

Economic Aspects of Terrorism and Tools for Their Research

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Summary:

This article presents results from a research project on the economic aspects of terrorism conducted by researchers from the Department of National and Regional Security in conjunction with the Center for Strategic Studies of Defense and Security in the University of National and World Economy.

The article elaborates mainly on two directions. First, the main stages of the project are presented and resultant conclusions are summarized. Second, the major focus is the analysis of the methods and tools that can be used to study important economic aspects of terrorism and make sound managerial decisions in this area.

Key words: terrorism, counterterrorism, economic aspects, research tools

JEL: C180, H400, C700

1. General information on the research

The research project on "Economic aspects of terrorism" was conducted

during the period 2009 – 2012. It was carried out by researchers from the Department of National and Regional Security in conjunction with the Center for Strategic Studies of Defense and Security in University of National and World Economy (UNWE), Sofia, Bulgaria. The project leader is Prof. Dimitar Panayotov Dimitrov. It is financed by the research fund of the UNWE.

The research team includes researchers with different backgrounds and experiences, doctoral students in the department, as well as students majoring in Economics of defense and security at the University. Such a team allows for the more experienced researchers to contribute with their experience while younger ones with their energy and enthusiasm to the successful completion of the research.

The study was carried out in three stages. During the first stage (2009-2010) analyses of international experience in the exploration of the economic problems of terrorism was made and opportunities were sought to identify the best practices in the area. At the second stage (2010-2011) an analysis was conducted of the impact of terrorism on various sectors of the economy

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and the experience was studied in applying different methods to research terrorism accumulated in the EU countries. In the third phase (2011-2012) the Bulgarian practice of counterterrorism was analyzed. We also formed the basis for modeling the relationship between terrorism and the economy.

The object of study in the research project is terrorist threats posed and terror-related events unfolding in Bulgaria and in other European countries. The topics of study during all three stages are somewhat different and are determined by the specifics of the research at each stage.

The main topic at the first stage is the economic aspects of terrorism at the national and regional level and their impact on economic growth, the real economy and several important sectors. At the second stage, the topic of the study is the specific economic impact of terrorism on sectors of the economy such as tourism, insurance, private business, energy, transport and others. During the third phase the impact of terrorism on other sectors such as insurance, transportation, cyber security was investigated. The economic aspects of counterterrorism measures, legislation and strategic documents on counterterrorism, as well as counterterrorist units were also subject to analysis.

The aim of this study is to highlight the range of economic consequences of terrorism and the classification of the costs involved in different sectors of the economy at the national and regional levels.

2. Main findings

During the first stage of the study some general questions concerning the clarification of the content and scope of certain categories such as terrorism, counterterrorism, targets of terrorist organizations were addressed. The experience of some countries in defining the economic aspects of terrorism like UK, Spain, USA, Northern Ireland, Turkey and Italy was also studied. As a result of the research we formulated some conclusions on terrorism as an economic activity, which can be summarized as follows: (See Dimitrov, 2010).

1. Economic aspects of terrorism are one of the least studied areas.
2. Terrorism, terrorist acts, and the existence of terrorist organizations require certain resources – human, financial and material, intelligence and organization.
3. In addition to direct damages, terrorist activities affect society also economically. As a result of the terrorist acts society incurs certain losses that have different dimensions – direct, indirect, short-term, sector, etc.
4. Fighting against terrorism requires resources related to spending on defense, domestic and information security, intelligence, the protection of critical infrastructure and other key assets.
5. The private sector is aware of the possible terrorist threats and spends certain resources on improving security.
6. Terrorism as a phenomenon has aspects which are interesting for economic

analysis, such as the preparation of population, changes in business and individual behavior as a result of terrorist threats, environmental issues, international relations, support of development and advances in science and technology.

7. Terrorist organizations choose when, where and how to carry out their attacks. They operate under certain restrictions. In economic terms the restrictions of terrorists are related to the production costs involved - the cost of labor, capital, entrepreneurial activity and other costs a given terrorist organization sustains.

