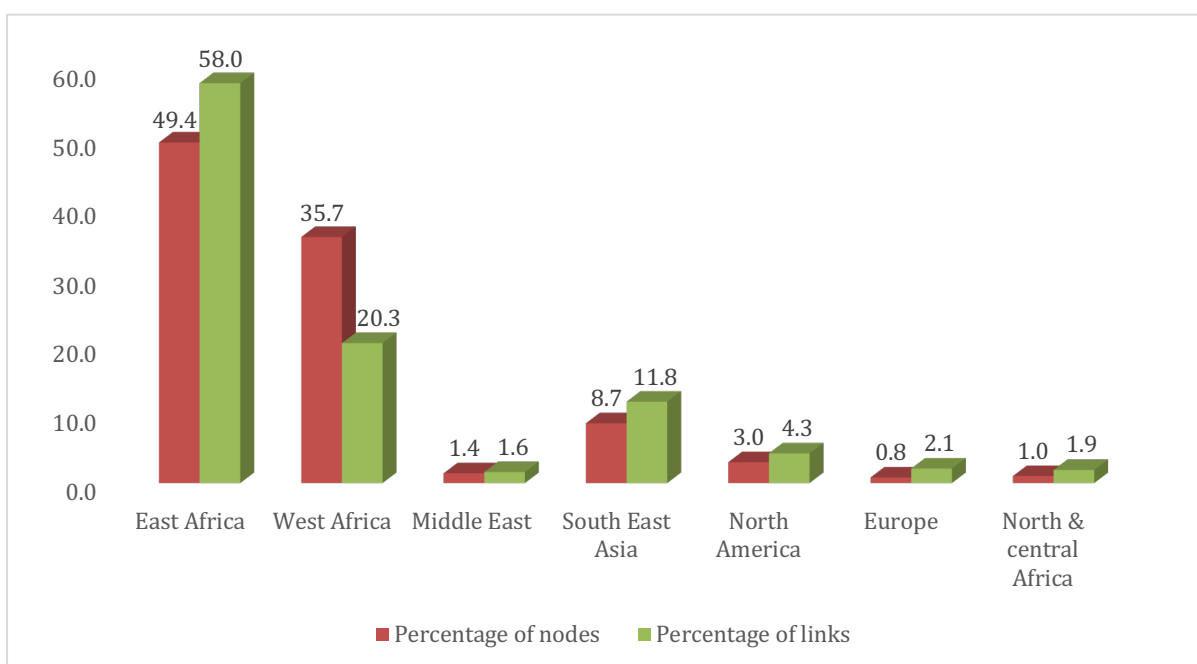
Figure 2: Geographical distribution (percentage on total) of nodes and links

Regions	Number of links (interaction)	Percentage of total links
East Africa	11340	58.0
West Africa	3971	20.3
Middle East	306	1.6
Southeast Asia	2301	11.8
North America	842	4.3
Europe	405	2.1
North & Central Africa	371	1.9

Table 2: N1's links, frequency and percentage

Moving the analytical perspective from the nodes' placement to the links' destinations – i.e. geographical locations with which N1 was communicating – it is possible to better frame the relevance of the different regions. The data presented in Table 2 and in Figure 2 shows that the links of N1 with East Africa represent 58.0 % of the links' total, followed by West Africa with 20.3%, Southeast Asia with 11.8%, and North America with 4.3%. Comparing the results for nodes and links, we can see West Africa attracts a higher

percentage of nodes (connections with N1) but a smaller percentage of links (interactions with N1), while all the other regions attract a higher number of interactions with respect to nodes. This means that the interactions of N1 with network members in East Africa are more intense compared to those connections in West Africa. This is not a surprising result, given that the main operational fields of N1 and his co-offenders are East African countries; logically, the trafficker N1 has massive operative interactions in this region, increasing the communication ratio with the nodes that are placed here. Similar dynamics happen e.g. in Southeast Asia, another region that presents a higher result for links than nodes. These findings suggest the centrality of East Africa and Southeast Asia, which being the exporting and importing terminals of the IWT naturally register the highest levels of interactions with N1. At the same time, the findings compress the role of West Africa in carrying out the IWT operations.

Figure 3 shows the flows of connections that link the regions. Thanks to the analysis of the secondary connections, we can see how – independently of the communications with N1 – nodes in the different regions are connected in a dense web of inter-regional links. Particularly meaningful are those relations between East Africa and West Africa, Southeast Asia and the Middle East, but also those links connecting West Africa with
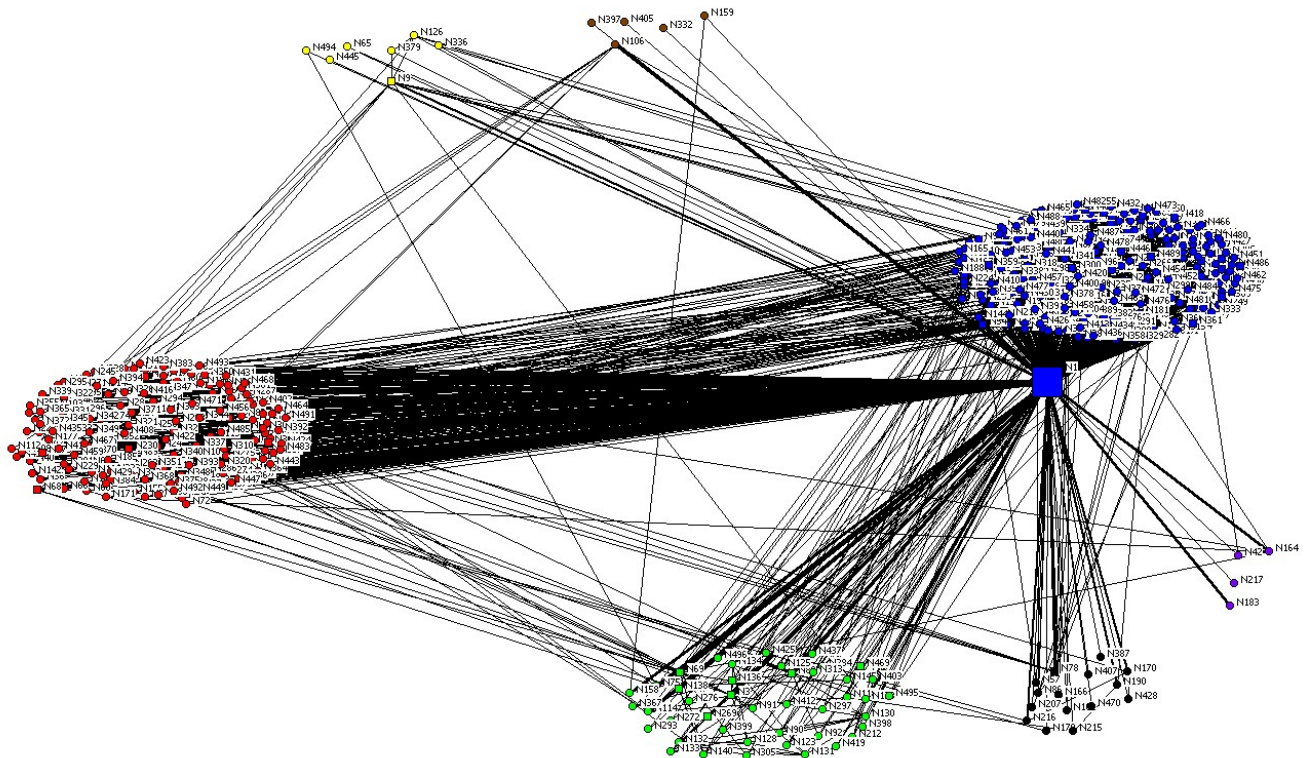
Figure 3: The web of links between regions in the N1's ego network

Southeast Asia and the Middle East. This tells us that the nodes who are part of N1's ego network build and maintain links with each other that are cross-regional in nature.

Figure 4 shows the frequency distribution of the links between N1 and the other nodes. The x-axis shows the number of interactions the different nodes record with N1, while the y-axis shows the frequency of the single links' amounts. For example, the amount of 1,067 links is registered by only one node (N2), while the amount of 5 links is registered by 34 nodes. The links' frequency distribution therefore follows a power law distribution (Barabási 2002; Albert et al. 1999), which means that most nodes have only a few interactions with N1, while only a few nodes – those labelled as hubs (Barabási 2002) – account for a large number of interactions with N1.[4] This suggests that power is not evenly distributed along the network, but is concentrated in a smaller number of relevant nodes – i.e. the hubs – who concentrate a disproportionate number of connections and interactions vis-à-vis other network members.
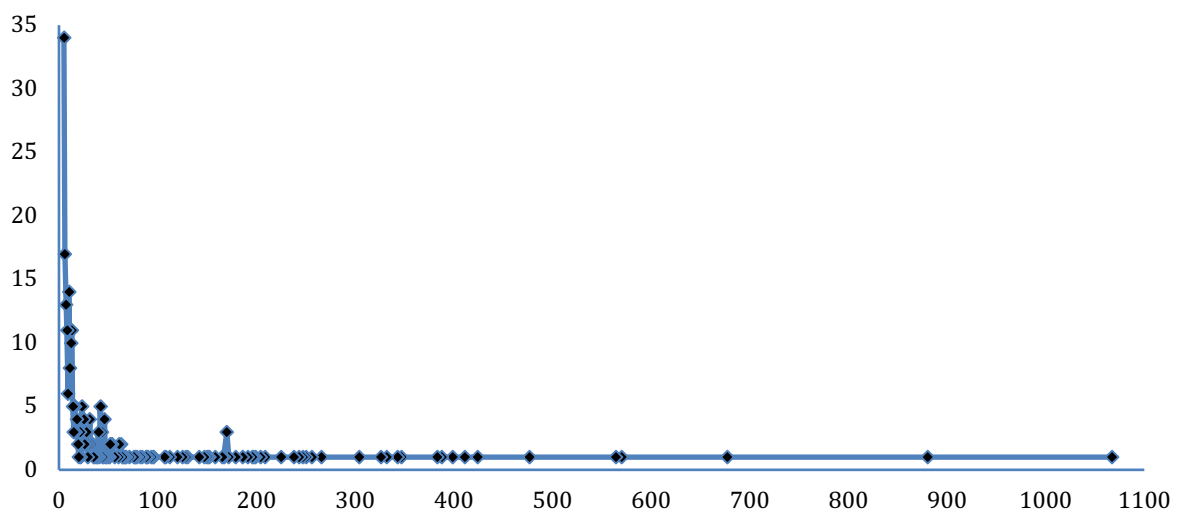
Figure 4: Frequency distribution of the links with N1

2.2 The nodes of the ego network

This section describes who are the nodes who operate in closer proximity to N1 and their roles in fostering the IWT business. Table 3 lists these nodes, as well as their categories and roles. This analysis is based both on SNA, that permits to study the proximity and placement of these nodes in respect to N1, and network ethnography, that permits to study the content of their interactions with N1. These findings have been triangulated,

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[4] This also confirms this network is a free-scale network based on preferential attachment, hub's hierarchies and "rich-get-richer" dynamics (Barabási 2002; Albert et al. 1999).

where feasible, with information extracted from other sources, such as newspaper articles and intelligence reports.

N1 is surrounded firstly by a **criminal firm** comprised of several nodes who come mainly from West African countries (WA3 and WA1) but are based in East Africa, particularly in EA1, EA2 and EA3. This criminal firm illegally operates to conduct IWT. The members of this criminal firm have a key role in organising the illicit business in the East African region and can be divided into two categories. The first consists of N1's **relatives**, who play a meaningful role in the illicit trade. Two of these – N2 and N8 – operate in EA2, where they coordinate with Asian buyers and other actors placed in the country. Another relative (N54) connects N1's network to other East African crime rings based in EA3 and involved in IWT in a regional and global dimension.

The second category of nodes that are part of N1's criminal firm are traffickers who are not relatives of N1 and who we have labelled as **co-offenders**. Examples of such co-offenders are N18 and N206, who have formal positions in a trading company owned by N1, N19 who operates closely with N1 on financial transactions with other nodes based in West African countries, and N48 who operates in EA2 with a large set of tasks, such as financial flows and the procurement and delivery of wildlife goods. The individuals in this criminal firm – both relatives and co-offenders – manage the key tasks related to the IWT: the procurement, packaging, concealment, delivery and shipment of illicit goods, as well as the associated financial flows. Some of these nodes manage N1's business, organisational and logistical tasks when he is travelling in other countries or regions. This group comprises a core crime ring similar to a family enterprise mixing relatives and allied traffickers (Hobbs 2001); the label of criminal firm perfectly describes this mechanism.

