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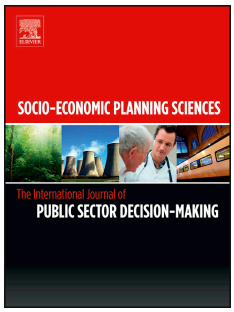

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ACCEPTED MANUSCRIPT

Analysis of Topologies and Key Players in Terrorist Networks

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Abstract. While topologies and key player positions and roles differ across terrorist networks, similar ideological networks share similar structures and topologies, maintaining structural properties of their predecessor groups. In this study, we look at basic ideological waves of terrorism in history, classify terrorist network ideologies, and describe the patterns in network topologies and key player characteristics. We show that ideological differences in terrorist networks in part explain the differences in the structure of links between key players.

Keywords: terrorist networks, topology, structure, key players, degree, eigenvector centrality, closeness, betweenness.

1. Introduction

After the events of September 11th, 2001, there has been much interest in terrorist network analysis from academics, intelligence analysts and criminologists. Sageman [8], as a pioneer of the research, looked at '*homegrown*' terrorists and developed the "bunch of guys" theory, which describes and models multi cell-based small self-organized terrorist networks where the terrorists have little or no prior contact with previously established terrorist groups. Sageman [9] finds that these groups emerge usually as disaffected amateurs who self-radicalize, and then, independently plan and execute their own operations with no outside guidance. As a result, they are very difficult to detect, infiltrate and prevent. These characteristics resemble more of Al-Qaida type networks, later called "*Shura based*" networks. But then, a natural question arises: are there any patterns corresponding to other ideologies and terrorist groups, such as extreme-left, ethnic or anarchist groups? Can one characterize such other terrorist groups accounting for the impact of their culture and practices on network topologies? Can one predict and characterize important key players within those terrorist networks in order to prevent or disrupt them?

This paper seeks to address these questions by looking at several real-world networks and drawing conclusions about how ideology explains network structure. The paper is organized as follows. Section 2 reviews the existing literature on terrorist organization ideologies and classifications. Section 3 discusses the concept of Key Player Problem (KPP) as a well-motivated tool for the analysis of terrorist networks, and overviews the existing mathematical formulations of this problem. Section 4 suggests an ideology-based classification of terrorist networks, and describes their properties. Section 5 presents the analyses of multiple networks, classified by ideology, and the results of centrality calculations and KPP solutions, along with the discussions of the accuracy of those results. Section 6 concludes the paper.

2. Terrorist Networks

Terrorist networks are criminal networks. However, there are differences between terrorist networks and other criminal networks. First, terrorist networks have certain ideologies around

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