8. Government actions in the area also follow an economic logic as they also require resources. Furthermore, expenditures allocated to combat terrorism cannot be maintained at a very high level for a long time. Governments also face the need to make a choice – a choice between different alternatives as to how much funds to spend, how to spend the allocated funds and for what purposes.

9. The economic aspects of terrorism include three areas:

- Resources for carrying out terrorist activities;
- Direct and indirect damages (losses) connected with the realization of terrorist acts or terrorist threats;
- Resources needed to combat terrorism;
- In the second phase of the study, our attention was focused on performing tasks along two directions. First we concentrated on analyzing the impact of terrorist attacks on the various sectors

of the economy, namely households, insurance, major energy projects, transport sector, tourism, the properties of social infrastructure, communications, cyber terrorism and others. The second direction was related to the methods and tools applied to the examination of the economic aspects of terrorism and counterterrorism. The main conclusions we reached in this phase fall under in two groups and can be summarized as follows (see Dimitrov, 2012a):

First – in terms of impact on different sectors:

1. The vulnerability of a certain sector to a terrorist act depends on its criticality, the nature of the incurred material damage and human casualties (actual or potential);

2. The knowledge of the size and amount of costs and damage brought about by terrorist acts may be used with a view to the prevention and elimination of consequences associated with rapid response of state authorities. The effectiveness of anti-terrorism measures can also be assessed from an economic point of view;

3. Terrorism has a different effect on the different segments of the economy. The severity of the impact depends on the type and purpose of the attack – whether the sector suffers a direct attack or its assets are affected by the destructions caused;

4. There is no agreement within the research community on how terrorism affects consumption and household savings. The difficulty in estimating the savings in troubled regions, the gray sector of the economy

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and human fears further complicate the identification of the real interdependences;

5. The actual amount of direct losses that terrorist attacks bring to companies largely depends on their structure, the type of attacks and the amount of damage they cause. Terrorist attacks and political instability have a strong negative impact on the normal functioning and development of business;

6. The risk of terrorism is associated with features that make it difficult to evaluate and hedge against;

7. Large energy facilities belong to critical infrastructure. As elements of such a system they are essential to the economy and society at large. Their destruction or damage would affect vital interests. Therefore they enjoy protection of the highest priority;

8. Transport is one of the economic sectors that is most vulnerable to terrorist attacks. Blocking the important transport connections brings large losses to transport companies;

9. The assessment of the impact of terrorism on tourism varies considerably because the structure of the tourist industry and the nature of terrorist acts differ not only across countries but also over time;

10. Due to their social significance and easy access, public infrastructure properties are the prime targets of terrorist groups;

11. The impact of terrorism on the media is enormous and will inevitably continue to expand;

12. Cyber terrorism is a relatively new and "modern" means used by terrorist

organizations and individual terrorists. It is characterized by low costs for terrorists and continuously growing costs for countries in the prevention and protection of and response to such acts;

13. Despite considerable losses and limited funding, terrorism as a whole adapts to the dynamically changing conditions. Decentralization is its most typical feature nowadays. There is an impending threat that terrorist structures will get access to biological and chemical weapons. Under certain conditions such weapons can produce an effect which is similar to that of nuclear weapons, while their production inputs are far more affordable;

14. National, regional and global responses to terrorism in the 21st century must be complex. They encompass various measures, ranging from police raids and border controls to intelligence and measures in the financial sector as well as measures in the area of criminal law and information technologies.

Second – in terms of the research methods and tools:

1. Various methods and tools can be applied in the investigation of the economic aspects of terrorism, which have different utility;

2. The areas that are relatively best provided with methods and tools are the strategy for combating terrorism and the justification of anti-crisis measures, whereas the area of sources of financing terrorism is relatively least provided with research tools;

3. The system of applied methods can be further grouped along two directions: first – exploring the possibilities of using other methods, second – extending the scope of application of existing and known methods;

4. Knowledge in the economics of terrorism will provide further insights and expose the hidden aspects of this phenomenon. Better knowledge in this area will improve the potential to develop successful policies aimed at curbing the phenomenon, minimizing its damage to society and evaluating the anti-terrorist measures;

5. Scenario planning as a research method can contribute significantly to identifying the expected outcomes of public policies, aimed at preventing and combating terrorism and to improving the assessment of the possible resources and efforts that the implementation of such policies requires.