A second type of actors comprises **other traffickers and criminal firms**. For example, the case study highlights the role of some nodes from West Africa (WA4 and WA3) who are based in EA1, such as N20, N82 and N300. As parallel structures with respect to N1's criminal firm, these nodes and their crime groups play a role in managing IWT between East Africa and Southeast Asia. These traffickers belong to other criminal firms but they coordinate with N1 to manage the supply of illicit wildlife goods, connecting people and managing goods and financial flows. All these nodes and their criminal firms are part of the broader IWT horizontal market that is in place in the East African region. In these horizontal markets, illicit goods are traded amongst these crime rings before being sold to the Asian trafficking groups. Rather than competitors, these nodes represent allies of sorts to N1 and his network, sharing business activities and illicit strategies amongst themselves. N1 is also surrounded by East and Central African medium-scale traffickers, who try to supply wildlife goods. This is the case for example of N106, who operates in NCA1 as a broker between West Africa and East Africa, supplying information about available illicit wildlife goods to N1.

Type of node	Nodes	IWT role
Criminal firm members		
Relatives	N2, N8, N51, N8, N51, N54, N238	Illicit business management; Organisation & logistic role;
Co-offenders	N18, N19, N48, N119, N189, N206, N224, N242, N285, N322	Financial flows management; Wildlife goods purchasing/selling; Goods delivery & shipment; Goods packaging & concealment;
Other criminal firms	N20, N82, N106, N241, N300, N304, N474	Illicit business management; Financial flows management; Wildlife goods purchasing/selling:
Globetrotters	N3, N45, N75, N88, N114, N138, N173, N187, N269	Illicit business management; Organisational & logistic role; Financial flows management; Goods delivery & shipment; Goods packaging & concealment;
Southeast Asia buyers	N49, N69, N136, N140, N367, N489	Illicit business management; Organisational & logistic role; Financial flows management;

		Wildlife goods purchasing/selling: Goods delivery & shipment;
Professionals		
Financial operators	N4, N44, N146, N291, N362, N388, N439, N440	Financial flows management; Goods delivery & shipment;
Delivery operators	N15, N121, N265, N277	
Global operators	N9, N126, N379, N445 (Middle East); N78, N170, N190 N215, N216, N375, N376, N387, N428, N470 (North America); N42, N164, N183, N217 (Europe);	Financial flows management; Wildlife goods purchasing/selling:
West African representatives	N68, N73, N80, N102, N105, N111, N142, N157, N175, N184, N311, N320	Financial flows management; Goods delivery & shipment; Goods packaging & concealment;

Table 3: Types of node surrounding N1 and their role in IWT

The third category gathers several nodes coming from West Africa who operate between West Africa, East Africa and Southeast Asia. The findings of the empirical research indicate the area where these nodes are highly active is Southeast Asia, in countries such as SEA1 and SEA2. These nodes are the **globetrotters** of the IWT. It is among these nodes that we find a high percentage of those using more than one international dialling code and who frequently travel between two or more regions. The capital city of SEA1 seems to represent a geographical space where these nodes settle when they spend a certain period of time in the region. N1 himself often travelled to this city, to meet with these Asia-

based African co-offenders. These globetrotters appear to play a role in coordinating and managing IWT financial flows, shipments and logistics between the regions. Given their geographical placement, these nodes acquire stable relations with the delegates of the Asian groups, who are their operative counterparts in Asia. Some of the evidence analysed seems to suggest these nodes are responsible for handling informal financial balancing systems that regulate the money flows between East Africa and Southeast Asia, preventing money from moving around unnecessarily and covering the tracks of the payments. Further analysis on this point would be important. As far as we understand, these nodes can be accompanied in their illicit actions by families and relatives.

A fourth category of nodes refers to **Asian buyers**. At the helm are traffickers N49 and N69, who have a leadership position. These individuals may be operatives belonging to the Asian syndicates that are based in Southeast Asian countries or may simply represent the links connecting the African and the Asian criminal organisations (brokers); the empirical findings do not permit to make firm conclusions in this regard. However, the findings suggest that these Asian buyers undertake different tasks, such as networking, building and nourishing social capital and relational structures with traffickers and crime rings based in East Africa. They are also involved in the procurement of goods, arrangement of shipment logistics and management of financial flows. In this case study, the activities of these Asian buyers are concentrated in EA1 and EA2 – where they build and maintain relations with N1 and his criminal firm – as well as with the West African globetrotters living in Southeast Asia, e.g. N3 and N88.

Another category refers those nodes who could be labelled **professionals** as they bring specific skills and know-how to the network. They are involved in specific operations and tasks, for instance playing a role in assisting with particular shipments and deliveries, or in the execution of financial transactions and the management of financial flows. As considered in the literature (Bouchard and Morselli 2014; Baker and Faulkner 1993; Galeotti 2001; Ruggiero 1997), this type of outsourcing mechanism characterises illicit trade and business. The largest part of these nodes is placed in the East African region.

For the shipment operations, this category includes clearing agents and freight forwarders, which in turn are connected to other professionals who work within the airline companies or cargo departments. Concerning the financial flows, it is possible to find accountants and employees of financial institutions. These nodes operate to transfer the money along the global financial network, sustaining the operative connections between two distant regions such as East Africa and Southeast Asia. These professionals are co-opted by the crime enterprise to recruit skills and know-how that are not available amongst members of the network and to bring into the fore individuals who have decision-making authority or have access to the resources and infrastructures necessary to facilitate the transactions and flows that the criminal IWT network requires. These co-opted individuals subsequently put their social capital, skills and know-how at the service of the criminal

enterprise; they operate in close proximity with N1 and his criminal firm, supporting them in managing financial and shipment issues.

Several other nodes – coming from West African countries – are based in other regions, such as the Middle East, North America and Europe. We can define these as **global level operators**. Countries like ME1 and ME2 represent both financial and commercial hubs. This mix between financial and trading centrality makes the role of this region in IWT very difficult to interpret. On the one hand, these countries represent an important space for moving illicit goods. There is evidence that Middle East ports and airports are often used as fictitious destinations; goods are initially marked to be delivered to these countries but, at a certain point while en route, the documents, the certificates and the final destination are changed (EIA 2017). There is also evidence that the Middle East is used as a transfer point, where goods and containers can be moved from one means of transport to another.

On the other hand, given the role of the Middle East countries as financial centres, money could be laundered, kept in financial institutions and reinvested in real estate or other businesses. In this vein, it is meaningful to underline the role of the West African node N9, who – for the length of time covered by this research – operated exclusively using the ME1 international dialling code, suggesting a permanent placement in the region. This node is placed at the core of a dense web of financial flows coming from East Africa and Southeast Asia. The financial transactions particularly come from nodes who seem to play a role in carrying out IWT along the East Africa and Southeast Asia axis. Given that we have no definitive findings, we can conservatively underline that, in this case study, the Middle East seems to be at the core of a financial web apparently related to IWT, as well as relational dynamics involving some of the most important nodes of this network.

Regarding the global level operators, other considerations are necessary for those individuals who operate in North America and Europe. The findings suggest that specific provinces and states attract consistent migratory flows from West African communities, NA1 and NA2. This is not surprising if we consider how the migratory chain works, as explained by the seminal work of Tilly (2005). The role of migration and diaspora mechanisms is evident when considering the case of N1's relatives N78 and N170. Similar mechanisms appear to be at play in European countries, where migratory flows from West Africa have connected – at least since 2010/2011 – countries of origin with various final destinations in Europe. The nodes living in these continents could be opportunistically used as bridgeheads to open new markets in countries that could represent relevant markets, both because of a high-income level and because of large Asian communities who can potentially be buyers of wildlife goods. Indications of this come from the interactions of N217, who is based in EU1, with N1 about a potential Asian customer in the country, and – reacting to this input – N1 sends back clear information on wildlife goods.

Finally, there are several nodes that are placed in West African countries, such as WA1, WA2, WA3, WA4 and WA5. As has been noticed, the largest proportion of the traffickers

operating between East Africa, Southeast Asia and the Middle East are from West African countries. Not surprisingly, these nodes maintain important relations with their communities of origin, as well as with their relatives and wider family groups. Some of these nodes and their community members may make economic requests directed to satisfy basic needs as food, house rent, school or medical fees (Kassa et al. 2019). Others seem to play a role in IWT, particularly when based in WA5, WA3 WA2 and WA4. For example, some of them receive information on traded illicit goods and key traffickers; others seem to be at the core of meaningful financial flows; others could be involved in goods delivery and shipment. For example, N230 seems to operate as a re-sender of money around different contacts based in the West African region, while N175 seems to play a role in the trade, given that he uses his company to supposedly deliver food products from WA1 to the East African region. As far as we understand, these kinds of activities could easily conceal the delivery of illicit wildlife goods, given that food products – such as soy beans, tea leaves, cereals, moringa powder – are often used to conceal illicit goods. It is necessary, however, to highlight that these assumptions are based on weak empirical evidence, therefore further research is needed to better investigate the role of the nodes located in West Africa in the trafficking network.

2.3 Assessing structure and nodes of the trafficking network

This chapter has analysed the structural characteristics of the ego network, such as its geographical spread and node typologies associated with proximity with N1.

The empirical findings show that the structures of the network are complex and chaotic when deconstructed in their basic units. Multiple local spaces and geographical contexts punctuate the transnational supply chain; a multiplicity of actors with different characteristics and goals operate worldwide; opaque trafficking clusters manage the illicit trade. Considered in their singularity, all these elements appear to be chaotic, complex, disorganised, i.e. indistinguishable and meaningless in the frame of IWT.

The network perspective permits to identify – beyond this amalgam of chaos and disorder – the scheme of order (Stewart 2019; Homer-Dixon 2002; Landa 2000; Byrne 1998). The accumulation and stratification in time and space of these factors (places and members) allow repeated patterns to emerge. Progressively, the chaotic perspective (micro level) gives way to the dynamics of order and regularity (macro level).

The focus on the collective dimension represented by the network perspective permits to see that, geographically, East Africa and Southeast Asia are the main terminals of the trade of wildlife goods. The majority of N1's connections are located in capitals or trading hubs, with very few connections to peripheral spaces. This points to the fact that N1 ran a high-level criminal network that operates in a regional and global rather than local dimension. In parallel, these findings underline that the network is rather disconnected from those local spaces and actors who operate in peripheral towns and provinces. This

gap indirectly confirms the compartmentalisation and separation between clusters placed in different points of the local-global supply chain.

In terms of ethnography, bonds of ethnic links, family relations, kinship and regional origin play a role in enabling effective and coordinated illicit activities. The analysis reveals how pervasive is the activity of West Africans in the illicit operations of the global network and wildlife trade, even when the epicentre of the illicit operations is located in East Africa or Southeast Asia. West Africans constitute the majority of the members of the different trafficking groups that operate in East Africa. It is also mainly West Africans who are based in Southeast Asia to ensure the running of the business. The geographical placement of all these nodes is determined by their role in the IWT chain. In this framework, Southeast Asians also play an important role in carrying out and managing IWT.

The cooperation between the different nodes and rings satisfies the conditions for a transnational criminal organisation, i.e. two or more individuals who co-offend in two or more countries to achieve illegal goals and profit (Albanese, 2012). The findings show the criminal organisations of West Africans in East Africa already have the characteristics of transnational organised crime with respect to actors, markets and suppliers. Confirming the findings of Hobbs (2001), this criminal organisation recalls a family enterprise mixing relatives and allied traffickers, and is able to operate between different countries within East Africa (EA1, EA3, EA4, EA5 and EA2). The systematic connections this crime ring has established with the Southeast Asian co-offenders expand the projection of the transnational criminal organisation along the East Africa – Southeast Asia axis.

The attributes of these trafficking organisations suggest that the criminal operations are based on fluid and flexible structures, able to trade at the regional and global dimensions thanks to the cooperation of relatives, co-offenders and professionals (Hobbs 2001; Bouchard and Morselli 2014). These criminal firms operate both in horizontal (regional dimension) and vertical (global dimension) markets to purchase or supply illicit wildlife goods.

The findings confirms how this transnational criminal organisation exploits a dense web of communication and transportation connections (Sabatino 2016; Albanese and Reichel 2014; Passas 2003). The illicit goods are delivered by a multiplicity of countries, and are received in an equally large number of countries. The data analysed for this study concretely identifies as exit gates EA1, EA2, EA3, EA5, NCA2 and NCA3. It identifies SEA3, SEA1, SEA4, SEA2 and SEA5 as potential entry gates in Southeast Asia.

Despite the criminal nature of the activities in which they are engaged, the relationships between the Asian actors and their African counterparts are based on a considerable amount of trust. Significant quantities of money – amounting to hundreds of thousands of dollars – are transferred from Southeast Asia to East Africa to finance the acquisition, stockpiling and delivery of illicit wildlife goods. Indeed, high-value illicit goods are sent from one continent to the other with the buyers having limited capacity to control the

content of the shipment. Of course, all of these high-value transactions take place without a legally enforceable contractual framework, and notably even the seizure of the goods does not seem to negatively affect these trust-based relationships. The repetition over time and the rate of success of the illicit business can help to explain the resilience of these relationships.

