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AUTHOR'S CONCEPT OF THEORETICAL JUSTIFICATION AREAS OF COUNTER-TERRORISM. ECONOMICAL BASED LOGICAL-MATHEMATICAL MODELS

Oleg V. Bazhenov (a)*, Denis V. Baev (b)

* Corresponding author

(a) Federal State Automonous Educational Institution of Higher Education "Ural Federal University named after the First President of Russia B.N. Yeltsin", Mira, 19, Yekaterinburg, 6819@list.ru, +79126302878
(b) Federal State Automonous Educational Institution of Higher Education "Ural Federal University named after the First President of Russia B.N. Yeltsin", Mira, 19, Yekaterinburg, denis-baev@list.ru, +79122947175

Abstract

In this article, the authors examine how to use logical and mathematical models (by the example of the balance model and the two-factor Altman's model), to estimate the potential of a terrorist threat that is determined as a complex concept which reflects the state of terror among the various microenvironment and macroenvironment levels. These levels are obtained by extrapolating the existing economic methods for the purposes of theoretical justification of counter-terrorism areas.The article is recommended for social engineers in order to developcounter-terrorism's ways. The purpose of this study is to present the author's concept of identifying areas to prevent the terrorist threat based on the extrapolation of existing economic models.
To achieve this purpose, the following tasks were accomplished:
1) present the authors' definition of potential terrorist threats; 2) form balance models of the terrorist threat of the medium micro and macro level; 3) demonstrate the way of using these balance models, where the informational basis is to assess the potential terrorist threat and study areas of counter-terrorism.
The following general scientific methods of study were used: analysis, synthesis, comparison, generalization. And also, specific methods of economic analysis: balance generalization, methods of rating evaluation, methods of complex probability assessment of the insolvency of the study subject.
The obtained results can be used by the executive authorities and law enforcement agencies for the purpose of increasing the effectiveness of the fight against terrorism.

1. Introduction

The urgency of the struggle against the terrorist threat in the world today is an important factor in the development of a socio-political process. The end of the twentieth century and the beginning of the XXI century was marked by an active struggle against illegal gang formations on the territory of a number of states, such as: Syria, Iraq, Libya, North Caucasian regions of Russia, etc. The consequence of which was and is the realization of terrorist aggression in the regions of the anti-terrorist operations, and beyond.

According to the current legislation of the Russian Federation, terrorism – the ideology of violence and the practice of influencing the decision-making bodies of the government, local authorities or international organizations related to the intimidation of the population and (or) other forms of illegal acts of violence.

Thus, terrorism has been and remains the most significant threat to national security and social stability of the area.

Applications of evaluation of a terrorist threat have used many different methods and approaches. Examples of methods that have been applied include gender aspects (Holman1, 2016), risk models (Willis, 2008; Zafar, 2016) agent-based models (N-ABLE, 2006; Tsvetovat & Carley, 2002), game theory (Kunreuther, 2005; Bier et al., 2005), economic input-output models (Haimes et al., 2005; Gordon et al., 2007), probabilistic risk analysis (Rosoff, & von Winterfeldt, 2006; ASME, 2007), operations research approaches, drawing upon queuing theory and decision analysis (Martonosi et al., 2005; Wein et al., 2006), and probabilistic models developed and used in the insurance industry (Willis et al., 2005; Willis, 2007; Carroll et al., 2005; Doherty et al., 2005).

But nevertheless,there is no accepted methods to evaluate a terrorist threat, therefore authors developed their own concept, based on extrapolated logical-mathematical models that are used all over the world in the field of economy.

1.1   Problem statement

Our proposed concept examines how to use logical and mathematical models to estimate the potential terrorist threat that are obtained by extrapolating the existing economic methods for the purposes of theoretical justification areas of counter-terrorism.

1.2   Research questions

The following questions have been addressed during the study to:
- present the authors' definition of potential terrorist threats;
- form balance models of terrorist threat ofthe medium micro and macro level;
- demonstrate the way of using these balance models, where the informational basis is to assess the potential terrorist threat and study areas of counter-terrorism.

1.3   Purpose of the study

Because the known ways of terrorist threat's evaluation haveseveral significant deficiencies, the relevance of the topic causes no doubt. The aim of our research is to develop an effective way of

estimating the potential of terrorist threat,using logical and mathematical models based on the data of balance models of terrorist micro- and macroenvironment.