During the third stage of this research, the main emphasis was placed on the analysis of the Bulgarian practice. The subject of analysis was various research projects implemented in the country in this field. In particular the subject of analysis was the information on terrorist acts available in the country, the regulations related to the fight against terrorism, the experience of the structural units for combating terrorism.

The main conclusions resulting from the research at this stage can be formulated as follows, (see Dimitrov 2012b):

- In recent years there is a growing number of scientific papers in the country that are

dedicated to the topic of terrorism and counterterrorism. This can be explained by the fact that the phenomenon is considered as a major threat to contemporary society. Moreover, our country is part of the allied war against terrorism in all its forms;

- The majority of studies address questions such as the nature of terrorism, its manifestations, causes, types and ways to fight it;
- The psychological aspect of terrorism has been given due attention, not only in the research conducted by psychologists. Many of the studied materials, whose authors are lawyers and philosophers, attempt to clarify the psychological and psycho-social aspects of the problem;
- There are various papers that analyze the problem in terms of its economic dimensions – the financing of terrorism, economic damage to countries exposed to a high risk of terrorist attacks, counterterrorism costs and others.

3. Methods and tools for the study of the economic aspects of terrorism and counterterrorism

This part of the study is based on the following logic. The analysis of the results of the first two phases of the study the main directions were established in which the economic aspects of terrorism and counterterrorism can be examined. The available publications on the application of field-specific research methods and tools were studied. As a result the methods and

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tools which are to be further investigated were shortlisted. They were examined with regard to their possible application within the main directions mentioned above.

We identified that the following directions for the study of the economic aspects of terrorism and counterterrorism are most important (Dimitrov, 2010):

1. Sources of financing terrorism;
2. Cost of terrorist acts;
3. Cost of anti-terrorist action;
4. The vulnerability of the sectors of economic life to terrorist acts;
5. The means employed by terrorists;
6. The targets of terrorist acts;
7. Types of terrorist organizations and their modes of operation;
8. Direct and indirect economic consequences of terrorist acts and threats;
9. Strategy for Combating Terrorism;
10. Anti-terrorism measures.

Based on interviews with experts working on the project we identified the methods and tools that are widely used in the study of the economic aspects of terrorism and counterterrorism. The most important ones are further elaborated on.

Statistical Methods

There are organizations that conduct long-term monitoring and maintain databases with information about terrorist acts over an extended period of time. In the field of International Terrorism such databases include Attributes of Terrorist Events (ITERATE), Global Terrorism Database (GTD), Worldwide Incidents

Tracking System (WITS), Database of Terrorist Incidents and others. These databases allow for an in-depth statistical analysis, despite the insufficient information at times.

Researchers argue (e.g. Enders and Sandler, 2006) that statistical observations on terrorist acts over a long period can be used to forecast terrorist activity and assess the outcome of specific anti-terrorist actions taken by the international community. Statistical analysis can support or reject a hypothesis about the dynamics of terrorist activity and the existence of certain long or short term cycles in this activity. Spectral analysis provides for the analysis of cyclical phenomena.

For instance, researchers have found that, contrary to the impression that media reports may create, there is no rising trend in terrorist activity.

Game Theory

Game theory is a part of Applied Mathematics and Operations Research. The use of models based on this theory assist rational decision making in times of conflict. The first systematic paper on game theory was published in 1943 by John von Neumann and Oskar Morgenstern (see for example Neyman, Morgenshtern (1970) and Gichev, Karamiteva (1980). Since then the theory has developed both in terms of tools and ways of their application in various fields of human activity.