In this framework, trust and proximity are not the only enforcing mechanisms the traffickers use to control the others' activities. Marginal empirical findings show how the threat to break down the criminal agreement between two nodes is used as a monitoring mechanism, as well as the threat of physical violence.

3 Functions for IWT

As we have seen in the previous section, the structural analysis of the network on the basis of geographical operations already sheds light on the various functions handled by the nodes. This section looks in more detail at the different functions that are carried out by individuals on behalf of the network and in support of the trafficking business.

3.1 Functions and nodes of the ego network

A literature review and network ethnography have permitted to identify five functions that are needed to support the operations of IWT in this case study. The five categories are: networking, money, delivery & shipment, business & goods, and concealment. These broad categories encompass the different activities that are implemented by the different nodes to achieve the overarching goals of the trafficking network. Table 4 lists these functions, a brief definition for each of them and the types of segments we used to identify and elaborate them.

Functions	Definition	Type of segments
Networking	Function related to the exchange, transfer and dissemination of personal contacts and information about other nodes between those involved in direct interactions.	a. telephone numbers, emails and names of individuals and enterprises; b. request for information on third parties; c. information on personal documents or business cards;

		d. pictures or videos circulated to identify individuals.
Money	Function related to the movement of money and financial flows along a dense web established by nodes and clusters placed in different countries and regions all over the world, realised through both formal and informal channels to satisfy IWT-related financial issues as well as kinship and community requests.	a. request to transfer money between traffickers; b. request to transfer money between relatives and friends; c. information on financial transactions and transfers; d. operative input regarding financial flows; e. small talk about money and transactions;
Delivery & shipment	Function related to activities necessary for the successful transport and delivery of goods from one place to the other such as route organisation, document preparation and goods loading and transportation.	a. information on senders and receivers of illicit goods; b. information on characteristics of delivered goods; c. information on the logistic of shipment; e. information on timing or delay in the goods delivery; f. information on transportation tools
Business and goods	Function related to the core activities of the criminal business, such as the procurement of wildlife goods, the match between supply and demand, and the protection of the illicit business from the activities of law enforcement and judicial powers.	a. information on illicit wildlife goods; c. interactions on agreement and supply-demand matching; d. interactions on arrests, trials, seizures or goods' disappearance; e. information on supply channels and procurement procedures.
Concealment	Function related to the modes and strategies that are used by traffickers and crime rings to conceal and hide the illicit wildlife	a. interactions on methods and strategies to conceal goods;

goods for transportation and delivery.	b. information on products to conceal illicit wildlife goods; c. information on efforts to acquire goods for concealment; c. information on boxes, tanks and bags used to conceal goods.

Table 4: Functions, brief definition and types of segments

The first insight underlines the relevance of the **networking** function (Jancsics 2015; Morselli 2003). Networking sustains – through the exchange of personal information and contacts – the capacity of the criminal network to enlarge its borders and membership. This is hugely relevant because it is associated with the trafficker's ability to manage the network in two crucial respects: co-optation and coordination. Networking is akin to the concept of co-optation as developed by Baez Camargo and Ledeneva (2017), which is a key management function of informal networks regulating recruitment into the network. As such, it represents one of the most important activities shaping network evolution. Networking allows traffickers and their crime rings placed along the East Africa and Southeast Asia axis to weave a dense web of connections with several other countries and clusters. The individuals who are involved in these networking activities – i.e. nodes whose personal information is exchanged within the network – clearly have specific traits. For example, they are "friends of friends" or trusted individuals who are already known, or that have been recommended by someone who is trusted.

The process of attracting new nodes into the network gives the traffickers the ability to react swiftly to fluid and even unforeseen circumstances and to create a pool of collaborators with particular skillsets and social capital that can be activated as needed. Networking activities therefore also allow N1 and his ring to coordinate the activities of co-offenders, traffickers and suppliers, indicating which nodes and clusters should be involved in any particular time in different aspects of the illicit business. In this vein, networking helps the criminal network to recruit a broad range of individuals, chosen because of their respective attributes, whether these be valuable skillsets, having the authority to protect and enable IWT activities vis-à-vis law enforcement, or possessing certain networks of their own in a particular sector or geographical region to name a few. A critical point is that the pool of individuals recruited into the network is not necessarily all active at once; some individuals' roles may lay dormant until they are needed and are activated for particular purposes.

From the perspective of the traffickers, networking can be considered an investment for the future. Thus, investing time and resources in the networking function is critical for the IWT network as instrumental and strategic recruitments allow it to react swiftly and adapt

to changes in contexts and external factors, as well as in response to damage inflicted by law enforcement agents and judicial investigations. It is telling that of the 46 nodes considered for this specific analysis,[5] only one is not involved in any networking mechanism. High networking frequency nodes are listed in Table 5.

Node description	Node #	N. "networking" segments
Relative of N1 part of the criminal firm	N54	69
Co-offender part of the criminal firm	N18	62
Relative of N1 part of the criminal firm	N2	47
Globetrotter	N3	36
Globetrotter	N45	26
Globetrotter	N88	25
Co-offender part of the criminal firm	N119	25
Globetrotter	N87	24

Table 5: Prevalence of interactions (segments) in the networking function

High networking frequency is displayed by members of the N1 criminal firm who operate to sustain the IWT and coordinate the activities of nodes and rings in East Africa and Southeast Asia. Other nodes with high networking frequency are the West African globetrotters who operate between East Africa and Southeast Asia. To pursue their illicit goals, they build relational basins with nodes and clusters that operate in different geographical regions. The effectiveness of the actions of these globetrotters – and consequentially the value they have for the most powerful node – is linked to their capacity to command other nodes and operate between the regions of the network. As we will explain in the next paragraph, this mechanism transforms the nodes endowed with high networking capacity in the so-called second-level hubs, who play a fundamental operative role in the conduct of IWT.

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[5] As explained in Annex A, this part of the analysis has focused on 46 nodes, i.e. those characterised by a large number of intelligible interactions with a relevant role for the finalisation of IWT.

A second set of activities is connected to the function **money**. The activities related to this function are for the most part cross-cutting with respect to the other functions, and concern all the regions where the network is active. In fact, financial activities sustain all the stages of IWT. Financial flows are necessary to pay for the procurement of the goods and their stockpiling in safe warehouses, their shipment, transportation and concealment, as well as the activities of professionals and co-offenders. At the same time, financial flows have another meaning when directed to relatives and kinship cliques. In this case, monetary resources serve to sustain communities and kinship groups that surround N1 and his ring (Kassa et al. 2019). The data confirms the requests for help coming from the kinship groups that surround N1 aimed at meeting basic needs such as food, school or medical fees, but also certificates and documents, travel and business investments.

Node description	Node#	N. "money" segments
Asian buyer	N49	87
N1's relative in NA2	N78	73
Globetrotter	N88	73
Relative of N1 part of the criminal firm	N8	44
Relative of N1 part of the criminal firm	N238	26
Globetrotter	N87	24
Co-offender part of the criminal firm	N189	23
Co-offender part of the criminal firm	N18	22
Relative of N1 part of the criminal firm	N54	22
Middle East based node	N9	19
Relative of N1 part of the criminal firm	N2	18

Table 6: Prevalence of interactions (segments) in the money function

Licit and illicit business transactions create a dense web of financial activities between East Africa, the Middle East, Southeast Asia and North America. The nodes with the largest number of segments in this category are listed in Table 6. Observing how the function "money" interacts with the other functions, we can identify two modes. The first is represented by those nodes who are exclusively involved in managing financial flows, such as N8 (East Africa), N9 (Middle East), N78 (North America) and N87 (East Africa,

but operating also in North America). These nodes play an important role in moving money between different regions. We can add to this list nodes with a similar profile such as N140, a financial expert working for the Asian buyers, and N146 and N388, who are two accountants based in EA1. We can label these nodes "financial operators" who are used by the traffickers to move financial flows, concealing their origins and sources. Other nodes mix "money" activities and other tasks, such as "delivery & shipment" and "business & goods", reflecting the fact that all these crime operations involve a financial side. Members of N1's criminal firm, West African globetrotters and Asian buyers present this combination between different core functions for IWT.

The function **delivery & shipment** gathers activities related to the transport and delivery of goods from one point to the other. These are key activities supporting the success of the illicit trade, as they involve organising and executing the logistical and operational plans underpinning the safe movement of the wildlife goods between the regions. As confirmed by empirical results, the activities linked to this function are concentrated in East Africa and Southeast Asia, where the traffickers rely on effective transportation and delivery infrastructures.

Node description	Node #	N. "delivery & shipment" segments
Asian buyer	N49	53
Delivery operators	N277	31
Co-offender part of the criminal firm	N189	24
Relative of N1 part of the criminal firm	N54	22
Co-offender part of the criminal firm	N18	21
Asian buyer	N69	19
Globetrotter	N75	18
Globetrotter	N3	14

Table 7: Prevalence of interactions (segments) in the delivery & shipment function

The evidence suggests that this function is concentrated on a small number of nodes, which are listed in Table 7. Some are dedicated exclusively to the "delivery & shipment" function, as is the case of N277, who operates in East Africa between EA1 and EA3 and is involved in managing deliveries. The activities associated with this node illustrate how specialised individuals in the IWT network need to develop their own networks in order to

successfully deliver what is needed of them. Thus, N277 has connections to clearing agents, logistics companies, drivers and public officials, each of which plays a role in ensuring the wildlife goods can be safely and swiftly transported.

Node description	Node #	N. "business & goods" segments
Asian buyer	N49	88
Relative of N1 part of the criminal firm	N2	64
Co-offender part of the criminal firm	N18	55
Globetrotter	N187	44
Europe-based node	N217	41
Co-offender	N224	39
Asian buyer	N69	36
Co-offender	N242	26
Contact in EA5	N312	22
Contact in NCA1	N106	10

Table 8: Prevalence of interactions (segments) in the business & goods function

The **business and goods** function represents the operative core of the crime business. It involves the procurement of the wildlife goods on illicit markets, matching supply and demand at the regional and global level, and the protection of the illicit business from the activities of law enforcement and judicial powers. The regions interested by these activities are East Africa, Southeast Asia, North and Central Africa, and – surprisingly – Europe. The most important nodes involved in this function are listed in Table 8.

The analysis of the data underscores the relevance of the business connections established between N1 and the Asian buyers who operate between East Africa and Southeast Asia. At the same time, the business relations between these two regions are facilitated by the West African globetrotters that coordinate operations between Southeast Asia and East Africa. The findings also show the involvement of the members of the N1's criminal firm who operate in EA1, EA2 and EA3, who play a key role in acquiring, stockpiling and preparing the illicit wildlife goods that are thereafter shipped towards Southeast Asia.

Node N217, who operates from EU1, also appears to play a role in this category as evidenced by communications with N1 about wildlife goods, as well as about the opportunity to connect with a potential Asian buyer. Reacting to this input, N1 sends him clear information on wildlife goods. As far as we understand, N217 operates as a "salesman", trying to opportunistically establish new commercial links in Europe, a region that could be interesting given its high income and the presence of large Asian communities. A similar role of "salesman" is performed by N106, who operates from NCA1 connecting East and West Africa. This node sends N1 concrete information on rhino horns and ivory tusks, making clear these goods are in WA4. Thus, while N217's activities aim to open business opportunities in new geographical regions, N106 shares information on possible new supply chains and procurement mechanisms at a regional dimension, in particular regarding a route that goes from West Africa to East Africa via Central Africa.

Node description	Node #	N. "concealment" segments
Globetrotter	N114	7
Globetrotter	N88	6
Co-offender part of the criminal firm	N48	6
Asian buyer	N49	5

Table 9: Prevalence of interactions (segments) in the concealment function

Other meaningful insights involve N224 and N242, who discuss with N1 judicial issues related to the risk of being sentenced by courts, as well as about related financial issues, such as paying the lawyers and the resources needed to informally grease the wheels of justice. The conversations of these nodes with N1 confirm the leader of the trafficking ring is ready to financially assist if any of his co-offenders are arrested and at risk of being jailed.

The last function is labelled **concealment** and refers to the modalities that have been used by traffickers to conceal the illicit wildlife goods during transportation and delivery. Clearly, this is another fundamental task to carry out IWT and protect the wildlife goods from detection. Table 9 summarises the number of interactions between N1 and other nodes in this category. The number of interactions in this category is small, as is the number of nodes involved in interactions with N1 on this issue. The findings indicate this function is mainly managed by one of the criminal firm co-offenders, two West African globetrotter nodes and an Asian buyer. All of these nodes also play a fundamental role in the procurement of wildlife goods and in national and transnational delivery. Logically the "concealment" function is operationalised in coordination with activities directed at organising the illicit business and trade routes. After all, the mechanisms of delivery have

to appear as logical and rational, i.e. there must be a requirement and demand for the goods used for concealment in the country, often in the same manufacturing or logistical district where the receiver of the shipment is based.

