Advances in Social Science, Education and Humanities Research, volume 517
Proceedings of the 6th Annual International Conference on Social Science and Contemporary Humanity Development (SSCHD 2020)

Visualization Study of Terrorist Groups in the Middle East Based on UCINET

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ABSTRACT
At present, with the development of information technology and the international community's efforts to combat terrorism, terrorism is constantly transforming and escalating, taking on the characteristics of Al-Qaida, globalization and networking. Therefore, it is of great significance to study terrorist organizations from the perspective of social network in order to combat terrorist activities. In this paper, we mainly use the social network analysis method to study the relationship network of terrorist organizations in the Middle East, and analyze their network centrality and density with the help of UCINET, so as to get the conclusion about the characteristics of terrorist organizations, and then formulate corresponding counter-terrorism strategies to provide strong theoretical support for the fight against terrorism.

Keywords: *Social network analysis, UCINET software, Middle East, Centrality, Network density.*

1. INTRODUCTION

Terrorism, as a special kind of violence, has emerged and developed along with the intensification or deformation of conflicts within and between States in various aspects [1]. Contemporary terrorism has become the most important concern for all countries due to the unimaginable spread of the harm and the consequences of contemporary terrorism. And with the rapid development of social network analysis in the fields of probability, graph theory methods, and statistics, it has shown unique advantages in many fields [2]. Therefore, after 9.11, social network analysis has become a hotspot in the field of counterterrorism [3]. The use of social network analysis can reveal the relationships between terrorist organizations and their characteristics, and provide advice and guidance for preventing and combating terrorism.

2. MODELING OF TERRORIST NETWORKS IN THE MIDDLE EAST

2.1. Research Methodology

The method used in the study of social relationship networks is social network analysis, which mainly analyzes the structure of the network as well as its characteristics, also known as structural analysis. The theory of anti-terrorism analysis based on social networks not only has the advantages of social network analysis, but also can analyze and study the characteristics and attributes of relational networks with the help of computer technology, so it is widely used in the field of anti-terrorism [4]. Its commonly used analytical indicators are centrality and network density.

2.2. Data Sources

The data in this paper is mainly based on the list of terrorist organizations identified by the main national and international organizations in the Yearbook of International Terrorism and the Fight against Terrorism as of 2019[5], which yields the following 103 major terrorist organization numbers in the Middle East.