The possible application of game theory to the study of terrorism and counterterrorism

is defined by the fact that in this field there are distinct players who have conflicting objectives. Players can choose among different activities and their utility will be determined not only by their choices, but the choice of the other player – the enemy.

There are studies in world practice that use models of game theory. Francois Melese (Memon, Farley, Hicks, Rosenorn, 2009, p. 319-332), for instance, presents a model of a situation in which a world leader conducts a risky policy (brinkmanship) involving preventive action to deter sovereign states or international terrorist organizations from acquiring weapons of mass destruction.

Other examples are the models developed by Enders and Sandler. One of the models shows that a state policy for terrorism prevention which is prepared in a "piecemeal" fashion may be more dangerous than the absence of such a policy (Enders, Sandler, 1995, p. 214-247). The two authors offer another model (Enders, Sandler, 2006, p. 92-108; Sandler, Enders 2007) that explores alternative strategies to combat terrorism and the possible cooperation of individual players (for example the United States and the European Union).

Risk Modeling

In world practice there is a variety of models designed to assess the intensity of the risk of terrorist acts in countries and regions. For example a model developed by Glenn Koller (2000, p. 21-66) evaluates the relative and absolute level of risk. The model can be used both by corporations and government institutions.

The relative and absolute level of risk is determined on the basis of expert opinions. According to the author, an important issue in such an assessment is that the expert team should reach a consensus on the evaluated parameters. Experts estimate the level of risk in terms of broad categories – organization of the terrorist group, funding, experience and technical skills.

The relative risk level for a country is identified by making a comparison between the values of the selected indicators for the analyzed group of states. The absolute level of risk is measured by the expected additional costs for counterterrorism activities or those could occur in the eventual terrorist act.

Risk modeling can be applied in the evaluation of alternatives for the implementation of specific investment projects in different countries. The aim is to compare the options on the level of risk of terrorist acts that could prevent the implementation of the project or worsen the outcome of its completion. Government institutions can use the method in shaping the foreign policy of a country.

Matrix "Asset criticality – consequences"

This tool allows evaluation of the assets of an organization in terms of their criticality for the organization's functions and severity of the consequences in case they are damaged or destroyed (see Norman, 2010).

As "assets" are considered persons, fixed assets, information or business reputation. The criticality of the asset is estimated in terms of its importance with regard to

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the implementation of the organization's goals and mission. The assets which are essential for the implementation of the organization's goals and mission can be assessed as critical. Furthermore, criticality can be internal or derivative. Internal criticality is evaluated according to the degree of the asset's importance in the fulfillment of the mission of the organization, while derivative criticality depends on the damage that will occur due to the loss of the asset. The level of criticality can also be evaluated in terms of costs and their possible recovery.

The assessment of the consequences of the loss of an asset is estimated in the following possible events: mass casualties, loss of property, loss of information, environmental impact, and loss of business reputation.

Interviews with experts

This is a very effective tool which is fairly simple to use. By using this method one can find answers to a series of questions, concerning the sources of risk from terrorist actions, the level of threat of such actions, the strategy and tactics of certain terrorist groups, the strategy and tactics of fighting against terrorism. The method is not suitable for the analysis and prediction of complex objects and processes that require knowledge in various scientific fields.

Comparison with analogues and systematization of best practices.

To use this method one needs to look

for similar objects that are already measured in terms of the risk of terrorist acts. The similarity can be sought in terms of the products or services, technology, functions performed, social significance etc. Objects for comparison can be found both in the country and in other countries. The systematization of best practices has been gaining popularity in recent years. There is an increasing likelihood that analogues for comparison and sufficient information about them be found. It is possible to search for best practices in the assessment of the risk of terrorist acts, the orientation of counteractions, actions to reduce the likelihood of terrorist attacks, etc.

Methods in support of decision making

Decisions taken in the field of counterterrorism are a specific type of managerial decisions. Therefore all rules and procedures typical of making managerial decisions of a general nature apply to them. In different situations, different government bodies, institutions and individuals have to make many decisions concerning the allocation of resources devoted to counterterrorism and specific action in the field.