3.2 Networking, co-optation and coordination

As discussed above, the function "networking" is fundamental for the evolution and resilience of the network in its ability to organise and successfully undertake the illicit trade. Networking activities contribute to the network's dynamism, increase connectivity among nodes, create clustering effects and improve coordination mechanisms within the trafficking network. Co-optation and coordination seem to be particularly relevant: these activities help to attract new nodes in the network, but also to coordinate tasks and functions between nodes and clusters. The second-level hubs, who promote these networking activities and control the sub-networks, basically contribute to carrying out these functions, i.e. in expanding the network's borders and in coordinating the activation of different clusters and nodes.

Networking activities are based on sharing personal contacts and information about the other nodes. These sharing mechanisms bring out the relational basins that surround the second-level hubs, i.e. those nodes who are surrounded by wide and relevant sub-networks. Important to mention is that N1 relies on these second-level hubs to achieve his criminal goals. It is therefore evident that these nodes are functional for the conduct of the illicit business. They control specific portions of the network and geographical spaces, handle operative functions, and help to coordinate tasks, activities and strategies for the finalisation of the illicit trade. The sub-networks that surround these second-level hubs inevitably mirror their geographical and functional background.
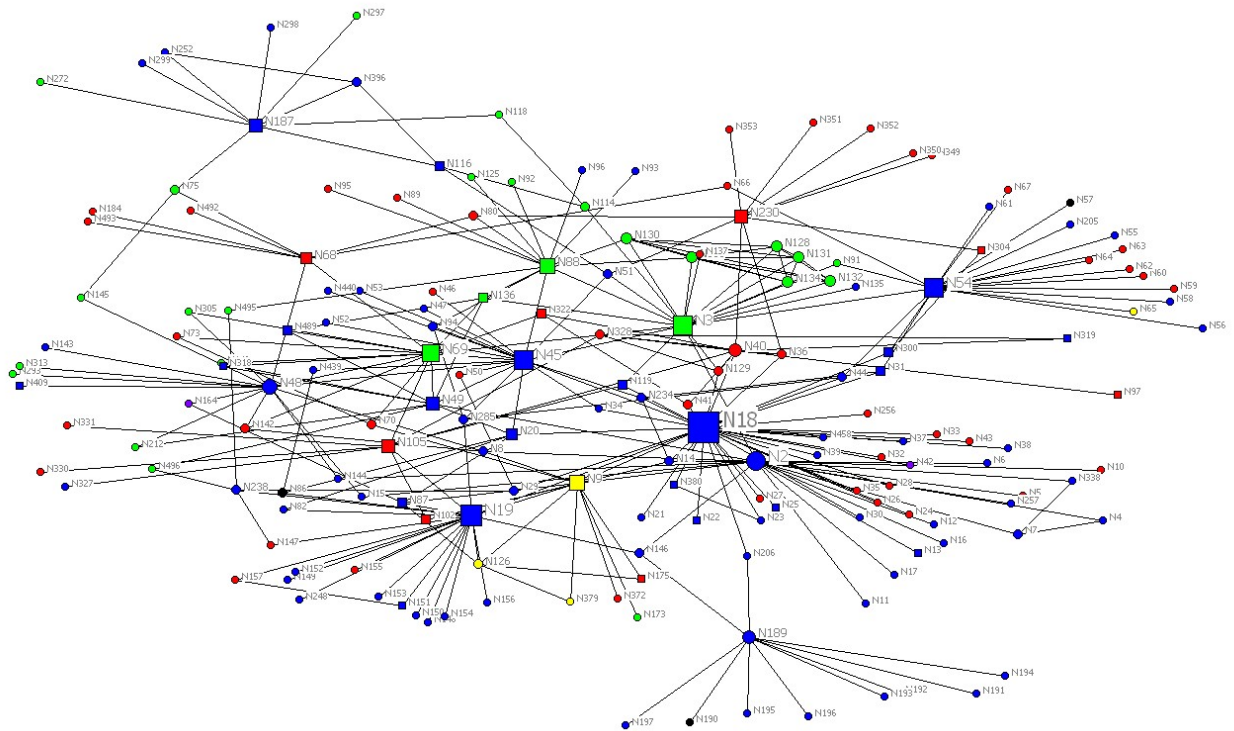
Figure 5: Crime network and link's collectors

Figure 5 shows the appearance of the network when mapping the relational clusters surrounding the second-level hubs. To build this graphic visualisation we have transformed the network into a dichotomic structure (0/1) and eliminated N1 and his links. There are two reasons to hide N1. First, this has permitted to free the graphical visualisation from the background noise related to the presence of N1 that reduces the explicative power, therefore revealing who are the nodes capable of attracting the largest amount of contacts. Second, if we apply the key players analysis (Borgatti 2006) to our network to understand how much it would be damaged if we eliminate N1, we see that the fragmentation level is 58.1%. This result is not high considering we are studying an ego network. This means that even if the main trafficker is taken out – for example because he is arrested – the network will not completely collapse. Even if we eliminate the core of this relational structure, all these sub-networks built around the secondary hubs could still have the capacity to evolve and grow. They can survive and adapt, transforming, increasing or merging their structures around new leaders or organisations (Palla et al. 2007). After all, these nodes own social capital and operative know-how, resources and infrastructures to autonomously promote the illicit trade between East Africa and Southeast Asia.

The members of N1's criminal firm are surrounded by relevant sub-clusters that permit them to systematically connect geographical spaces and relational clusters (Stovel and Shaw 2012; Jancsics 2015). These members of the criminal firm are based in EA1 (N18, N19 N189), in EA3 (N54) and in EA2 (N2, N48). To manage the tasks of the illicit business,

they attract a large set of secondary relations within the regions where they perform their functions. These nodes coordinate the activities of co-offenders, traffickers and professionals in East Africa, participate in the organisation of financial flows and deliveries towards Southeast Asia and the Middle East, as well as cultivate relations with their families and kinship communities in West Africa. For example, the co-offender N18 – who is the most connected second-level hub and the connector of these different sub-networks – presents important connections with N1's key criminal firm members (such as N19) and other nodes in EA1, EA3, EA2 and EA5. Other links exist towards West Africa (WA2, WA3, WA6 and WA5) and the Middle East. N2 builds the largest part of his relations in EA2, where he operates. This person seems to be predominantly involved in the management of financial flows and wildlife goods procurement around the region. His sub-network includes individuals who are involved with financial flows in East Africa and the Middle East. N2 also connects individuals involved in delivering the illicit goods in East Africa, as well as with the West African globetrotters and Southeast Asian buyers operating between East Africa and Southeast Asia.

The Asian buyers N49 and N69 also operate as second-level hubs collecting social capital and information necessary to purchase illicit wildlife goods and to transport them to Southeast Asia without being discovered. To achieve these results, they operate together with other Asian nodes of their inner circle, e.g. the money man N140. Both N49 and N69 are connected to the receivers of the illicit wildlife goods in the Southeast Asian countries. Other links connect these two nodes to East Africa, and overall to the West African globetrotters who operate between the two regions to coordinate the illicit business, e.g. N3, N45 and N88. Interestingly, N69 shows links towards WA3, WA5 and WA4. Information regarding N69 is spread around West Africa by N1, who sends the node's personal information to other spaces in the network. Given the role of N69 for the IWT, the fact that N1 shares this personal information with other nodes in West Africa reveals the interest of these nodes in the illicit business.

Several West African nodes operate between East Africa and Southeast Asia, mediating and coordinating the business relations between N1's and N69's inner circles. These are the individuals we have previously labelled globetrotters. Four of these nodes (N3, N45, N88 and N187) operate as second-level hubs. They take care of financial flows, demand-supply matching, delivery of goods and logistics. These nodes coordinate the activities of the actors who sit along the supply chain, creating an equilibrium between different interests, needs and goals. It is not surprising these nodes have extremely strong relations with East Africa and Southeast Asia, as well as with West Africa and the kinship communities where they come from. The three nodes N3, N45 and N88 create a small cluster; likely, other West African nodes who operate in the region belong to this small group. Particularly, the network ethnography indicates SEA1 and its capital city as their meeting point. These nomadic nodes have important links within East Africa, where they connect the members of N1's criminal firm, both relatives (such as N2 and N54) and co-offenders (such as N18 and N48). At the same time, they connect nodes who surround N1 and are involved in financial flows and goods delivery. In East Africa, they present

connections with other important West African traffickers, such as the members of the other crime rings. Also, these three nodes include in their sub-networks the Asian buyers N49 and N69, their Asian co-offenders and the receivers of the illicit goods in Southeast Asia. Finally, all these globetrotters have links towards West Africa-based nodes. These findings give more indications of their origin and the nature of their kinship communities.

The second-level hub N9 is a quite interesting case. He operates in ME1 at the core of a dense web of financial and relational connections. The cross-border and transnational nature of this connective subset is mirrored by the shape of N9's sub-network, which connects him to East Africa and N1's criminal firm members (e.g. N2 and N18), Southeast Asia and West Africa.

Some of these second-level hubs operate in West Africa. These nodes are surrounded by relational basins that develop in two main directions, i.e. internally within the West Africa region and externally towards East Africa. Important connections link these nodes with others operating in the same region. At the same time, their relational basins involve members of N1's crime ring in East Africa. These second-level hubs could serve several goals in IWT, such as coordinating activities and strategies in West Africa, managing financial flows between East and West Africa, and fostering trade relations between East and West Africa. For example, N40 and N105 seem to establish – together with other nodes – a small cluster operating in WA5 that plays a certain role in supporting the IWT chain towards East Africa. Not surprisingly, these nodes are linked to other West African countries, such as WA3, WA6, WA7 and WA4.

Another meaningful node is the West African N68, who has strong connections within the West African countries, including WA3 and WA2. In parallel, he seems to have a specific interest in the Southeast Asia region, being linked to a globetrotter based in Southeast Asia. He also receives from N1 information about the Asian buyer N69, who leads the operations on the Asian side. As considered above, this point reveals that nodes placed in West Africa are interested in the illicit business connecting East Africa and Southeast Asia. Interesting to mention is that both N68 and N105 receive from N1 the personal information of N69. Finally, the second-level hub N230 follows N1's input, unpacking and re-distributing financial flows and money to different nodes who operate in WA4, WA3, WA2 and WA5. In fact, the largest part of his connections go towards nodes who operate in West Africa, e.g. N40 among several others. Outside this region, the relational basins of this node are quite limited, being reduced to just a couple in the surroundings of N1 in EA1.

3.3 Functions and order

This chapter has analysed the key functions that are handled by the different nodes of the network in support of IWT. When deconstructing the functional element in its basic components related to the micro dimension, we can see it is composed of multiple events and episodes that are apparently disconnected from each other. Just as for the

geographical distribution and membership of the network, its operative functions can be represented as a chaotic, opportunistic and complex amalgam. These events happen in multiple local spaces that punctuate the cross-border supply chain, because of the day-to-day actions of traffickers, professionals or community members. The single purchase or supply of wildlife goods does not necessarily follow an institutionalised pattern. Nor is the cross-border transportation is necessarily organised but rather informal (Titeca, 2018b, 2019). This remains true when considering single transnational and cross-border financial flows or delivery procedures. Trading strategies and behaviours can be spontaneous and opportunistic; repetition and learning-by-doing shape the operative strategies. In other words, previous experiences – basically, what has been positive and negative – influence the adoption of operative strategies.

Once again, the network perspective permits to switch the analytical lens, and look at these episodes in their collective dimension. The accumulation and stratification of these events on the network, i.e. at the macro level, sheds light on the common patterns of order and regularity which are hidden within the chaotic multitude characterising the micro level. This permits to identify specific but interrelated operative functions, which are captured under the categories listed above, i.e. money, networking, business & goods, shipment & delivery, and concealment.

The function "money" is particularly meaningful, concerning all the regions where the trafficking network operates. It can have a double aim. The money activities cut across all stages of the illicit trade, from the goods procurement until delivery. In parallel, financial flows play a role in sustaining social bonds with community members. This mechanism aims to satisfy the social norm that it is important to share resources within one's network; i.e. with close family and friends (Kassa et al. 2019; Baez-Camargo and Ledeneva 2017; Bayart 2009).

Assessing whether these functions are performed separately or conjointly by particular nodes gives us information on their operative roles. Nodes who handle overlapping functions can be considered as the organisers of the IWT, while those who handle limited functions (e.g. delivery rather than financial flows) can be considered as the nodes who supply professional and technical skills and know-how.