2. Methods

Based on the broad diversification of the causes of terrorist aggression, deep secrecy terrorist networks and the international nature of the threat, the struggle against terrorism requires significant manpower, material and time costs. In this regard, the question,concerning the forming of the principles of justification of the most effective areas of the fight against terrorism,remains. For a description of these principles, it is first necessary to formulate the main factors influencing the potential terrorist threat. At the same time, a potential terrorist threat is a probability of terrorist attacks in a certain area in a certain period of time.

Potential of terrorist threat is a complex concept which reflects the state of terror among the various levels:

-microenvironment – the level of the individual artist or territorial cells;

-macroenvironment – the level of individual state and interstate cooperation.

In order to most accurately take into account the factors that influence the potential terrorist threat (regardless of the medium scale),these factorsmust be more detailed and based on the characteristics of forming a terrorist environment of each particular level. This is important not only for property state of the environment, but also for the sources of its formation. According to authors, the most visible form of environment representation at any level is the appropriate balance model.

Microenvironment. The balance model of terrorist microenvironment can be represented as follows (the authors' view) (Table 1).

Table 1. Balance model of terrorist microenvironment

ASSETS	LIABILITIES
I. Intangible assets	
1. Ideology 2. Professional skills 3. Others	1. Ideological commitments 2. Personal reasons 3. Targeted funding 4. Others
II. Tangible assets	
1. Means of terror (weapons) 2. Means of communication 3. Means of secrecy 4. Organizational structure 5. Cash and cash equivalents 6. Others	
Total ASSETS	**Total LIABILITIES**

We will characterize the basic components of the balance model of terrorist microenvironment shown in Table 1.

The Intangible assets characterize the theoretical readiness of a particular person to commit a terrorist act:

-ideology is a system of values and judgments;

-professional skills are the level of trainings that is necessary and sufficient to carry out a terrorist act.

The Tangible assets reflect a list of property (assets) and an organizational structure to ensure the actual implementation of the crime.

The sources of assets formation are as follows:

-the ideological commitment is a motivator formed from the existing system of values and judgments;

-personal motivation is a motivator formed by means of the existing subjective reasons (personal animosity, revenge, blackmail, profit, health and so forth);

-target financing - the main source of the creation of tangible assets.

Macroenvironment. The balance model of terrorist macroenvironment can be represented as follows (the author's view) (Table. 2).

Table 2. The balance model of terrorist macroenvironment.

ASSETS	LIABILITIES
I. System forming assets	*III. System forming liabilities*
1. Intangible assets 1.1. interstate cooperation 1.2. Interaction supporters of the ideology within states 1.3. Ideology 1.4. Technologies 1.5. Control system 1.6. Other	1. Ideological commitments 2. The business interest 3. The political interest 4. Targeted financing 5. Other
	IV. Long-term liabilities
2. Tangible assets 2.1. Market of terror and other special means 2.2. Affiliated businesses 2.3. Affiliated financial sector 2.4. Potential participants 2.5. Schools and base 2.6. Ideological centers 2.7. Loyal people 2.8. Other	*1. External liabilities* 1.1. Credits and loans 1.2. Other *2. Internal liabilities* 2.1. Credits and loans 2.2. Other
	V. Short-term liabilities
II. Current assets	*1. External liabilities* 1.1. Credits and loans 1.2. Other
1. Affiliated representatives of small and medium businesses 2. Current infrastructure 3. Other	*2. Internal liabilities* 2.1. Credits and loans 2.2. Accounts payable 2.3. Other
Total ASSETS	**Total LIABILITIES**

We will characterize the basic components of the balance model of terrorist macroenvironment shown in Table 2.

The System forming assets are the basis for providing main tasks of micro- and macroenvirenment: social, economic and political centre functions.Such assets are characterized by a long useful life and are the basis for the formulation of strategic decisions. The System forming assets section is divided into two components: the intangible and tangible assets. The main characteristic of intangible assets is the lack of the material form.In spite of this, their value for a given level of the terrorist environment is decisive. Tangible assets are a tangible form and the appropriate response.

The Current assеts reflect the property of the micro- and macroenvironment. This property is characterized by a constant changing of materials in dynamic.

The System forming liabilities are aimed for information categories, reflecting the fundamental liabilities, the main reasons, inducing the formation and maintenance of the existing terrorist environment.