After the analysis of the characteristics of managerial decisions in the fight against terrorism the following characteristics have been identified:

1. Security sector, (part of what are decision making bodies in the area of counterterrorism) produces a public good that is hard to measure and estimate in terms of the resources spent on its production;

2. Decisions are typically risky;
3. The implementation of decisions requires significant resources;
4. Some decisions at the strategic and tactical level are taken by a collective body. Other decisions, especially at the operational level, are individual;
5. The market structure of security sector is specific. A state represented by the institutions in charge of the fight against terrorism is the only buyer. Potential suppliers are usually only one or a few (limited in number) companies. As a result, market forces cannot possibly be relied on to determine the price and other conditions laid down in the contract for the award of the public procurement of assets. It is essential that competition between suppliers is encouraged as much as possible, a cost tracking system for producers is maintained and the price-cost liaison is regulated;
6. Part of the information necessary for decision making is classified and is not accessible by a sufficiently broad range of people to ensure transparency;
7. Decisions should comply with a set of strategic and program documents that define the objectives, priorities and criteria for evaluating alternatives;
8. The risks of terrorism are dynamic. Security forces continually invest in actions taken to reduce the vulnerability of targets while terrorists can continuously change their preferred targets;
9. There are insufficient resources to eliminate all risks or to comply with all established security standards and requirements;

10. There are too many possible scenarios to carry out terrorist attacks, as well as alternatives for protection. It is therefore very difficult to evaluate all possible combinations of measures (portfolio of measures) to mitigate the effects of terrorist attacks. Theoretically these combinations can be thousands or millions in number;
 11. The available historical data for terrorist acts is limited. Therefore there is high uncertainty in the assessments of threats, the vulnerability of the targets and the consequences of the terrorist acts;
 12. Risks of terrorism are assessed mostly on the basis of subjective judgments. Although most researchers say that risk is a function of threat, vulnerability and consequences, there are various theories suggesting how to account for these components (the characteristics 8 – 12 are adapted from Dillon, Liebe, Bestafka, (2009, p. 322).
- Decision making in the field of counterterrorism requires that a set of constraints and criteria are taken into consideration. The main constraint (valid in all study areas) is the lack of resources in the budgets of the central and local government authorities dealing in counterterrorism. There are some limitations typical of certain study areas. Sometimes there can be shortages of skilled and trained staff in decision making in specific situations. Significant constraints involve the possible lack of information. A possible constraint may occur if the political parties in parliament fail to reach a sufficient consensus on the importance of