Analysing what is missing adds interesting insights to the understanding of IWT. Given these empirical findings, the lack of activities related to corruption immediately catches the eye. The common narrative in East Africa is that corruption is everywhere but interestingly, the empirical materials refer to corruption only in a marginal manner. This result could be explained with a couple of considerations.

First, the links to corrupt public officials – such as law enforcement agents – are already part of the network and its sub-components, as an important component of the social fabric that compose them (Gupta 1995; Binmore 2011; Haller and Shore 2015). When the traffickers need to activate these corrupt public officials for criminal goals, the reticular

(network) structure – as well as the presence of shared informal rules and social norms – permits their immediate activation through smooth corrupt mechanisms. Given their nature, these corrupt mechanisms can happen without leaving any traces in the empirical materials, making them difficult to detect during the analysis. Second, it could be that the corrupt activities typical of this context are very easy and simplistic, not going very far from its basic shape, i.e. the bribe. The lack of complicated financial transactions or abroad-to-abroad payments, as well as the lack of offshore centres or tax havens, reduce immensely the organisational and logistical efforts needed to carry out the corrupt exchange, as well as the need to coordinate the activities of the different co-offenders. In this way, the corrupt activities could happen under the radar, leaving no tangible signs of their presence.

The findings highlight the basic role played by the networking activities in creating order and regularity from the chaotic and opportunistic amalgam of behaviours and events. The findings show networking activities are cross-cutting tasks, cutting transversally across nodes, regions and other functions. As in the literature (Jancsics 2015; Stovel and Shaw 2012; Morselli and Roy 2008), the networking function is important for the dynamism, growth and evolution of the networks, as well as for its coordination. Together with face-to-face meetings, the networking function represents an instrument to attract and co-opt new links and nodes (Baez Camargo and Koechlin 2018), and to activate those who already belong to the network but are dormant. The exchange of contacts, names and numbers is therefore critical for the network's consolidation, especially when it has a transnational dimension. At the same time, networking plays a role in coordinating the activities between co-offenders, traffickers, crime rings and professionals. In fact, it permits to identify those nodes and clusters that need to be activated during the conduct of the illicit business, giving specific inputs for the operations of co-offenders and sub-clusters.

Networking activities create a dense web of relations that unify nodes across countries, rings and kinship communities. This relational substrate reduces the distance between the actors, the timing, costs and risks of these illicit activities, and finally contribute to increasing the illicit profits (Vannucci 2011; Lambsdorff et al. 2004). Importantly, networking is crucial to integrate the second-level hubs into the trafficking network as these sub-clusters are critical in enabling the overall trafficking operation to react swiftly to challenges, solve problems, achieve operative goals and acquire technical skills. These sub-networks can also survive the collapse of the trafficker's network, e.g. in the case of his arrest, guaranteeing the resilience to adapt to the damage and evolve in new relational structures (Palla et al. 2007).

The shape of the different sub-clusters permits to differentiate between actors who have a regional projection and those who have a global projection. The first typology commands a thick web of contacts in the region where they operate which allows them to play an important role in organising and coordinating licit and illicit activities in support of IWT locally and regionally. They coordinate the operations between different countries

including exchanges in horizontal markets, financial flows, transportation, and shipping, delivery and receiving infrastructures within their regions. Tentatively, these nodes have a role in regionally coordinating the network. The second typology commands relations with nodes, cliques and crime rings placed around the world. Basically, they operate as connectors of the different sub-networks placed in the different regions. These nodes close the empty spaces at the global level (Burt 1992), permitting a smooth operation of the IWT. They operate in multiple regions and countries, acting on the field as implementers of the illicit trade, assisting both sides of the exchange. Tentatively, we can state that these nodes have a role in globally coordinating the activities of the network.

4 Information flows and chronological model

This section studies how different pieces of information move along the ego network (Liu et al. 2012). The aim is to frame these insights in a coherent model that can explain strategies, methods and timing characterising the illicit wildlife route that connects East Africa and Southeast Asia in this case study. Through the tracking of selected segments of information, we can identify who sends what to whom, where senders and receivers are placed, as well as how many nodes receive a specific piece of information.

Mechanisms and routes of information percolation are important because they allow N1 and his crime ring to collect inputs coming from different actors and geographical places. In turn, N1 forwards these inputs within the network, amplifying their operative range, effectiveness and efficiency. Thanks to the percolation of information along the ego network, N1 can allocate tasks and functions to those nodes who can implement them. This mechanism allows N1 to coordinate the flow of information and tasks necessary to carry out, for example, the procurement of wildlife goods, the management of financial flows, the matching of supply and demand, and the logistics of concealment and delivery. Thanks to this movement of information along the network, N1 and his co-offenders coordinate the actors, geographical spaces and operative functions that characterise this illicit trade.

4.1 The percolation of information along the ego network

The trafficker N1 receives the pieces of information from nodes belonging to his ego network and decides who to send this information to. We analysed the route of 123 segments for the category money, 92 segments for networking, 92 segments for delivery & shipment, 19 segments for concealment and 67 segments for business & goods. Figure 6 reproduces the movement of these segments along the network. This is a very simplified graph, showing only the flows between N1 and the other nodes, and not the relations between these nodes. The network resulting from this analysis is reduced in size

compared to the previous one, being formed by 119 nodes, i.e. N1 and another 118 nodes.

A first observation is that N1 sends out more messages than he receives. In fact, N1 presents a higher outdegree (297) than indegree (238).[6] This means he receives a certain number of segments from his contacts, and then he operates like a repeater, spreading them to other nodes. These empirical results show the role N1 plays as controller and decision-maker within the network, personally choosing the activities that have to be accomplished and the nodes that have to be activated.
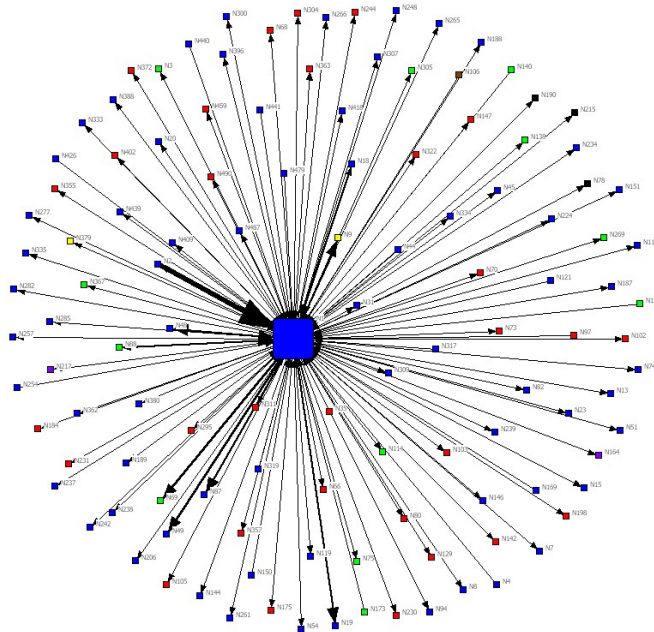
Figure 6: Percolation of information along the ego network

In terms of the context of the information exchanged, the data reveal that N1 plays a key role in mediating communication between the African (supply side) and the Asian (demand side) traffickers. Regarding the "senders" – understood as those nodes who have the highest activity in sending information out to others – the most relevant node is N2, who is a relative of N1 and part of his criminal firm. This outdegree is built above all by sending N1 segments related to illicit wildlife goods. The biggest part of the information he sent to N1 concerned rhino horns, ivory tusks and big cat skins. This suggests that

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[6] In a directed and weighted graph, the outdegree represents the number of outbound links from a specific node to the other nodes, while the indegree represents the number of links entering from the other nodes to a specific node (Borgatti et al. 2013; Hanneman and Riddle 2005).

N2, who is based in EA2, could have an important role in acquiring and collating the illicit goods. In turn, N1 forwards these pieces of information to the Asian buyers N49 and N69.

Other nodes – e.g. N18 and N48, who belong to N1's criminal firm – send relevant segments concerning the delivery of the illicit goods from East Africa to Southeast Asia. In particular, these nodes share with N1 information on air waybills, timetables and routes of the shipments that leave EA1, NCA2 and NCA3 destined for SEA3, SEA2, SEA1 and SEA4. All this information is probably obtained by these nodes from freight forwarders, clearing agents and air cargo employees. Once again, N1 forwards the information to N49 and N69 (Asian buyers). It is meaningful to confirm that N48 (criminal firm co-offender) receives the shipping address for the goods from N1, who in turn receives this information from the Asian nodes N49 and N69. On the basis of this information, the airway bills are prepared and thereafter sent to N1 by the co-offender N48. In this framework, there is perfect correspondence between the addresses sent by the nodes N49 and N69 to N1 – and then in turn indicated by N1 to N48 – and those indicated on the air waybills that are sent from N48 to N1, and in turn from N1 to N49 and N69.

The globetrotter N88 is an important sender too. This node – a West African operating between Southeast Asia and East Africa – sends N1 several receipts with calculations concerning quantities and prices, which N1 forwards to the Asian component of the network. N88 also sends N1 segments regarding the methods to conceal the goods during the shipment, and information about the receiver to whom to send the goods. Once again, the N1 forwards these pieces of information to several other nodes of his criminal firm.

Regarding the receivers who operate in N1's ego network, the Asian buyers N49 and N69 play a quite predominant role. Node N1 sends them information on financial flows, delivery strategies and illicit goods. Nodes N49 and N69 receive the segments where calculations are reported, like the receipts sent by N88 to N1. In parallel, nodes N49 and N69 receive information on the delivery routes of the illicit wildlife goods from East Africa to Southeast Asia. To conclude, nodes N49 and N69 receive information on the characteristics of wildlife goods, including details of types, weights and quantities. These findings further reveal the role of these Southeast Asian nodes in carrying out IWT between East Africa and Southeast Asia. Given the quantity and quality of the information they exchange with N1, the findings confirm these nodes represent the Asian counterparts of the West African rings based in East Africa. These two groups jointly organise the exchange of goods, input and resources that makes the illicit trade possible. This strict collaboration between West Africans and Southeast Asians, which takes place both in East Africa and Southeast Asia, well represents the foundations of the transnational criminal organisation that operates between these two shores to carry out IWT.

4.2 An evidence-based chronological scheme

Given the previous analysis, it is meaningful to conclude the empirical part of the report by framing the findings into a coherent model, able to explain the step-by-step nature of the illicit exchange as revealed in this case study. This represents the chronology of the activities that characterise the IWT between East Africa and Southeast Asia in this case study, i.e. the sequence of inputs, actions and reactions that connect the two terminals of the export/import chain. Understanding this chain of action and reaction, as well as considering the intertwining between actors, regions and functions, are fundamental elements to produce fresh knowledge on this illicit phenomenon.

The chronology starts at stage T_0, when the traffickers in East Africa (N1 and his co-offenders N2, N18 and others) collect information on the availability of wildlife goods – such as rhino horns and ivory tusks – on the illicit markets. N1 sends detailed information on the goods that are available on the illicit markets to the Asian nodes N49 and N69. These wildlife goods may already have been purchased by the trafficker's ring, or they can still be available for individuals that can purchase them, being owned by other traffickers and middlemen. These traffickers and middlemen are mainly located in EA1 and surrounding countries, such as NCA1, EA5 and EA2.

Reacting to the input at stage T_1, after having received the information from N1, nodes N49 and N69 give their confirmation for the operation. Once this positive decision has been taken, the Asian buyers – directly or through the West African globetrotters based in Southeast Asia – send N1 instructions about where to deliver the goods (country, address, and receiver's name). In turn, N1 forwards this information to his co-offenders, such as N2, N18, N19, N48 and N54, who organise delivery procedures, routes and documentation.

Asian buyers and West African globetrotters also send N1 clear input and indications on the goods to conceal the illicit wildlife products during transport, as well as the money to organise the purchase of the illicit goods and their delivery. As before, N1 shares this information with his own criminal firm. It is interesting to see here that the Asian buyers send the money to the West Africans based in East Africa in advance. Once they decide that an operation is meaningful, they transfer to their West African counterpart based in East Africa a large amount of money. The money is used by the crime ring to organise all the stages of the illicit business, from the procurement of the goods to their stockpiling in safe house, from their packaging to their final delivery to the destinations in Southeast Asia. This is where trust, proximity and coordination between nodes and clusters – as well as the repetition of the game along an indefinite time horizon – cement the crime relations between the different rings of the transnational criminal organisation operating between East Africa and Southeast Asia.