Code	Terrorist organization	Code	Terrorist organization	Code	Terrorist organization
A1	Hamas	A36	Islamic Army of Iraq	A71	Yemeni Islamic Jihad
A2	Palestinian Islamic Jihad	A37	black flag bearer	A72	Abu Ali al-Harsi Brigade
A3	PFLP	A38	the Ansars Senna army	A73	Abu Hafs al-Masri Brigade
A4	Democratic Front for the Liberation of Palestine	A39	Islamic army	A74	Young Believers
A5	Abu Nidal Organization	A40	Islamic Jihad Brigade	A75	Yemeni Soldiers Brigade
A6	Popular Front for the Liberation of Palestine-General Command	A41	Saddam's victims	A76	Al-Qaida in the Arabian Peninsula
A7	Al-Aqsa Martyrs' Brigade	A42	National Islamic Resistance Movement of Iraq	A77	Kuwaiti Jihad
A8	PRC	A43	Islamic Resistance Front of Iraq	A78	Abdelaziz Muklin Brigade
A9	soldier of God	A44	Jash Rashtin	A79	Peninsular Lion
A10	Palestinian Islamic Army	A45	Nasserist	A80	Association for Social Reform
A11	FAG	A46	restoration	A81	Islamic Heritage Revival Society
A12	Imad Mughniyeh	A47	Armed Pioneers of the Second Mohammedan Army	A82	Islamic Front for the Liberation of Bahrain
A13	thunder and lightning	A48	Iraqi Resistance Brigade	A83	Jewish Federations
A14	Storm Eagle	A49	Awakening and Jihad	A84	Kahani Movement
A15	Ansarzana	A50	Abu Daraa Organization	A85	Union for the Defence of the Jews
A16	Egyptian Islamic Jihad	A51	Jihad and the Course of Reform	A86	PKK
A17	Islamic organization	A52	Hamas in Iraq	A87	Hizb ut-Tahrir
A18	Atonement and IQM	A53	Warrior in Paradise	A88	RPLP
A19	Islamic Self-Respect Brigade of Egypt	A54	The Army of the Nacos Bandian Commander	A89	FIO
A20	Abdullah Azzam Brigade	A55	Iraqi Hezbollah Brigade	A90	ISA
A21	Egyptian Mujahideen	A56	mujahideen	A91	Allah's army
A22	Jihad and Unity	A57	Al-Qaida in Jordan	A92	Liberation of the eagle of Kurdistan
A23	Muslim Brotherhood	A58	Islamic Combatant Group Tunisia	A93	Kurdish Treh Hazadiyeh
A23	Muslim Brotherhood	A58	Islamic Combatant Group Tunisia	A93	Kurdish Treh Hazadiyeh
A24	Supporters of Jerusalem	A59	Supporters of Shariah in Tunisia	A94	Union of Revolutionary Communists of Turkey
A25	Hezbollah	A60	Moroccan Islamic Combatant Group	A95	Ergnet hole
A26	Fatah al-Islam	A61	Inheritance of the Mujahideen	A96	Gray Wolves
A27	Ansar Alliance	A62	Ansar Mehdi	A97	Mojahedin-e Khalq Organization of Iran
A28	Zayed Geraha detachment	A63	Ansar al-Islam in the Muslim Desert	A98	Almighty God's Brigade
A29	Liberation of Al-Sham	A64	Young Islamic Fighting Group	A99	Kurdish Free Life Party
A30	Khorasan Network	A65	LIFG	A100	Iranian People's Fada Guerrillas
A31	Sharm Free People	A66	Libyan branch of the Islamic State	A101	Democratic Front for the Arab People of Ahvaz
A32	Islamic State	A67	Salafist Organization for Mission and Combat in Mauritania	A102	Awas Arab Ba'ath Party
A33	Hezbollah Brigades	A68	Al-Qaida in the Islamic Maghreb	A103	Tripoli Youth Movement
A34	Ansar al-Islam	A69	AQAP		
A35	Mohammedan army	A70	IAA		

Figure 1 List of terrorist organizations.

Use B1, B2... B17 for the 17 Middle Eastern countries of Palestine, Egypt and Iraq, numbered as follows.

Code	Country	Code	Country	Code	Country
B1	Palestine	B7	Tunisia	B13	Kuwait
B2	Egypt	B8	Morocco	B14	Bahrain
B3	Lebanon	B9	Libyan	B15	Israeli
B4	Syria	B10	Mauritania	B16	Turkey
B5	Iraq	B11	Yemeni	B17	Iranian
B6	Jordanian	B12	Saudi Arabia		

Figure 2 Middle East country code.

2.3. Building Relationship Matrices and Network Models

Combining Figures 1 and 2, the matrix and network model of "organization-organization" and "organization-area of activity" relationships in the Middle East are constructed.

	A1	A2	A3	A4	···	A101	A102	A103
A1	1	1	0	0	···	0	0	0
A2	1	1	0	0	···	0	0	0
A3	0	0	1	1	···	0	0	0
A4	0	0	1	1	···	0	0	0
···	···	···	···	···	···	···	···	···
A101	0	0	0	0	···	1	1	0
A102	0	0	0	0	···	1	1	0
A103	0	0	0	0	···	0	0	1

Figure 3 Organizational-organizational.

	B1	B2	B3	B4	···	B15	B16	B17
A1	1	0	0	0	···	1	0	0
A2	1	0	1	0	···	1	0	0
A3	1	0	1	0	···	1	0	0
A4	1	0	1	0	···	1	0	0
A5	1	0	1	0	···	0	1	0
···	···	···	···	···	···	···	···	···
A101	0	0	0	0	···	0	0	1
A102	0	0	0	0	···	0	0	1
A103	0	0	0	0	···	0	0	0

Figure 4 Organizational-territorial.