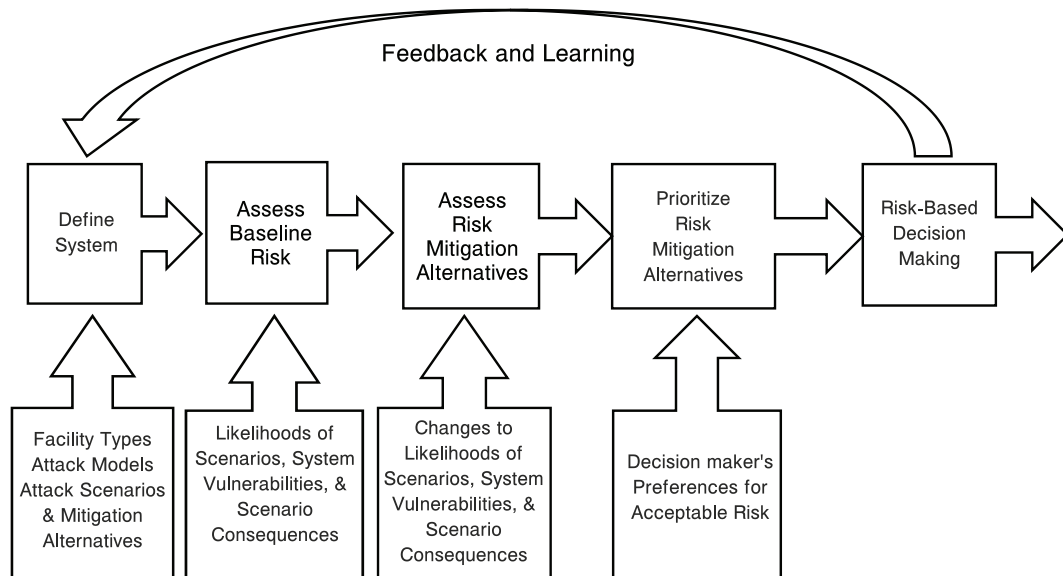


Fig. 1. Risk-based decision making

counterterrorism issues in decision making with regard to amendments in legislation.

The literature in the field offers a model in support of decision making based on the risk assessment of terrorism – Anti-Terrorism Risk-Based Decision Aid (ARDA). The model (Dillon, Liebe, Bestafka, 2009, p. 321-335) allows for prioritizing the potential measures to combat terrorism. It was developed as part of a larger project to evaluate the necessary investment for the protection of the US Navy. The overall concept for the construction of the model is presented in figure 1.

At the initial stage the system to be analyzed is identified. This requires the following datasets: potential targets, types of terrorist attacks, attack scenarios, alternatives to mitigate risks. Potential targets may be specific military installations or groups of facilities such as office buildings, airports,

ports, repair stations etc. It is necessary to collect information about the vulnerability of facilities and their level of importance for the implementation of a defense mission.

The terrorist attacks analyzed in the study are distinguished according to the type of weapon used and their method of delivery: small arms and personal weapons, taking of hostages, small or large vehicles, small or large vessels, small or large aircraft, swimmers' conventional explosives, chemical, biological or radiological weapons. Types of terrorist attacks are ranked according to the degree of technical complexity of their implementation.

Alternatives to reduce risks are associated with various possible measures to enhance security or mitigation. The study analyzes 22 such alternatives, which include technology to improve the oversight of security, access control, the protection of sea borders,

readiness of medical units to respond in case of accidents, inspections, setting up regional operating centers. Not only the alternatives but also possible combinations between them (portfolio of alternatives) can be assessed.

The literature (e.g. Barry, Bennett, von Winterfeldt, Sokolowski, Collins, 2010, p. 579) on the analysis of terrorism presents two sets of logic tree models. The first group includes the probability tree, the tree of events and the decision tree. The second group includes the fault, the attack and the success tree.

The probability tree allows for the graphic representation of all events in a particular situation and calculating their probability by applying algorithms of probability theory and formulas for the calculation of conditional probabilities. Nodes in the model refer to specific possible events. Events are connected with the branches that reveal the logical possibilities of combining events. The probabilities of matching between events are assigned to the branches. It is thus possible to calculate the likelihood of occurrence of each event from the model.

Events tree is based on "from the present to the future" logic. It is possible through this tool to model the relationship between a specific causing event and the different effects that it can produce. Branching tree reflects the occurrence of subsequent events and the possible reactions to them. Each branch can be studied as a possible scenario for the event's appearance. It is possible also to calculate the probability of occurrence of each scenario.

Decision tree models can reflect both the possibility to take different actions as well as their results. When using the model for the analysis of terrorism and counterterrorism one can choose between the following options (Barry, Bennett, von Winterfeldt, Sokolowski, Collins, 2010, p. 580-581):

1. The decisions of terrorists are represented as decision nodes, while the actions of the defense system – as result nodes;
2. The decisions of the defense system are represented as decision nodes, while the terrorist attacks – as result nodes;
3. The decisions of both the terrorist and the defense system are represented as decision nodes.