The findings signal that the flows of money seem to take place in two ways. The first one concerns the use of financial institutions or institutionalised hawala systems. Significant

flows of money are concentrated in a few days when thousands of dollars are transferred from one region to the other. Because financial transaction spikes can be detected and trigger investigations by law enforcement agents and investigators, the traffickers adopt camouflage strategies to reduce the visibility of these suspicious transactions. The data partially shows how the traffickers fractionalise these financial flows into several smaller streams. Thanks to the use of front men, co-offenders and relatives who send smaller amounts of money, these financial flows can be unpacked, making their identification less likely. A total amount of thousands of dollars can be reduced, thanks to these strategies, into smaller financial flows that – being under the alert threshold for financial institutions – are very difficult for law enforcement agents and investigators to detect.

The second method seems to be based on an informal balancing system established between the West African traffickers and Southeast Asian buyers located between East Africa and Southeast Asia. For example, this case study seems to show this informal balancing mechanism between trafficker N1 (East Africa), buyers N49, N69 and N140 (Southeast Asia), and globetrotters N3, N88, N138 and N187 (East Africa and Southeast Asia). The balancing system could permit these actors to equalise what they must give and how much they must receive without moving real money on any traceable financial structure. As with any informal system used to exchange money (Maimbo 2003; Maimbo and Passas 2004), this method requires a high level of trust between the different actors.

At stage T2, the trafficker N1 and his co-offenders – N2, N18 and N19, among others – operate to purchase and stockpile the illicit wildlife goods, to prepare their packaging for local and regional transportation, to purchase the goods that have been indicated by the Asian counterpart as concealment goods for the transnational shipment (sea or air cargo), and to prepare the documents for the delivery along the global supply chain together with fictitious senders, clearing agents and freight forwarders.

Once N1 and his ring receive the input on the concealment goods from the Asian counterparts, the co-offenders start to search for those products in their region. The analysis undertaken for this case study suggests that the efforts to find the concealment goods – in this case, semi-precious and rough stones[7] – is collective and involves nodes both in East Africa and Southeast Asia. At the same time, the findings do not provide further evidence to properly explain where and how wildlife and concealment goods are consolidated together.

When the traffickers purchase the goods to be used for concealment and identify possible senders of this cargo, the freight forwarders organise the shipment and prepare the documents. The case study offers insights into these mechanisms, due to the cooperation

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[7] Other sources describe the use of other concealment products, such as grains, tea leaves, soy beans, fish maws, plastic or metallic products, and timber for concealment (EIA 2017; Neumeister and Cooper 2019).

between the trafficker N1 and his co-offenders N18, N48 and N54, and nodes who play the roles of senders and freight forwarders, such as nodes N15, N121, N265 and N277. In parallel, the clearing agents prepare the loading documents, certifying the load of goods used as concealment without mentioning the illicit wildlife goods that are hidden there.

Stage T3 regards the shipment of illicit goods exiting East Africa towards the final destination in Southeast Asia. Like in the case of the financial flows, the shipment of the illicit goods takes place in bursts and is implemented in a manner that breaks up the shipments to minimise the risk of detection. The findings show the shipments are concentrated in one or a few days, with large amounts of wildlife goods delivered from East Africa to Southeast Asia. To reduce the risk of detection and the illicit goods being seized by law enforcement agents, goods and shipments are distributed among several companies. In one example in the data, the crime ring used different mining companies based in EA2 as senders. These different companies are related to the same telephone number and, thanks to the organisation of the freight forwarders, shipped the goods on the same day, with the same airline and on the same flight.

At stage T4, the Asian buyers receive the illicit goods at the indicated address and move them to safe warehouses and stockpiling points. Here, they proceed in weighing the illicit goods, checking the quality of the products, and comparing the results they obtain with the information they received from their African counterparts before the delivery. In our case study, this is made evident by the segments that N49 and N69 sent to N1 confirming the receipt of the goods and the alignment of what was received with what was indicated before the shipment. If they register incongruencies with the information they had received before, or if the amount of money they sent to organise the operations is actually higher than the value of the illicit goods, then the traffickers based in East Africa have to return this surplus. This happens at the stage T5, which signals the conclusion of the transaction.

4.3 The hidden order of the information flow

This chapter has analysed the flow of information along the ego network, as well as the chronological model that characterises the interaction between East Africa and Southeast Asia in this case study. As with the previous two elements, i.e. structures and functions, the percolation element is also chaotic, complex and disorganised in its basic components. At its micro dimension, it is composed of a high number of dyadic contacts spread around very distant geographical contexts and criminal clusters. Different types of information are exchanged in the interactions between actors, and an encrypted language is often used to conceal the subject. Several topics and issues are touched in these interactions.

Once again, the network perspective helps us to consider the macro dimension of these flows of information, thanks to their accumulation and stratification – along an indefinite

time horizon – on the network structure. The common patterns and repetitive schemes that emerge from this chaotic starting point permits to analyse the ordered nature of the mechanisms of information percolation.

The findings show that the trafficker collects the information on goods, financing, packaging and transportation from different sources and geographical regions. Then he strategically allocates this information to criminal firm members, professionals or Asian buyers. The percolation of information through the network resembles the effect of the flow of a contrast liquid along the veins of the body. As it flows, this liquid progressively activates nodes, clusters and regions of this body, giving them life and reason to operate. Basically, the flow of information activates relations that are "dormant", forcing their mechanisms of action and reaction. Despite appearing like a disorganised exchange of immaterial elements, this percolation represents the grammar of order that moves this relational structure.

Here, order comes from two elements. The first is the direction given by the trafficker actions (top-down). The second is the further spread through self-organisation dynamics, i.e. that is more developed from the bottom up thanks to the non-linear efforts of the network's members (Comello et al. 2011). This means that in this case study, both top-down and bottom-up mechanisms cooperate in assuring order and regularity to the percolation of information around the network. As the networking activities serve to coordinate the activation of specific nodes, so the percolation mechanisms serve to coordinate the operations in relation to wildlife goods, money and shipments.

These common patterns also allow a picture to emerge about the scheme behind the geographical distribution of the key senders and receivers of the information, permitting to connect what they send and their placement. The grammar of order that regulates the IWT between East Africa and Southeast Asia is clearer when putting together the pieces of the analysis into a single composition. In fact, the chronology of the illicit trade exactly represents the ordered output descending from a large set of chaotic and opportunistic inputs. It is along its mix of interrelated strategies and alternate interactions that the chaotic elements of the network, i.e. its geography, membership, functions and percolation mechanisms, find their place within an ordered and regulated framework. Analysing the chain of action and reaction, as well as studying the intertwining between actors, regions and functions, have been important in highlighting this order and regularity as basic elements of IWT (macro dimension) in the light of their chaotic and complex origin (micro dimension).

5 Conclusion

The previous pages took the reader on a journey through the structures, functions and mechanisms characterising this case study of IWT along the East Africa and Southeast Asia axis. This chapter summarises the main considerations emerging from the empirical analysis and presents some evidence-based suggestions for practitioners, law enforcement agents and other stakeholders.

5.1 Is organisation arising from chaos?

Conducting research on IWT means diving into the debate about its opportunistic (Titeca 2019) or organised nature (Wasser et al. 2018). This report shows that IWT is shaped by the mechanism by which chaotic behaviours are transformed into organised mechanisms through the mediation of complexity and non-linearity (Stewart 2019; Byrne 1998; Landa 2000). The report empirically deconstructs an IWT cross-border network into its micro elements with respect to structures, functions and percolation mechanisms. The findings show that, when considered in their micro components, these three pillars are a shapeless amalgam of chaotic and opportunistic spaces, actors, mechanisms and flows. However, their accumulation and sedimentation on the network structures along an indefinite time horizon permit the transformation of these chaotic inputs into ordered outputs.

In this way, criminal networks operate as a machine of order that puts together the different micro elements and reduces the chaotic nature of their singularities. What is inputted is chaotic and opportunistic; the mediation of the machine of order transforms the chaotic pieces into an ordered picture. The investment in resources, time and effort that is necessary to increase the efficiency and effectiveness of this machine of order is supplied by the transnational criminal organisation which is established between the import/export terminals of the cross-border supply chain. The operative and logistics efforts of organised crime give the network the amount of "energy" needed to reduce the chaos of the initial status into the order of the final status.

The empirical analysis and its results permit to elaborate on the relations between criminal networks and organised crime, drawing a model that explains overlaps and differences between these two concepts. Our conceptual and analytical framework describes organised crime as a limited space in the network where the dynamics of accumulation and stratification of chaotic and opportunistic behaviours have condensed and coagulated around specific attractors, such as powerful individuals and leaders, a hierarchical organigram, repeated operative models and organised strategies (Stewart 2019). This relational and operative set is able to take on a life of its own with respect to the rest of the network, progressively establishing hierarchies, borders, membership, leadership, as well as monitoring and enforcing mechanisms (Albanese and Reichel 2014; Albanese 2010; Paoli 2014).

In this model, the organisational and logistical efforts of members and co-offenders of the criminal organisation – as well as their capacity to accrue new strategies, skills and know-how – permit them to drive and guide the operations and evolution of the criminal network. Co-optation and activation of other nodes, coordination and bargaining between different clusters and goals, monitoring and punishment are all managed on a daily basis by the participants of organised crime. Compared to the chaotic and opportunistic inputs, the organised behaviours are designed and projected by leaders, management groups and key co-offenders. They are based on top-down and hierarchical decisional inputs rather than on bottom-up mechanisms. They also activate specific dynamics of task assignment, labour division and strategic placement between traffickers and co-offenders.

This case study has permitted to highlight the role of both chaotic and organised dimensions, their non-linear interaction and their symbiotic effects on IWT. Some considerations emerge from this analysis, framing the relations between IWT, criminal networks and organised crime.

First, the switch in the analytical perspective from individuals (micro) to network (macro) permits to follow the switch in the nature of the phenomenon from chaos (micro) to order (macro). In other words, the manifold opportunistic actions of actors involved in IWT can contribute to its organised shape. Criminal networks are machines of order that permit to transform chaos in order.

Second, the organised activities of transnational organised crime make the transformation of chaos into order more efficient than in a situation where transnational organised crime is not active. The organised strategies of the crime organisation's members direct the process of transforming chaos into order towards the achievement of the shared crime goal, i.e. the successful procurement and cross-border delivery of illicit wildlife goods.

Third, criminal networks and criminal organisations are two different, albeit intrinsically interrelated, concepts. The first is the borderless structure of relations and links between individual and collective actors. The second is a bordered group of people that operates to carry out IWT. The evolution and operations of the criminal network are influenced by two different factors. Partially, it autonomously evolves according to the rules of emergence-from-below and self-organisation as intrinsic traits of networks and complex network dynamics (Barabási 2002). In parallel, the operations of organised crime make the evolution of the criminal network more effective and efficient. In fact, a criminal organisation acts as an enforcer that implements, empowers and controls informal norms of cooperation and repetition mechanisms, as well as performs the functions of co-optation, coordination, conflict, bargaining and security (Baez Camargo and Koechlin 2018). This role of a criminal organisation hence helps in increasing the effectiveness and efficiency of the operations of the criminal network, and consequently the profitability of IWT.

5.2 Practical suggestions for law enforcement, investigators and practitioners

Given this analysis, it is possible to extract some practical conclusions for law enforcement agents, practitioners, investigators and other stakeholders who operate in the IWT field.

Concerning the geographical distribution of the criminal networks, the report suggests to investigators and practitioners the relevance of identifying the key locations in question. In other words, it is important to identify which regions are involved in the supply chain, as well as their role in the illicit trade. The same is true for cities and towns; it is likely high-level networks will be concentrated in capitals, megalopolises and trade hubs, while low-level networks will be placed in small and peripheral towns, border provinces and in the vicinity of natural parks and game reserves. In these different geographical spaces, the illicit trade between export and import terminals is organised and concretised, and its logistical and financial operations are finalised. Surrounded by transportation and communication networks (local, regional and transnational), these spaces offer an effective context for the organisation of the illicit business.

Together with transportation and communication networks, capitals and trade hubs offer the perfect ecosystem to cultivate urban networks built around professional or diaspora communities. These urban networks enable crime rings and traffickers to hide their illicit business behind a veil of legitimate activities and community relations. These urban networks seem to be particularly important for communities based in foreign countries and regions, such as the West Africans and Southeast Asians who operate in East Africa in our case study.

Regarding socialisation dynamics, i.e. where and how the traffickers build their criminal networks, investigators and law enforcement agents should identify places where the co-offenders meet together to organise the illicit business. For example, shopping malls, shops, business headquarters and hotels seem to represent meaningful meeting points for the jumble of criminal interests and strategies that shape the IWT. Once these places have been identified, it could be meaningful to arrange field operations such as electronic surveillance and shadowing activities to collect fresh intelligence on crime relations and business mechanisms. At the same time, these places can often be identified with the senders or receivers of shipments of illicit goods, as well as financial flows. A systematic analysis of this information can supply priceless information on how the business is managed.

