

# Power Distribution in the Networks of Terrorist Groups: 2001-2016

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**Abstract.** Since 9/11, terrorism has become a global issue of the 21<sup>st</sup> century. Terrorist organizations become important actors of world politics as they gain influence on political process and decision-making. We study the distribution of power among terrorist groups using network approach.

**Keywords:** Network Analysis, Terrorist Groups, Influence, Centrality.

## 1 Introduction

Terrorist organizations can influence political process in a certain country, region or the whole world. As terrorist groups form connections, we get a global network of terrorist organizations. Obviously, the structure of this kind of network is not homogeneous. Thus, it is important to study power and influence of terrorist groups. We will do it constructing a network of terrorist groups and evaluating centrality in this network. For this purpose we use Short-Range and Long-Range Interactions Centrality Indices introduced in (Aleskerov et al., 2014; Aleskerov et al., 2016; Aleskerov et al., 2017), which allow determination of direct and indirect, individual and group influence of nodes in a network, and take into account individual characteristics of actors. We assume that individual characteristics of terrorist groups, such as number of attacks and number of people killed during the attacks, are related to terrorists' power and influence. Hence, exactly these groups can affect political agenda and decision-making, and these very groups should attract an attention of government in negotiation processes to confront them or other decisions.

## 2 Literature Review

The vast majority of the existing literature focuses on the ties between individuals within a terrorist network rather than on the connections between the groups of terrorists. However, there are some works on the topic.

The coalitions between terrorist organizations has been studied in Karmon (2005) pointing out that coalitions usually consist of two groups; larger coalitions are possible if groups are geographically close.

Another research (Asal et al., 2015) related to terrorist intergroup cooperation studied ties between organizations and their characteristics.

To find the connection between lethality and terrorist alliances, Horowitz and Potter (2014) studied the intergroup cooperation of terrorists. They claim that terrorist groups are used to form alliances instead of acting alone.

Pedahzur and Perliger (2006) studied terrorist groups' networks from other point of view. They showed that network structure influences group's effectiveness, which is associated with a large number of hubs and subgroups in a network. There is another article by Perliger (2014), where he used a dataset of 18 terrorist networks to determine the factors that affect network productivity and durability.

Further, Bond (2010) examined the relationship between terrorist groups' (violent non-state actors) power, identity and intergroup cooperation. It has been observed that only 3 percent of terrorist groups' pairs cooperated with each other more than twice.

Mainas (2012) described basic SNA measures for investigation of terrorism. These measures are used to define highly active actors or organizers. Medina (2014) applies these measures on the Islamist terrorist network. He concludes that this network is resilient and efficient even if important nodes are removed. Ouellet et al. (2017) calculated Al Qaida's size, density, clustering coefficient and degree before the War on Terror and during the War on Terror.

Latora and Marchiori (2004) proposed a method to identify the critical components of a network. The critical nodes are key players to target to disrupt the terrorist network.

Gaining power and influence is one of the main goals of terrorism. For example, Smith (2008) studied documents, speeches and manifestos of terrorist and non-terrorist groups with same ideologies, and found that terrorists express higher levels of power motive imagery and higher levels of affiliation motive imagery towards their adherents than their non-terrorist comparison groups.

We should take into account not only cooperation between terrorist groups, but competition among them as well. Groups are seeking for attention of recruits and for public support – studies show that terrorist competition increases violence (Nemeth, 2014).

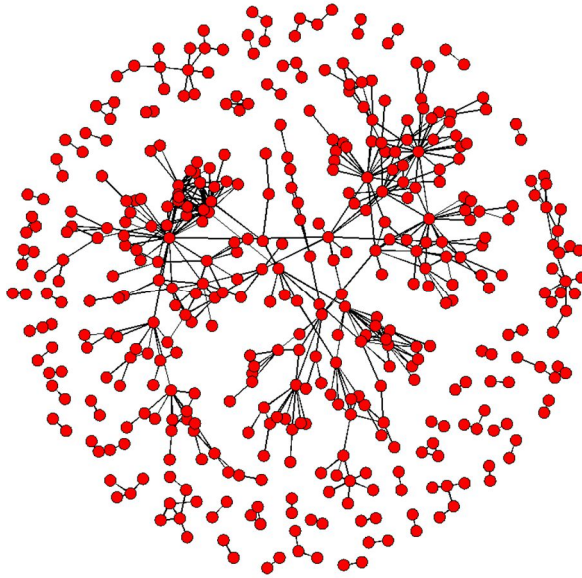
### **3 Methodology**

#### **3.1 Data Description**

The Global Terrorism Database (GTD) is used as a basis for research. The database is maintained by the START Consortium (National Consortium for the Study of Terrorism and Responses to Terrorism). The database provides a worldwide information on terrorist attacks from 1970 to 2016. It contains 135 variables and 170350 observations. We use information on terrorist attacks between 2001 and 2016, which reduces the number of observations to 98773. Variables include information on the date (year,