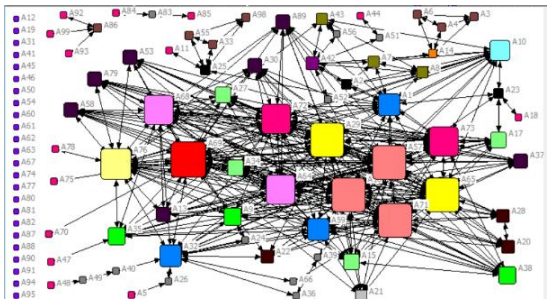

Figure 5 Organization – Organizational.

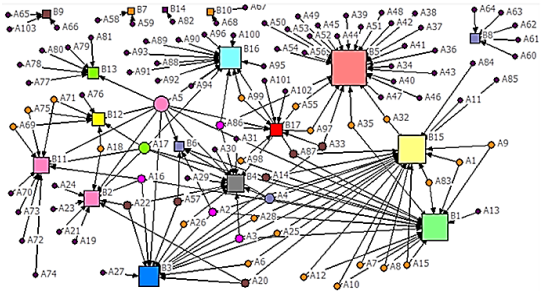

Figure 6 Organization - area of activity.

It can be seen that the organizational relationship network mainly consists of three sub-networks centered on A83, A86 and A69, of which the sub-network centered on A69 is the largest; and the centrality of B5 in the activity area relationship network is the largest, it means that it is in the core position of the network.

3. ANALYSIS OF THE NETWORK OF TERRORIST ORGANIZATIONS IN THE MIDDLE EAST

3.1. Centrality Analysis

Centrality is an indicator used to describe the importance of actors in a network and is divided into: point, middle and near-centrality [6]. If a terrorist organization has a high degree of centrality, it is considered to have direct links to many organizations; if