Given the framework of cooperation and coordination that characterises IWT, the report calls for greater attention to the activities of nodes who are particularly effective in connecting and coordinating different criminal clusters and regions. For example, the West African globetrotters operating between East Africa and Southeast Asia in this case study well represent this category of individuals. These nodes could play an important

role in carrying out IWT, coordinating activities and exchanges between the different criminal clusters.

Another social issue that can have consequences for investigative activities concerns family and kinship relations. Because the activities connected to IWT are complex and require a large amount of trust, the traffickers and their crime rings seem to rely on relatives, friends and fellows that come from their kinship communities. Elucidating this framework can help the investigators to deconstruct the organigram of an illicit ring, or the meaning of the financial flows connecting different regions and relational clusters.

Moving to transnational organised crime, this report calls to look at these organisations not like mafia-style structures, but rather as a cross-border illegal chain of criminal enterprises which is fluid, adaptive and changing. The key components of this chain are strategically placed between the main terminals of the illicit trade. The report has shown that the organised nature of IWT comes from the accumulation of chaotic mechanisms: opportunistic and disorganised behaviours represent the basis for the organised dimension of criminal networks and organised crime. Investigators and law enforcement agents who are interested in neutralising the mechanisms of transnational organised crime have ultimately to look for the high-level individuals, clusters and rings that play a major role in transforming these opportunistic mechanisms into organised dynamics. These high-level individuals participate in creating order from chaos, while having the concrete power to shape both the demand and supply dynamics of the IWT market. Normally, these high-level individuals are strategically placed at the periphery of the criminal networks and hidden behind a veil of secrecy and protection to increase their safety. At the same time, they can drive the illicit business through instructions and hierarchical inputs to subordinates and co-offenders. Understanding who these criminal hubs are, where they are placed, and how their criminal organisations are structured and aggregated in larger cross-border criminal structures, is important in decrypting, anticipating and neutralising their recurrent operative schemes.

The report highlights the relevance of networking activities for the evolution and coordination of the network. Investigations and law enforcement strategies have to target these relational clusters, trying to identify the second-level hubs and the shape of their sub-networks. This can help to clarify the nature of these second-level hubs – i.e. their regional or global projection – as well as their operative goals and aims. In addition, it would be possible to identify the scope of activity of the nodes on which to focus investigative activities to disarticulate the transnational supply chain. This analysis also permits to map the relational basins that surround these second-level hubs, giving specific indications on where to direct in-depth investigative activities.

Targeting the networking activities of traffickers and co-offenders can further help the investigations. The report shows that the arrest of the key traffickers may not even cause the disruption of the entire criminal network. In fact, it can survive thanks to the survival of these relational sub-networks. So, we have to be aware of this additional element: the

deactivation of the key nodes does not mean the destruction of the entire network, because pieces of sub-network can survive, typically where the judicial and law enforcement capacity is low, and as long as there is high demand for these illicit goods. The relational clusters that survive arrests and law enforcement activities can forge together a new network, weaving new relational structures to cover the gaps between lost nodes and clusters. As a consequence, the network is alive and resilient, and can further evolve even if it has been deprived of its organisational head. This can happen because of the actions from below of its nodes and the capabilities of the sub-networks in performing the different functions required to operationalise the IWT. These connective and relational activities contribute to the dynamics of merging, growing and multiplying that lead to a renewed relational structure. Investigators and law enforcement agents have to maintain their attention on these small pieces of relational islands and to follow their evolution along the time horizon. In this way, they can anticipate their evolution and initiate new investigations. After all, these sub-clusters and their second-level hubs encapsulate know-how and operative skills, social capital and resources that are fundamental to continuing the business activities in place of those arrested.

The report also makes it clear which actors are worth focusing on in investigations and law enforcement activities. For example, the relational networks of relatives and co-offenders – who are part of inner circles and crime rings and manage relevant IWT functions – could still weld with other crime rings, supplying to the crime chain the skills, know-how and relational basins they have acquired over the years of their criminal careers. Other groups of traffickers and criminals, similar to those West African rings based in EA1 and elsewhere in the East African region in our case study, can cover the void left by the disruption of other trafficking rings thanks to their own criminal skills and relations. A third group is the nodes who are particularly effective in connecting and coordinating different criminal clusters and regions, such as the West African globetrotters studied in this research. Their operative and logistical know-how – as well as their social capital – can be valuable for coordinating and managing the conduct of the illicit trade.

Lastly, the report indicates that Southeast Asian buyers represent a fundamental cluster for this transnational organised crime as buyers and receivers of illicit wildlife goods. These actors and their surrounding criminal networks will continue to create and recreate relational links with the countries where illicit wildlife goods are poached and delivered. Targeting all these different actors and clusters can help investigators and law enforcement agents to anticipate how the illicit field is evolving, thereby understanding in advance how these criminal clusters and rings are re-shaping their alliances and operative systems.

Concerning the percolation mechanisms of these networks, the report suggests to investigators to pay particular attention to their substance and timing. The identification of recurring schemes for these information flows can increase the interpretative capacity of the investigations. Understanding the roles of the different actors in the light of the

percolation mechanisms, and triangulating this information with the node's placement, permits to identify from which portions of the network the information on wildlife goods, financial flows and airway bills come and go. Putting the mosaic tiles in the right place allows the investigators to understand which functions are enforced and where, as well as how the actors that manage them are activated and mobilised by the traffickers and their co-offenders. This can offer important information for advancing the investigations, as well as for increasing their efficiency and effectiveness.

The report also paves the way for a more generic suggestion to investigators and law enforcement agents. The criminal networks are transnational, and their investigations have to be transnational as well, involving different countries and jurisdictions around the world. As we know pretty well, this collaboration in specific fields – e.g. the sharing of data – can be quite difficult for legal and security reasons. Hidden agendas and interests can further resist this collaboration. But this report provides yet more compelling evidence for a stronger coordinated and systematic cooperation between countries, jurisdictions and – where the state capacity is particularly low – NGOs with regard to investigative coordination, networking capacity, and information and data sharing. In particular, it calls for a greater regional collaboration both within East Africa and Southeast Asia as well as between these two regions. It also seems important to have strong investigative connections between West Africa and East Africa.

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Annex A: Research methodology

This research uses social network analysis to study the structures and functions of a criminal network involved in IWT along the East Africa and Southeast Asia axis. In the last years, the role of criminal networks has progressively acquired more attention among scholars and professionals, becoming an important interpretative key for the analysis of IWT (Borgatti et al. 2013; Hanneman and Riddle 2005; Garay-Salamanca and Salcedo-Albarán 2012). Network ethnography and mixed methods are then used to complement the social network analysis, permitting to pay attention to the content of the criminal

relations that connect individual and collective actors, and to increase the explanatory capacity of the research (van der Hulst 2009; Borgatti et al. 2013; Hanneman and Riddle 2005).

6.1 Methodological background

Social network analysis (SNA) is a set of theories, analytical procedures, methods and techniques, and software built on the basis of network theory. This grammar has been increasingly used in the last thirty years to study the networks created by the social interactions of collective or individual actors (van der Hulst 2009; Borgatti et al. 2013; Hanneman and Riddle 2005). In the criminology literature, SNA has been used to analyse structures defined as dark networks, i.e. sets of actors who operate to achieve criminal goals (Raab 2003; Jancsics and Jávor 2012; Morselli 2009; Morselli et al. 2010; Bright et al. 2012).

Two basic elements build a network: the nodes operating in the field and the links which connect them (Barabási 2002; Borgatti et al. 2013). Nodes are those actors who operate in the field; they can be individual (such as persons) as well as collective actors (such as companies). They transmit two types of information: who or what they are (sociometric attributes) and which role they perform in the network (centrality measures). Each node has its own characteristics. For example, individuals are characterised by gender, age, citizenship, place of residency, education, professional role, income and so on. The literature tells us that these personal characteristics and the node's centrality measures are strictly related. The network authority of a node is driven by its intrinsic characteristics, which shape its attractiveness in respect to other nodes (Bianconi and Barabási 2001a; 2001b; Barabási 2002); in turn, the authority a node gains in the network can modify at least some of its sociometric attributes, such as professional role, income and place of residency.

Nodes transform within a specific social environment. From the beginning, they are immersed in a relational substance coming from ethnic, familiar, friendship or professional relations (Tilly 2005; Binmore 2011; Morselli et al. 2010). This substance represents the social capital of the nodes and their relational set built on trust, informal norms, shared perceptions and action reciprocity (Coleman 1988; Putnam 1994; 2000; Farr 2004; Lauchs et al. 2012).

Four analytical levels are meaningful for SNA:

First, **each pair of nodes is connected by a dyadic link**, which represents the raw relational element of the network. The link can originate from different sources, such as family, political, economic or criminal connections. Financial transactions and shipments create a link between two entities, as well as telephone conversations or in-person meetings. Being part of the same family creates a link, as well as playing in the same football team. Basically, there are several types of relations we can use to identify the links between

nodes. The decision about which "level" to analyse is driven by the objectives, questions and hypotheses of the research. When these dyadic links are analysed, two main characteristics are meaningful: weight and direction. Considering the weight, links can be weighted (how many interactions between two nodes?) or dichotomic (does a relation exist between two nodes?). At the same time, links can be directed from one node to the other, or they can be undirected and simply represent the presence of a connection between two nodes without considering the direction.

Second, **every node is surrounded by a set of other nodes, who compose its ego network**. We can consider this ego network as the "topography" of the individual relational basin built by an ego – in other words, how and where his other nodes are distributed within the network. When we analyse an ego network, we are interested in knowing which are its key traits, who are the other nodes and where they are placed, which type of functional relation they establish, and what their role is in the phenomenon we are considering.

Third, **when we connect the multitude of ego networks surrounding every node, we obtain the complete structure of the network**, characterised by a specific number of nodes and links. This relational structure has specific structural characteristics, such as distance between nodes, density, centralisation and core/periphery dynamics (Borgatti and Everett 2000; Borgatti et al. 2013; Hanneman and Riddle 2005). The nodes are characterised by their authority in the network, well captured by specific measures such as degree (the number of links owned by each node) and betweenness centrality (the capacity of every node in intermediating between the other nodes) (Borgatti et al. 2013; Hanneman and Riddle 2005). Additional methodological steps permit to identify the key players acting in the network (Patel et al. 2015; Borgatti 2006; Schwartz and Rouselle 2009). Other SNA techniques increase our capacity to deconstruct the typology of brokerage we can find in the network (Gould and Fernandez 1989; Burt 1995; Stovel and Shaw 2012; Morselli and Roy 2008).

The fourth level is produced by the **connection of different networks to create a bigger structure, which can be defined as a network of networks or meta-network**. This type of structure is helpful in identifying actors who operate in different networks through strategic behaviours and camouflage. Their key role and position cannot be revealed unless you put together several different networks, thus bringing out their prominent role.

Literature has investigated the "physical" characteristics of the social networks as being free-scale networks – i.e. whose degree distribution follows an exponential law – characterised by dynamism and evolution (Albert et al. 1999; Barabási 2002; Bianconi and Barabási 2001b; 2001a; Jeong et al. 2003). What does "free-scale network" mean? It is the opposite of a network in which the links between nodes are linearly distributed, i.e. every node has about the same quantity of links as every other node in the network. In contrast, in a free-scale network the links are exponentially distributed between nodes, i.e. few nodes connect to a large number of nodes, while the majority of the nodes have

very few links. Those nodes who attract the highest number of links are called hubs, and represent the powerful poles of the network. A free-scale network is articulated in a hierarchy of nodes from a few hubs to a lot of pendant nodes (Albert et al. 1999; Barabási 2002). The dynamic mechanisms characterising these free-scale networks are based on "rich-get-richer" and preferential attachment, i.e. that the new nodes entering the network connect preferably to the hubs (Barabási 2002; Jeong et al. 2003). Networks can follow different type of evolutive models, that we can identify as patterns of growth, merging, birth, contraction, splitting and death (Palla et al. 2007).

SNA, like every other method and technique, has its limits (Campana 2016). Given these limits, several scholars suggest to complement the quantitative tools of SNA with the qualitative instruments of ethnography. This opens the door to a set of methods and techniques known as network ethnography, as a way to study practices, norms and mechanisms of networks in greater depth (Berthod et al. 2017; Edwards 2010; Jones et al. 2018; Heath et al. 2009; Coviello 2005). Thanks to the combination of SNA and network ethnography, it is possible firstly to map networks and secondly to explore the meaning of links, social norms and strategies (Edwards 2010). In this framework, the idea is to use ethnographic techniques to collect and analyse qualitative data and thereby acquire a better inferential and analytical capacity. Different approaches can be found under the term network ethnography, such as focused ethnography (short-term ethnography), multi-site ethnography (following objects and conducting research in different key places) and multi-event ethnography (based on tracking and following multiple key events) (Berthod et al. 2017; Delgado and Cruz 2014). An additional tool that can be very useful to generate information on networks between nodes is a set of techniques known as visual mapping techniques (Heath et al. 2009).