Using the decision tree models is usually based on two assumptions that sometimes provoke disputes. The first assumption is that terrorists are rational actors. In other words the terrorist as a decision maker is presumably able to distinguish between the possible outcomes of each decision, arrange the outputs according to certain measures and then to choose the optimal outcome (Keast, 2009, p. 9). There are many arguments in favor of the statement that terrorists do not always act in accordance with the rational actor model. Moreover, it is not always possible to identify all the objectives and the corresponding objective function according to which the terrorist will optimize his decisions if he presumably operates according to the rational actor model.

The second assumption is that the terrorist is an intelligent adversary. In many cases in which it is necessary to take risky decisions the so called fight against nature takes place.

In other words, risk events can happen with a certain probability. This is the basis on which decisions for countermeasures are made. In the field of terrorism and counterterrorism one can expect that after selecting certain anti-terrorism measures, the terrorist will be able to change his strategy and to take remedial action in line with the new situation to achieve his own goals and promote his own interests.

Fault tree and success trees can be seen as complementary tools. Fault tree is a graphic model for different parallel and sequential combinations of faults that could bring about a predetermined adverse event. Likewise, the success tree reveals the combinations of events that lead to the occurrence of a predetermined event that could be defined as success. Any fault tree model can be transformed into an equivalent success tree model (Fault Tree Handbook 2002, p. 4).

Using the above methods can be facilitated by applying the appropriate software. Examples of such products are FaultTree+ of Isograph¹, ITEM Software², Windchill FTA of PTC³.

The attack tree is a modification of the fault tree. This model provides for systematizing the ways a system can be attacked and analyzing the possibility of building systems sustainable to these attacks. This model can be used to evaluate the means to counter terrorist attacks. It is widely used in the field of information security for the analysis of possible attacks

launched against software systems. There are software products that support the analysis using the methods of attack tree such as a SecurITree of Amenaza⁴.

Risk Response Matrix

This method is intended to systematize the major risks posed to a project implementation or operation of a facility as well as the possible strategic responses to risks. It provides the opportunity to expose both the positive and negative impacts of each of the strategic actions for each risk. The matrix can also expose both the positive and negative mutual influences between the planned strategic actions.

Graph theory models

The methodology of graph theory and graph models is widely applied in several areas. The literature presents ample opportunities for the application of this theory in the study of terrorism.

Graphic models can be used to identify the connectivity and intensity of the relationship between individuals or groups who form a terrorist cell or network. It is possible, for example, to draw a graph, where the nodes represent individuals while arcs – the relationships between individuals. The length of the arcs reveals the intensity of the relationship between individuals. This intensity can be measured by the number of the identified contacts or other specific indicators. These links can be unidirectional or bidirectional. It is assumed that the intensity

¹ <http://www.isograph-software.com/ftpover.htm>

² <http://www.itemsoft.com/>

³ <http://www.ptc.com/product/windchill/fta>

⁴ http://www.amenaza.com/SS-what_is.php

of the relationship is inversely proportional to the distance between individuals.

Such an approach provides for the exploration of established terrorist networks and the identification of newly emerging or newly discovered networks. If sufficient information is collected about the financial relationships between individuals and terrorist groups it will be possible to track the existing cash flows and thus make valuable conclusions on the financing of terrorist organizations.

When applying this approach account should be taken of the difficulties in gathering the necessary information as well as its possible manipulation.

Application of system dynamics methodology

Methods of system dynamics have been applied in business management since the middle of the last century. The methods are designed for the study of complex dynamic systems, initially in industry and later on in other systems such as the economic, social, and environmental ones, among others. The credit for the development of the methodology goes to Jay Forrester. In Bulgaria this methodology is known from the publication of his book "Fundamentals of Cybernetics of the enterprise (industrial dynamics)" (Forrester, 1971).

At the core of the methodology lies the assumption that complex systems should be studied on the basis of the analysis of interrelated processes and flows over time rather than on single events. Forrester

identifies different interrelated streams in activities of the industrial enterprise (Forrester, p. 11). An important point is the ability to grasp the direct and reverse causal relationship between phenomena and processes, both positive and negative.