		1 Degree	2 Closeness	3 Betweenness	4 Eigenvector
1	A1	18.627	2.590	12.028	18.275
2	A2	4.902	2.556	0.000	2.075
3	A3	2.941	2.484	0.000	0.005
4	A4	2.941	2.484	0.000	0.005
5	A5	0.980	2.498	0.000	0.049
6	A6	2.941	2.484	0.000	0.005
7	A7	5.882	2.559	4.737	2.079
8	A8	5.882	2.558	0.034	2.207
9	A9	12.745	2.571	0.517	19.208
10	A10	16.667	2.586	5.239	18.188
11	A11	0.980	2.514	0.000	0.043
12	A12	0.000		0.000	0.000
13	A13	10.784	2.565	0.000	18.093
14	A14	3.922	2.522	3.611	0.101
15	A15	11.765	2.566	0.000	19.066
16	A16	32.353	2.597	3.109	35.396
17	A17	11.765	2.567	0.150	18.303
18	A18	0.980	2.530	0.000	0.210
19	A19	0.000		0.000	0.000
20	A20	7.843	2.563	0.000	11.959
21	A21	6.863	2.562	0.000	11.382
22	A22	7.843	2.567	0.000	12.403
23	A23	4.902	2.571	1.277	4.359
24	A24	1.961	2.537	0.000	1.947
25	A25	4.902	2.554	4.795	0.890
26	A26	1.961	2.537	1.242	1.023
27	A27	11.765	2.571	0.473	18.231
28	A28	7.843	2.563	0.000	11.959
29	A29	31.373	2.596	1.903	35.195
30	A30	10.784	2.565	0.000	18.093
31	A31	0.000		0.000	0.000
32	A32	18.627	2.577	7.777	21.165
33	A33	2.941	2.515	0.000	0.048
34	A34	11.765	2.566	0.000	19.263
35	A35	12.745	2.567	1.242	19.308
36	A36	1.961	2.537	0.071	1.105
37	A37	10.784	2.565	0.000	18.093
38	A38	12.745	2.567	0.002	20.182
39	A39	1.961	2.556	0.074	1.755
40	A40	1.961	2.539	2.446	1.023
41	A41	0.000		0.000	0.000
42	A42	8.824	2.560	3.132	2.269
43	A43	5.882	2.555	0.736	2.866
44	A44	0.980	2.482	0.000	0.005
45	A45	0.000		0.000	0.000
46	A46	0.000		0.000	0.000
47	A47	0.980	2.527	0.000	0.931
48	A48	0.980	2.461	0.000	0.002
49	A49	1.961	2.500	1.242	0.049
50	A50	0.000		0.000	0.000
51	A51	1.961	2.521	1.242	0.110
52	A52	1.961	2.551	0.000	0.991
53	A53	10.784	2.565	0.000	18.093
54	A54	0.000		0.000	0.000
55	A55	2.941	2.515	0.000	0.048
56	A56	1.961	2.521	0.000	0.248
57	A57	32.353	2.597	3.119	35.276
58	A58	10.784	2.565	0.000	18.093
59	A59	18.627	2.576	0.241	24.248
60	A60	0.000		0.000	0.000
61	A61	0.000		0.000	-0.000
62	A62	0.000		0.000	0.000
63	A63	0.000		0.000	0.000
64	A64	26.471	2.589	0.720	32.160
65	A65	31.373	2.596	1.903	35.195
66	A66	1.961	2.560	0.000	2.724
67	A67	0.000		0.000	-0.000
68	A68	26.471	2.593	1.007	32.164
69	A69	33.333	2.597	4.368	35.352
70	A70	0.980	2.556	0.000	1.705
71	A71	32.353	2.597	2.814	35.321
72	A72	27.451	2.593	1.313	33.001
73	A73	27.451	2.593	1.313	33.001
74	A74	0.000		0.000	0.000
75	A75	0.980	2.556	0.000	1.705
76	A76	28.431	2.594	2.555	33.074
77	A77	0.000		0.000	-0.000
78	A78	0.980	2.553	0.000	1.595
79	A79	10.784	2.565	0.000	18.093
80	A80	0.000		0.000	-0.000
81	A81	0.000		0.000	-0.000
82	A82	0.000		0.000	-0.000
83	A83	1.961	0.990	0.019	-0.000
84	A84	0.980	0.990	0.000	-0.000
85	A85	0.980	0.990	0.000	0.000
86	A86	2.941	1.000	0.058	0.000
87	A87	0.000		0.000	-0.000
88	A88	0.000		0.000	0.000
89	A89	10.784	2.565	0.000	18.093
90	A90	0.000		0.000	0.000
91	A91	0.000		0.000	0.000
92	A92	0.980	1.000	0.000	0.000
93	A93	0.980	1.000	0.000	0.000
94	A94	0.000		0.000	0.000
95	A95	0.000		0.000	0.000
96	A96	0.000		0.000	0.000
97	A97	0.000		0.000	0.000
98	A98	2.941	2.515	0.000	0.048
99	A99	0.980	1.000	0.000	0.000
100	A100	0.000		0.000	0.000
101	A101	0.000		0.000	0.000
102	A102	0.000		0.000	0.000
103	A103	0.000		0.000	0.000

Figure 7 Centrality of "organization-organization" relationship networks.