The Long-term liabilities and Short-term liabilities reflect the size of the environment's debts to the external and internal borrowing. External liabilities represent the amount of debt owed to non-residents of the state, internal – to residents, both in fact and in other case, the creditors may make individuals, legal persons and other states.

Further, we consider a number of models to prove the most effective (according to the authors' hypothesis) directions of counter-terrorism.

2.1 The balance model

This model is based on the primary balance rule, namely, equality of outcome asset and a liability.

The first phase of this model, it needs to conduct a qualitative assessment of the indicators presented in the balance sheet models in Table 1 and 2, it means to evaluate every line of assets and liabilities, for example, on a 5-point scale (from -2 to 2). In this case, the negative values will be indicative of the negative impact of factors on the terrorist environment, positive values is a positive impact, the zero value – an insignificant impact. The rating is based on the analysis of statistical data and actual terrorist environment or by expert scoring, or using techniques ballroom-rating methodology.

In the second phase, it adds a quantitative assessment of the quality indicators, it means on the basis of statistical evidence and assign a weight to each factor value of assets and liabilities.

Then the total balance sheet equity for any level of the terrorist environment takes the following form:

$$Y_1A_1+Y_2A_2+\ldots+Y_iA_i = X_1L_1+X_2L_2+\ldots+X_jL_j \quad (1)$$

where:

$A_1\ldots A_i$ – high-quality value of the asset lines in the balance model of the terrorist environment at all levels;

$Y_1\ldots Y_i$ – the weight value of the asset in the balance model lines terrorist environment at all levels;

$L_1\ldots L_j$ – quality value of liability lines in the balance model of the terrorist environment at all levels;

$X_1\ldots X_j$ – the weight value of liability lines in the balance model terrorist environment at all levels.

In the third phase based on statistical data it determines by the qualitative characteristics of assets and liabilities included in the balance model in which:

- the potential terrorist threat is estimated as maximal;

- the potential terrorist threat is assessed as high;

- the potential terrorist threat is assessed as significant;

- the potential terrorist threat is estimated as average;

- the potential terrorist threat is estimated as insignificant;

- the potential terrorist threat is assessed as minimal.

In the fourth phase, on the basis of actual data is calculated and estimated current potential terrorist threats and develop measures for its reduction. At the same time with limited means and capacity of law enforcement agencies reducing the potential terrorist threat comes from the current to the following order

with significant amounts of assets and capabilities of law enforcement activities may be developed aimed at reducing the potential terrorist threat on several levels.

2.2 Rating evaluation

This model is based on the calculation and subsequent analysis of the outcome of the rating on the basis of the data of balance models terrorist micro- and macroenvironment.

The order of the rating: the first and the second phases are qualitative and quantitative assessment of indicators of assets and liabilities in the balance models are appropriately reflected in the description of the balance model.

In the third phase, it is necessary to form a system of key performance indicatorsfor each level of the terrorist environment.

At the same time, forming the system of key performance, indicators should be guided as follows:

1. Indicators in the system and their target values should not contradict each other.

2. Prohibition of quantitative overload interdependent parameters of the system (at least at the maximum analytical performance information).

3. Indicators must be essential to the full (comprehensive) assessment of the terrorist environment appropriate level.

4. Forming a system of indicators should consider the peculiarities of the most appropriate level of environmental terrorism.

5. Indicators should have a relative view.

6. Indicators should be approximately equal for the purposes of a comprehensive assessment of the overall terrorist environment.

Specific indicators are formed and calculated on the basis of statistical and factual data about the terrorist environment.

In the fourth phase, the values of the coefficients of the balanced scorecard should be consolidated by calculating the number of rating and assign an appropriate rating for each of the levels of terrorist environment.

The considered method of determining the ranking of the terrorist environment (regardless of level), that is based on the balance model, means a one-time existence of the following requirements:

- the allocation of the five classes of reliability;

- the allocation of six rating groups.

At the same time, the following settings will be guided in determining the grade of reliability:

- if the key indicator in the first grade reliability – it is given 5 points;

- if the key indicator is in the second grade reliability – it is given 4 points;

- if the key indicator in the third grade of reliability – 3 points;

- if the key indicator is in the fourth grade reliability – 2 points;

- if the key indicator in the fifth grade reliability – 1 point.