month, day) in which the incident occurred as well as the location of it (region, country, city); perpetrator group's names, numbers of killed during the incident are also involved. Lethality of the incidents can be used as a measure of terrorist group's effectiveness and strength. As terrorism and a terrorist attack have a broad definition, we exclude uncertain incidents such as insurgency/guerilla actions, other crime type, etc., and focus only on the incidents that fully meet the criteria of a terrorist attack brought by GTD.

In general, there are 1323 terrorist organizations, which perpetrated attacks during the observed period. Using the Global Terrorist Database we selected 1216 terrorist attacks committed by two or more groups during 2001-2016, considering that groups are tied if they act together. We built an undirected network with 426 nodes (terrorist groups) and 564 edges (ties between groups). The network can be visualized as it is shown on Figure 1:



**Fig. 1.** Illustration of global terrorist network

We also built two weighted networks, which illustrate the strength of groups' ties. The first network uses the number of attacks committed by two groups in cooperation as the value. Similarly, the second network uses the number of killed during the attacks provided by two groups as the value.

### 3.2 Connected components

The global terrorist network in this period includes more than 400 terrorist organizations in different regions of the world. Obviously, they all cannot be connected with

each other. In that way, we can analyze connected components. A connected component is a maximal connected subgraph of the graph. Our network consists of 60 components or subgraphs, the largest components and their characteristics are presented below. The network consists of five largest subgraphs, covering different regions of the world. We can also note that the two largest components of the network (1 and 2) are mostly formed by religious and ethnic terrorist groups.

**Table 1.** List of the largest connected components

No. of component	No. of groups	Regions	Ideology	No. of attacks	No. of victims
Component 1	25	Middle East North Africa Central Asia South Asia Southeast Asia Sub-Saharan Africa Europe North America	Religious (Islamic) Separatist Ethnic Leftist	24284	104392
Component 2	20	Sub-Saharan Africa	Ethnic Religious (Islamic)	2078	6151
Component 3	13	Europe North America Latin America Australia & Oceania	Anarchist Ecologist Leftist	245	1
Component 4	7	South Asia (Nepal)	Separatist	41	46
Component 5	5	Latin America	Leftist	1374	1449

*Component 1.* The largest subgraph includes 253 groups; all these groups organized 24284 terrorist attacks in total. In this subgraph, 32 groups committed more than 100 terrorist attacks between 2001 and 2016; 80 groups committed more than 20 attacks, while there are 73 groups that organized only one attack. These groups cover several regions of the world: Middle East, North Africa, Central Asia, South Asia, Southeast Asia, Sub-Saharan Africa, Europe and North America. According to the BAAD database (Big, Allied and Dangerous by the START Consortium), groups of this part share different organizational motivation, but the majority of them are religious and separatist; there are also leftist groups – Communist Party of India – Maoist, New People's Army, United Liberation Front of Assam are the most active of them and all come from India. Other groups could be considered as ethnic, such as Kurdistan Workers' Party, Baloch Republican Army and Al-Qsa Martyrs Brigade.

Hereafter we mention terrorist groups that are associated with the highest frequency of the attacks.

Taliban committed 5634 attacks, what is more than other terrorist groups did. They acted in Afghanistan and Pakistan each year in the observed period, being especially active in 2012-2016. The second most active group, Islamic State of Iraq and the Le-

vant (ISIL), was active only in 2013-2016 and organized 3564 attacks in 21 countries (Iraq, Turkey, Syria, Tunisia, Lebanon, Belgium, Egypt, Libya, Saudi Arabia, West Bank and Gaza Strip, France, Bahrain, Jordan, Somalia, Germany, Yemen, Malaysia, Indonesia, Philippines, Russia, Georgia). Both Taliban and ISIL are religious terrorist groups. The third group of the subgraph, Boko Haram, is religious and separatist simultaneously. It committed 1901 terrorist attacks during 2009-2016 in Nigeria, Mali, Cameroon, Niger, Chad and Burkina Faso. They were more active in 2014 and 2015 and committed more than 450 attacks per year.

Tehrik-i-Taliban Pakistan (TTP) is the last group in the subgraph that committed 1092 terrorist attacks. They were active from 2007 to 2016 in Pakistan, Afghanistan and the United States.