	Degree	Closeness	Betweenne
A1	0.118	0.658	0.001
A2	0.235	0.686	0.006
A3	0.235	0.708	0.011
A4	0.294	0.713	0.014
A5	0.588	0.906	0.228
A6	0.118	0.662	0.002
A7	0.118	0.658	0.001
A8	0.118	0.658	0.001
A9	0.118	0.658	0.001
A10	0.118	0.658	0.001
A11	0.059	0.570	0.000
A12	0.118	0.658	0.001
A13	0.059	0.624	0.000
A14	0.176	0.666	0.003
A15	0.118	0.658	0.001
A16	0.235	0.722	0.024
A17	0.353	0.795	0.069
A18	0.118	0.544	0.001
A19	0.059	0.531	0.000
A20	0.176	0.691	0.013
A21	0.059	0.531	0.000
A22	0.176	0.654	0.007
A23	0.059	0.531	0.000
A24	0.059	0.531	0.000
A25	0.118	0.662	0.002
A26	0.118	0.631	0.001
A27	0.059	0.607	0.000
A28	0.118	0.662	0.002
A29	0.059	0.601	0.000
A30	0.059	0.601	0.000
A31	0.059	0.601	0.000
A32	0.118	0.674	0.042
A33	0.176	0.737	0.048
A34	0.059	0.576	0.000
A35	0.118	0.737	0.043
A36	0.059	0.576	0.000
A37	0.059	0.576	0.000
A38	0.059	0.576	0.000
A39	0.059	0.576	0.000
A40	0.059	0.576	0.000
A41	0.059	0.576	0.000
A42	0.059	0.576	0.000
A43	0.059	0.576	0.000
A44	0.059	0.576	0.000
A45	0.059	0.576	0.000
A46	0.059	0.576	0.000
A47	0.059	0.576	0.000
A48	0.059	0.576	0.000
A49	0.059	0.576	0.000
A50	0.059	0.576	0.000
A51	0.059	0.576	0.000
A52	0.059	0.576	0.000
A53	0.059	0.576	0.000
A54	0.059	0.576	0.000
A55	0.118	0.699	0.024
A56	0.059	0.576	0.000
A57	0.176	0.639	0.002
A58	0.059	73.667	0.000
A59	0.059	73.667	0.000
A60	0.059	24.556	0.000
A61	0.059	24.556	0.000
A62	0.059	24.556	0.000
A63	0.059	24.556	0.000
A64	0.059	24.556	0.000
A65	0.059	44.200	0.000
A66	0.059	44.200	0.000
A67	0.059	73.667	0.000
A68	0.059	73.667	0.000
A69	0.118	0.526	0.000
A70	0.059	0.519	0.000
A71	0.118	0.526	0.000
A72	0.059	0.519	0.000
A73	0.059	0.519	0.000
A74	0.059	0.519	0.000
A75	0.118	0.526	0.000
A76	0.059	0.512	0.000
A77	0.059	0.509	0.000
A78	0.059	0.509	0.000
A79	0.059	0.509	0.000
A80	0.059	0.509	0.000
A81	0.059	0.509	0.000
A82	0.059	221.000	0.000
A83	0.118	0.658	0.001
A84	0.059	0.570	0.000
A85	0.059	0.570	0.000
A86	0.235	0.784	0.098
A87	0.176	0.713	0.024
A88	0.059	0.610	0.000
A89	0.059	0.610	0.000
A90	0.059	0.610	0.000
A91	0.059	0.610	0.000
A92	0.059	0.610	0.000
A93	0.059	0.610	0.000
A94	0.059	0.610	0.000
A95	0.059	0.610	0.000
A96	0.059	0.610	0.000
A97	0.118	0.678	0.012
A98	0.118	0.650	0.004
A99	0.118	0.631	0.003
A100	0.059	0.610	0.000
A101	0.059	0.576	0.000
A102	0.059	0.576	0.000
A103	0.059	44.200	0.000

Figure 8 Terrorist organization centrality of the "Organization-Area of Operation" network.

the intermediate centrality is high, the terrorist organization is considered to be important; and if the proximity centrality is high, it is likely to be at the center of the network [5, 7]. Using the Centrality function to calculate the centrality of the network of "organization-organization" and "organization-area of activity" relationships in the Middle East, the results are as follows.

The diagram shows that A69, A57, A71, A76, and A16 are core organizations with high degrees and proximity to the center and relatively low degrees and proximity to the center, while A1 and A32 have high degrees and proximity to the center and relatively low degrees and are key nodes in determining whether other terrorist organizations can be linked.

A5 has the highest punctuality and centrality and a low proximity to centrality, indicating that it is active in multiple countries but is not a core organization, while A58, A59, A67 and A68 have the highest proximity to centrality and very low punctuality and centrality, indicating that it is at the center of the network.

	Degree	Closeness	Betweenne
B1	0.184	0.531	0.144
B2	0.097	0.427	0.072
B3	0.136	0.511	0.088
B4	0.117	0.504	0.103
B5	0.262	0.475	0.281
B6	0.049	0.414	0.007
B7	0.019	67.500	0.000
B8	0.049	27.000	0.001
B9	0.029	45.000	0.000
B10	0.019	67.500	0.000
B11	0.097	0.414	0.079
B12	0.068	0.407	0.038
B13	0.058	0.404	0.070
B14	0.010	135.000	0.000
B15	0.204	0.469	0.108
B16	0.146	0.515	0.160
B17	0.078	0.475	0.070

Figure 9 Regional centrality of the "Organization-Area of Activity" network.