The system dynamics methodology is suitable for modeling complex human systems, such as terrorist organizations. It can be possibly applied to analyze and forecast the behavior of an organization. Consider, for example, the following model of causality to explain terrorist activity, shown in figure 2.

This model can be used with a specialized software to monitor the behavior of a system during a given time interval. Suitable software was developed as early as in the 1980's (See for example Dostoynova, 1982). Nowadays it is widely used Vensim software, developed by Ventana Systems (Vensim, 2007).

Conclusion

Based on the study of the existing methods applied to the various economic aspects of terrorism and counterterrorism the following conclusions were drawn:

1. World practice knows many methods and tools that can be used to support counterterrorism at different levels and to make managerial decisions in all functional areas.
2. The areas of Strategy for Combating Terrorism and anti-crisis measures reasoning are relatively best provided with research methods and tools. Also, there are sufficient research tools in place to analyze the targets

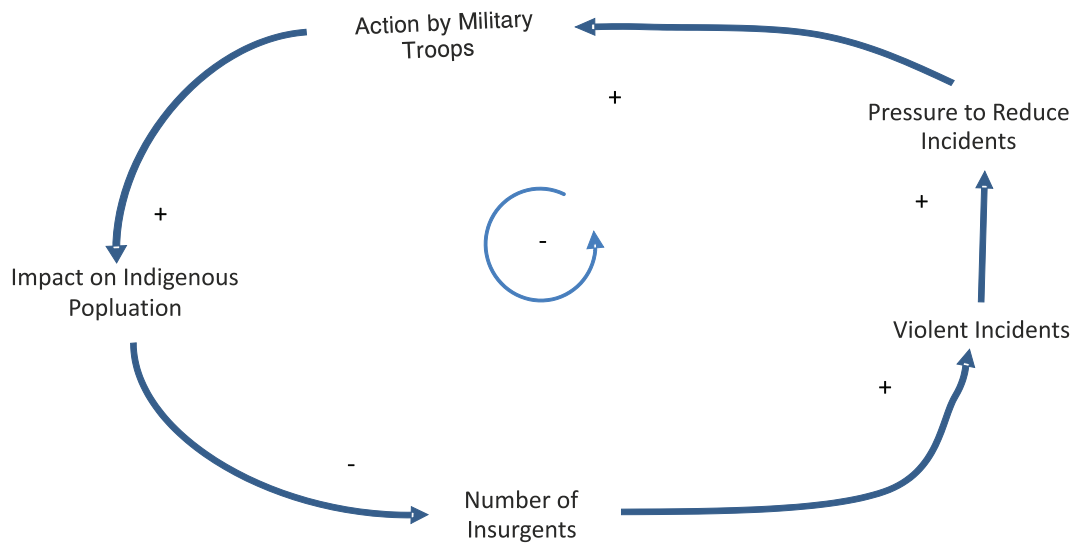


Fig. 2. Diagram of causality to explain terrorist activity

Source: Barry Charles Ezell,¹ Steven P. Bennett, Detlof von Winterfeldt, John Sokolowski, and Andrew J. Collins, *Probabilistic Risk Analysis and Terrorism Risk*, *Risk Analysis*, Vol. 30, No. 4, 2010, p. 585.

of terrorist acts and justify the allocation of the funds needed for counterterrorism.

3. The areas of sources of financing terrorist activity are relatively least provided with research tools.

4. The existing set of methods can be developed along two lines. The first one involves exploring the possibilities of using other methods, and second one - extending the scope for the application of the available and known methods.

5. There is awareness in the country that experts dealing with the theoretical issues of terrorism and counterterrorism can use most of the methods offered.

6. The Bulgarian institutions have shown a sufficient potential of theoretical knowledge and research experience in implementing some of the methods.

7. Insufficient is the accumulated statistical information that can be used in

the development and application of such methods and models.

8. It is appropriate that researchers should apply quantitative methods to security to extend their research on the possible application of the presented methods in the Bulgarian practice. They can be adapted and equipped with software that is suitable for their application.

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