It is worth mentioning Al-Qaida and its branches in Arabian Peninsula (AQAP), in Iraq, in the Islamic Maghreb (AQIM), in Yemen and in the Indian Subcontinent. Together, they committed 1478 terrorist attacks.

### 3.3 Network Dynamics

Looking at the frequency of terrorist attacks organized by 426 groups of the network (alone or in cooperation), we observe that terrorist activity has been changing over the observation years.

Different levels of terrorist activity presuppose that groups cooperate with each other differently.

Characteristics of this network (from 2012 to 2016, more than 2000 attacks) are as follows – number of nodes 306, number of edges 385, Density 0.008, Centralization 0.074. Density and centralization, topological network measures, allow the evaluation of the network structure in general. Density is a ratio of the number of actual edges to the number of possible edges in a network. Centralization (based on degree centrality) determines an extent to which the network depends on certain nodes.

### 3.4 Methods

To analyze the influence of nodes (terrorist organizations) we use different centrality measures, such as Degree, Betweenness, and Eigenvector. We also use Short-Range Interactions (SRIC) and Long-Range Interactions Centralities (LRIC). These indices take into account individual characteristics of the nodes. The SRIC index is primarily based on the power index analysis (Aleskerov et al., 2006), but it was adjusted for SNA (Aleskerov et al., 2014). SRIC defines influence of one node on the other, taking into account direct interactions of the first level (node A directly influences node B) as well as indirect interactions (node A influences node B via node C). One of the main features of the index is that it takes into account the influence on a node from group of nodes. For this the threshold parameter  $q$  is used showing the influence on a node from a group of nodes calculated as a share of total influence this group makes to the node under consideration. In our work, we use the number of joint terrorist attacks and the number of victims as tie weights.

The Long-Range Interactions Centrality (Aleskerov et al., 2016) is an improved version of SRIC index, as LRIC index is able to take into account several intermediate nodes between two nodes. Thus, this index considers chain reactions in a network.

In this work, we use LRIC based on paths, which combines a method of path aggregation and a method of calculating path influence. Three ways of path aggregation exist: taking sum of paths influence, maximal path influence and using threshold rule; and two ways of calculating path influence are possible: multiplication of direct influence and taking minimal direct influence. We take sum of paths influences, maximal path influence and multiply direct influence; that is, we use SumPaths and MaxPath LRIC types (Aleskerov et al., 2016). We evaluate a direct influence of the first level, using SRIC and LRIC; we also evaluate an indirect influence of the third level (two intermediary nodes between two nodes).

We calculate SRIC and LRIC indices for the period of 2012-2016, setting threshold  $q$  equal to 0.5%, 1%, 3% and 5%.

## 4 Analysis of Terrorist Groups Network

### 4.1 Classical centralities

We present the results only for the first largest connected component of the network and calculate Degree, Betweenness and Eigenvector centralities. Centralities were calculated for unweighted as well as for weighted networks. In the 1st component, Islamic State of Iraq and the Levant and Al-Nusrah Front are among the most influential groups according to all three centralities and in all types of network. In general, results of centrality by ties, number of joint attacks and number of victims are quite similar as they mainly agree on the most influential groups, such as Islamic State of Iraq and the Levant, Al-Nusrah Front, Al-Qaida, Tehrik-i-Taliban Pakistan, Ahrar-al-Sham, etc. It is notable that Al-Qaida appears to be more important in terms of Betweenness centrality. Hence, Al-Qaida can be considered as one of the gatekeepers of the network.

### 4.2 SRIC Results

We calculated SRIC index for the first component and the period of 2012-2016.

*Component 1.* The most influential groups of the unweighted network are presented below. The results are identical for the thresholds  $q = 1\%$ ,  $3\%$  and  $5\%$ .

**Table 2.** SRIC for unweighted network

Terrorist Group	SRIC index
Islamic State of Iraq and the Levant	0.04
Al-Nusrah Front	0.034
Tehrik-i-Taliban Pakistan	0.032
Ahrar al-Sham	0.026
Free Syrian Army	0.021

**Table 3.** SRIC results for attacks-weighted network, TOP groups,  $q = 5\%$ 

Terrorist Group	SRIC index
Al-Nusrah Front	0.076
Islamic State of Iraq and the Levant	0.057
Tehrik-i-Taliban Pakistan	0.048
Ahrar al-Sham	0.035
Taliban	0.031

**Table 4.** SRIC results for victims-weighted network, TOP groups,  $q = 5\%$ 

Terrorist Group	SRIC index
Al-Nusrah Front	0.131
Tehrik-i-Taliban Pakistan	0.079
Ahrar al-Sham	0.061
Islamic State of Iraq and the Levant	0.059
Taliban	0.046

### 4.3 LRIC Results

We calculated LRIC Max and LRIC Sum indices for two types of routes: direct route of the first level, where one group directly influences other group (Path Length 1), and indirect route of the third level (Path Length 3), where one group influences other group via some other groups. LRIC Max and LRIC Sum indices show similar results – groups are ranked in the same order. We present results only for the 1st and the 2nd components as it makes sense to take into account the largest networks while calculating LRIC.