In general, with the exception of some terrorist organizations, there is little difference in the degree of centrality of the areas in which they operate, indicating there is a clear trend towards the globalization of terrorist activities.

3.2. Network Density Analysis

Density reflects the closeness of the relationships between the components. To calculate the density of the

network, first should calculate the shortcut distance of each point. After calculating the shortcut distance of the network centered on A69, organizations with a shortcut distance of no more than 2 to the core organization (degree centrality $\geq$ 32) are selected to build a relationship matrix and calculate their average distance, cohesion index and network density. The results are as follows.

Core organization	Average distance	Cohesion index	Network density
A16	2.351	0.262	0.1011
A57	2.359	0.257	0.1004
A69	2.312	0.269	0.1131
A71	2.312	0.269	0.1131

Figure 10 Table of values for three indexs.

In terms of overall values, the cohesion index and network density of the four networks are low, suggesting an increasingly broad and loosely globalized approach to terrorist relationships.

4. COUNTER-TERRORISM SITUATION AND RESPONSES

4.1. Features of Terrorist Organizations

First, the terrorist organization structure is networked. As we can see from the visualization model in Figure 5, the structure of terrorist organizations is transformed from a vertical structure into a non-central, flexible network structure[8], with scattered branches and members, no unified leadership, fighting on their own, flexible actions and strong organizational planning ability, which brings certain interference to our search for key leading organizations when analyzing the relationship network of terrorist organizations.

Second, the globalization of terrorist organizations' activities. According to the results of regional centrality and network density analysis, the links between terrorist organizations are no longer limited by countries and regions, and the transnational nature is getting stronger and stronger. This also leads to the strengthening of the concealment of terrorist organizations, which brings great difficulty to intelligence collection [9].

Third, the motives of terrorist organizations are diversified. The traditional terrorist organizations have clear political ideas and specific political goals, but the motives of terrorist organizations to create terrorist incidents are sometimes purely retaliatory, without clear political goals, and the targets of attacks have a tendency to be random and non-selective.

4.2. Counter-terrorism Response

First, we must strengthen international counter-terrorism cooperation. Terrorism is global in nature and threatens the security and development of all countries. Therefore, it is necessary to strengthen international counter-terrorism cooperation, cut off terrorist organizations' foreign financial sources and foreign aid channels, reduce their operating space, and carry out intelligence exchanges and technical cooperation with international organizations and other countries to combat terrorist activities [10].

Second, overall planning of the fight against terrorism. The issue of terrorism involves all aspects of national security. Therefore, the fight against terrorism must be planned as a systematic project. To achieve economic prosperity, to resolutely oppose linking the spearhead to a certain nationality, and to prevent terrorist forces from using religion for reactionary propaganda and agitation [1].

Third, to establish an international political and democratic system. In order to reform the international political and economic order, it is necessary to take measures to correct the root causes, consult on political equality and seek mutual benefit in the economic field, and seek to establish appropriate mechanisms to eliminate existing contradictions so as to promote the process of world democratization [11].

5. CONCLUSION

In this paper, the network of terrorist organizations in the Middle East is studied according to the social network analysis method. Then using UCINET to analyze their network density and centrality. The experimental results show that the characteristics of terrorist organizations derived from the study are consistent with reality, indicating that the method is more reliable in the field of counter-terrorism.

ACKNOWLEDGMENTS

This work is supported by the Natural Science Basic Research Plan in Shanxi Province of China (No.2020JM-361), the Young and middle-aged scientific research backbone projects of Engineering University of PAP (No.KYGG201905) and the basic research foundation project of Engineering University of PAP (No.WJY201920, No.WJY202019), military theory research project of Engineering University of PAP (No.JLY2020085), education and teaching fund project of Engineering University of PAP (No.WJJ202039), the PAP's Military Scientific Research Mandatory Project (No.WJ2020A020047, No.WJ2020A020048, No.WJ2020A020029, No.WJ2020A020049).

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