6.2 The context of the research

The Basel Institute on Governance is leading a cross-divisional project called "Stop corruption from fuelling illegal wildlife trafficking along the East Africa – Southeast Asia trading chain". Funded by PMI Impact, this project aims to promote intelligence-led action against organised criminal networks involved in IWT between these regions. In this framework, the Institute is implementing a collaboration between the research driven through SNA and investigations in the field (Costa 2020). In this framework, we accessed the field and started to collect reports, background information and newspaper articles. These materials permitted to identify players and events which could represent the core of the research. We decided to investigate wildlife trade networks through the analysis of a specific criminal network in East Africa as our case study.

The case study is meaningful for several reasons. First, it offers a large catalogue of structures, functions and mechanisms that are functional to the conduct of IWT. Second, this is an exploratory case study research, an opportunity to illuminate the darkness of how these networks work. Finally, despite the shortage of empirical materials normally

available to study IWT, the Basel Institute's pre-established presence in the region made possible the collection of high-quality empirical data.

Clearly, this report is built on the analysis of a single case study, i.e. the transnational network surrounding a trafficker and his ring. The research will be helpful in identifying some commonalities and shared characteristics of IWT, but at the same time its findings cannot be generalised to all the criminal and trafficking networks involved in IWT. More than that, this report represents a starting point to create and provide new knowledge and hypotheses that can be rejected or confirmed by further research.

The empirical materials used for this research are mainly composed of telephonic intelligence data of a wildlife trafficker in East Africa. The data spans the period from August 2014 to February 2017. After a preliminary evaluation of the materials, a decision was taken to study the ego network surrounding the targeted trafficker. Even if not comparable with the study of a complete network, the analysis of an ego network maintains a high explicative power. The type of information we have extracted from the empirical materials is quite valuable, including phone numbers and contact lists, analysis of the phone traffic, and the amount and content of SMSs and instant messaging chats that have been sent and received by this node.

It is necessary to clarify a specific caveat that characterises the research. Given that the investigations around the criminal networks surrounding the trafficker N1 are still ongoing at the time of writing, it is even more important to protect the sensitive information that could be accidentally disclosed during the analysis. At the same time, it is also evident that the analysis of this set of intelligence data represents a unique opportunity to better investigate the concrete operations of a current transnational criminal network in the field of IWT. These two motivations have pushed us to use this empirical material despite its sensitivity while maintaining the highest level of data protection as possible. Together with assuring the anonymity of the nodes through their coding from N1 to NX, we have also implemented a further level of data protection through coding the names of the different countries involved in this network with labels linked to their regional placement: East African countries are identified as EA#, West African as WA#, Middle Eastern as ME#, South-East Asian as SEA#, North American as NA#, European as EU#, North and Central African as NCA#. This coding will be not related in the text with the countries, so making it even more difficult to connect specific nodes with specific countries. This partially reduces the explicatory capacity of the research, but at the same time permits to kill two birds with one stone: achieve the research goals, while maintaining a high level of data protection. This represents an important lesson for all scholars who want to use intelligence data as empirical material for designing research in the field of IWT, corruption and other criminal behaviours.

The available data has permitted to focus our attention on specific issues, such as the proximity and weight of connections between the trafficker and other nodes; the placement and operational field of the other nodes; the mechanisms of networking and

clustering; the functions performed by the nodes; and the dynamics of information percolation along the network. The analysis of these topics increases our knowledge about actors, structures, functions, operations, mechanisms and strategies that are typical of an illicit network operating between East Africa and Southeast Asia to perform the illicit trade of wildlife goods. This can offer the opportunity for the entire IWT community to better target mechanisms and phenomena, and to increase the quality of the strategies defined to fight this illicit trade.

6.3 Structures of the ego network

The research begins by investigating the structure and composition of the ego network. This means analysing which nodes are part of this relational structure, how many interactions they have, and where they are placed. In particular, we have analysed the proximity of the other nodes to the trafficker, considering the number of interactions they had during this length of time and their geographical placement, considering the international dialling codes of the phones these nodes use to communicate. With respect to the wider scope of the research, this first stage defines the key structural traits of the ego network, i.e. its composition and what we call the "topography" of the network. Who are the nodes that compose the ego network? What is their role for IWT? Where they are placed? These are all important points to clarify how criminal networks foster IWT.

We started by collecting information on nodes, phone numbers, geographical placement and number of contacts. This information was collected in a dataset that was continuously fed during the analysis. Regarding the proximity of the nodes, we fixed the threshold to consider them in the ego network at five contacts. To obtain a well-defined list of nodes – as well as their corresponding number of contacts – it was necessary to clean the data extracted from the empirical materials. For example, the contact list was full of phone numbers saved several times, nicknames with different phone numbers, phone numbers without any nickname, and similar nicknames with different phone numbers. Network ethnography, given its role in the in-depth analysis of conversations, has permitted to confirm the matching nicknames/phone numbers. These methodological precautions permitted to consolidate the information on nicknames, phone numbers and number of contacts.

Concerning the placement of the nodes in terms of geography, we have analysed the international dialling codes of the phone numbers these nodes have used. These international dialling codes permit to understand, with a certain degree of approximation, where the nodes are placed. However, it is important to underline this does not give us any information on their citizenship, but exclusively on where these nodes operate. Clearly, this presents specific caveats. When considering SMSs and telephone calls, we can be confident there is a certain correspondence between the international dialling code being used and the country where the node is placed. This link become weaker when considering instant messaging chats. First, these applications work through the

association between a personal account and phone number, independently of where the person is or the SIM card they are using. An individual can be placed in a country and connected to WI-FI or have a specific SIM card, but at the same time use these applications with the number they previously registered. In this way, the link between the phone number used, the international dialling code and the place where they are operating become more uncertain. Once again, the ethnographic analysis helped us to reduce the potential errors connected to this issue. Cross-referencing the information collected by these two different sources has helped us in increasing the quality of the data concerning the issue of the placement and operational field of the nodes. Despite this expedient, we have to be aware that this section presents specific limits and caveats, as we have explained.

The majority of the nodes (88.9% of the total) can be associated with a single country dialling code, while 11.1 % of the nodes can be associated to various phone numbers with different international dialling codes. This means this minority uses phone numbers linked to two or more countries. To understand where the nodes mainly operate, we counted the number of interactions they had for each of the phone numbers. This permitted to identify which number was used more frequently, and, thanks to the dialling codes, which was the main operational field of the node. Information given by the other phone numbers offer additional details on these nodes. Possibly, the set of phone numbers that a node uses can add details on countries of origin or residency, on markets where he or she is doing business or on travel destinations.

6.4 Functions of IWT in the ego network

The second stage of the analysis regards tasks and functions that characterise this ego network and are relevant to carry out the illicit trade. The goal is to examine, within this specific case study, which functions relate to IWT, which actors perform these functions, and where these functions are mainly performed. With respect to the objective of the research, this helps to clarify which functions play an important role in regulating the illicit trade and the flows of goods, resources, logistical support and information between clusters and regions. Network ethnography rather than SNA has been important to consolidate this part of the research.

This component has taken inspiration from Natarajan's seminal work on crime rings involved in the heroin trade in the USA (Natarajan 2000). This research studies hierarchies and organisational charts of a trafficking ring. Natarajan analyses the transcripts of the wire-tapping surveillance and identifies as a unit of analysis the "segment", defined as a continuous, uninterrupted utterance by an individual (Natarajan 2000, 277). For our research, we identified as basic units of analysis – i.e. our "segment" – a sentence, set of sentences or attachment (picture, video, vocal message) that are sent in the same message from one node to another.

We applied this framework to our case study as a method to identify the functions that are managed by the nodes involved in IWT. Thanks to the network ethnography, it has been possible to identify five functional categories: money, networking, delivery & shipment, concealment, goods & business. It is meaningful to underline that these five categories are not elaborated on the basis of the literature, but have emerged during the empirical analysis. Characteristics and borders of these categories have been continuously refined thanks to a continuous feedback mechanism. To evaluate the relevance of these functions with respect to nodes and IWT, we calculate their relative weight by adding up the segments in every category for every one of the analysed nodes. This part of the research has been conducted on 46 nodes, i.e. those characterised by a large number of conversations that are relevant for the conduct of IWT. It has permitted to collect insights on the relevance of these five functions for every node (longitudinal dimension), as well as the relevance of these five functions within this set of 46 nodes (latitudinal dimension).

Following the method of Natarajan (2000), we prepared a coding guide that explains why we have related the different segments to the different categories. Concerning the category "money", the segments of conversations deal with: a. request to transfer money coming (going) from (to) co-offenders, traffickers and middlemen; b. request to transfer money coming (going) from (to) relatives, friends or acquaintances; c. information on financial transactions and transfers (financial institutions, sender/receiver, amount, currency, place of transfer, date, telephone number); d. operative input regarding financial flows; e. small talk about money issues and transactions.

Concerning the category "networking", the segments of conversations deal with: a. telephone numbers, emails and names of other individuals; b. information on companies and enterprises without a clear relation to the shipment; c. request for the contact information of third parties; d. pictures of passports, ID cards or business cards; e. pictures or videos circulated to identify certain individuals.

Concerning the category "delivery & shipment", the segments of conversations deal with: a. information on individuals/companies as senders or receivers of illicit goods; b. information on the weight and quantity of delivered goods; c. information on specific shipments (air waybill, loading documents, flight timetables); d. request for clarification on specific stages or mechanisms of delivery; e. information on timing or delay in the goods delivery; f. pictures of cars, trucks, buses, trains or other transportation methods.

Concerning the category "concealment", the segments of conversations deal with: a. different methods to conceal goods; b. pictures of boxes, tanks and bags used to conceal goods; c. specific efforts to acquire and buy goods for concealment; d. pictures of specific goods used to conceal illicit wildlife goods;

Concerning the category "business & goods", the segments of conversations deal with: a. information on illicit goods (types of goods, number of items, weight); b. pictures or videos showing illicit wildlife goods (stockpiled, packaged, weighed); c. business

agreements and supply-demand matching; d. situations such as arrests, trials, seizures or goods' disappearance; e. supply channels and procurement procedures.

6.5 Percolation, information and the ego network

The third part of the empirical analysis looks at the mechanisms of information percolation, i.e. how specific pieces of information flow around the ego network from the core to the periphery, or vice versa (Liu et al. 2012). The goal is to understand how information flows between different clusters and regions, which actors play a role in controlling these mechanisms of percolation, which regions are involved in these flows, and what functions these mechanisms have in the picture of IWT. This is fundamental to add another brick in the wall of our knowledge of how IWT and its criminal networks operate. Where does this information percolation start? And where does it finish? Who are the senders and the receivers of these sensitive pieces of information? All these topics represent the last step to build a solid and evidence-based framework of how IWT works.

We analysed the segments we had previously collected under the five functional categories. Some of these segments were characterised by a trait: being trackable along the data. The filename for pictures or videos, particular names of people and companies, addresses, codes of financial transactions and shipments; all these references can be followed through the data and make it possible to see, for example, who is the sender and who are the receivers. Given the data we used and the ego network we created, the pivotal and central actor is the trafficker we targeted for the research. He receives this information from a multitude of nodes – placed between the different regions – and then decides whether to distribute the information to one or several receivers, or not. Clearly, this information comes from specific nodes who are placed in the different operational fields and manage different functions, and are sent to node/s who are placed in other regions with specific functions. In this framework, we created a matrix able to describe both the value of the connection and its direction. In the analysis we used 123 segments for the category money, 92 segments for networking, 92 segments for delivery & shipment, 19 segments for concealment and 67 segments for business & goods. When we put this information together, we are able to see the overall mechanism, the timing and the strategy of the illicit trafficking.

6.6 The analysis of the data

SNA has identified a relational basin of 286 nodes who are characterised by a direct link with the targeted trafficker. The number of interactions between these nodes and the trafficker ranges from 1,067 contacts to 5 contacts, i.e. the lower threshold to consider the nodes into the analysis. To this set of primary connections, we added those nodes and links that came out of the analysis of the networking mechanisms, where names and phone numbers of other individuals are exchanged. We consider them as secondary connections. These additional 210 nodes have been connected to the network with a link

value of 1. Integrating these nodes into the analysis permits to further open and deconstruct the black box, adding more information on structures and functions, operative mechanisms, clustering dynamics and cross-regional connections. We obtained an ego network of 496 nodes (1 ego and 495 others), going from N1 (the targeted trafficker) to N496. To protect the identity and privacy of the nodes, we have anonymised this information using the progressive codes of N1, N2, N3 …… N496. We operationalised the analysis of this data through a specialised software for SNA called UCINET 6 (Borgatti et al. 2002; Borgatti et al. 2013; Hanneman and Riddle 2005).