*Component 1.* LRIC results for the unweighted network are presented in the table below.

For different threshold values  $q$  for the period 2012-2016 we obtain the following results. Here we adduce threshold values set at 3% and 5%, as results calculated with threshold values set at 3%, 1% and 0,5% are identical.

**Table 5.** The most influential groups according to LRIC indices, unweighted

Rank	Path length 1		Path length 3	
	$q = 3\%$	$q = 5\%$	$q = 3\%$	$q = 5\%$
1	Al-Nusrah Front	Al-Nusrah Front	Ansar (Libya)	al-Sharia Islamic State of Iraq and the Levant (ISIL)
2	Islamic State of Iraq and the Levant	Islamic State of Iraq and the Levant	Islamic State of Iraq and the Levant	Al-Nusrah Front
3	Free Syrian Army	Ahrar al-Sham	Al-Nusrah Front	Ansar al-Sharia (Libya)
4	Southern Front	Tehrik-i-Taliban Pakistan	Abdullah Brigades	Azzam Islamic Front (Syria)
5	Ahrar al-Sham	Free Syrian Army	Liwa Ahrar al-Sunna	Al-Nasir Army (Syria)

We can observe the influence of previously unnoticed groups, such as Jaish-e-Mohammad, Kurdistan Freedom Hawks and Great Eastern Islamic Raiders Front in 2001-2007; Abdullah Azzam Brigades, Liwa Ahrar al-Sunna, Islamic Front (Syria), Al-Nasir Army, etc., in 2012-2016.

LRIC indices calculated for the attacks-weighted network show that groups have different levels of influence depending on threshold value set. Results for  $q = 5\%$  are presented in Table 6.

**Table 6.** The most influential groups according to LRIC indices, attacks-weighted,  $q = 5\%$

Rank	Path Length 1	Path Length 3
1	Free Syrian Army	Jaysh al-Islam (Syria)
2	Islamic State of Iraq and the Levant	Ansar al-Sharia Operations Room (Syria)
3	Al-Nusrah Front	Islamic State of Iraq and the Levant
4	Jaysh al-Islam (Syria)	Al-Naqshabandiya Army
5	Ahrar al-Sham	Southern Front

In the victims-weighted network, new groups appear among the most influential, such as Asa'ib Ahl al-Haqq and Syrian Resistance.

**Table 7.** The most influential groups according to LRIC indices, victims-weighted,  $q = 5\%$

Rank	Path Length 1	Path Length 3
1	Al-Nusrah Front	Asa'ib Ahl al-Haqq
2	Tehrik-i-Taliban Pakistan	Syrian Resistance
3	Ahrar al-Sham	Military Council of the Tribal Revolutionaries
4	Islamic State of Iraq and the Levant	Kurdistan Freedom Hawks
5	Khorasan Chapter of the Islamic State	Al-Naqshabandiya Army

## 5 Conclusion

Using the database on terrorist attacks during 2001-2016, we built the worldwide undirected network of terrorist groups to determine the most influential actors of the network. The global terrorist network is large and sparse, therefore we analyzed connected components of the network. The 1st component is the largest one with 253 groups and is the most international of all components, as it covers several regions of the world.

We have evaluated classical centralities as well as new Short-Range and Long-Range Interactions indices, which define direct and indirect influence of groups, take into account characteristics of groups and, using a threshold values, exclude edges without real influence on the network. Setting different threshold parameters did not significantly affect the results. SRIC agreed with classical centralities results, but identified other influential groups and ranked them in a different way. SRIC and



LRIC indices determined the most influential nodes of each component, based on the number of ties, number of joint attacks and number of people killed during joint attacks. SRIC and LRIC results for the unweighted and attacks-weighted networks mostly coincide, while victims-weighted networks allow to discover other influential groups. LRIC applied to a route of the 3rd level (indirect) reveals the ‘hidden’ influence of some groups on the network.

Using Short-Range and Long-Range Interactions Centralities we are able to determine powerful and influential terrorist groups, which could seem unobvious at first sight. In that way, the knowledge about the power of non-state actors and the dynamics of their influence is understood deeper. It will open new ways for negotiations with these actors, and to confront them when necessary.

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