The criteria for the high potential of the terrorist threat is the greatest amount of points for key indicators.

Moreover, rating groups formed by the degree of the potential terrorist threat will meet forth above in description of the balance model.

In the fifth phase, the current potential of terrorist threatsis being estimated and measures are being developed for its reduction on the basis of the actual rating. The emphasis should be on a reducing the quality of key performance indicators presented in the system. Targeting efforts in this case will not only reduce the funds but also to catalyse the achievement of the priorities in the field of reducing the terrorist threat.

In order to form judgments about the integral territory of the terrorist environment (microenvironment and macroenvironment), the authors believe it is advisable to use a graphical method by constructing an appropriate graph.

To do this it is advisable to build a coordinate system in which the horizontal axis will reflect the rating group of the microenvironment, the vertical axis is a rating group of the macroenvironment. Then the current state of the terrorist complex environment can be represented as follows (see the conventional example in the Figure 1).
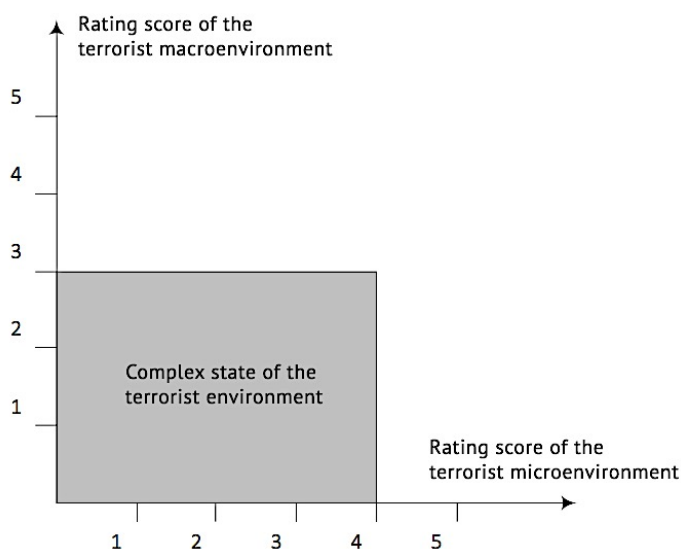

Fig.1. Conventional example of graphic reflection of complex evaluation of the terrorist environment.

2.3 Extrapolation of the two-factor Altman's model

The model is based on an analysis of the functions of some indicators, that characterise the potential terrorist environment.

The procedure for the implementation of the following models.

The first and second phases (a qualitative and quantitative assessment of indicators of balance sheet assets and liabilities models)are appropriately reflected in the description of the balance model.

In the third phase it is necessary to create indexes that characterise the degree of solvency and motivation of the terrorist environment at various levels (figures extrapolated from Altman's model, but can be changed on the basis of the current weight values of the indicators that make up the assets and liabilities of balance models). Authors' vision of similar set of indicators is formed on the basis of the balance data patterns shown in Tables 1 and 2 can be stated as follows (Table 3).

Table 3. Performance evaluation of the terrorist environment selected for the construction of two-factor extrapolated Altman's model.

N	Name of indicator	Calculating formula	
		Numerator	Denominator
Assessing indicators of the terrorist microenvironment			
1	Solvency of microenvironment (F^{mi}_1)	Tangible assets	Financing
2	Motivation level of microenvironment (F^{mi}_2)	Ideological liabilities + Personal motives	Total Liabilities
Assessing indicators of the terrorist macroenvironment			
1	Solvency of macroenvironment (F^{ma}_1)	Current assets	Long-term liabilities + Short-term liabilities
2	Motivation level of microenvironment (F^{ma}_2)	System forming assets	Total Liabilities

After the formulation of indicators, extrapolated two-factor model of Altman will be as follows:

For the purpose of terrorist microenvironment assessing:

$$Z^{mi} = X_1 F^{ma}_1 + X_2 F^{mi}_2 \quad (2)$$

where:

X_1 and X_2 are weighted value of indicators characterizing their value (calculated on the basis of statistical and actual data);

Z^{mi} – value of an assessment scoring of the terrorist microenvironment. It is calculated on the basis of statistical and factual data, and depending on the value that can characterise the potential terrorist threat (potential terrorist threat levels appropriate to make a similar representation in the description of the balance model).

For the purpose of terrorist macroenvironment assessing:

$$Z^{ma} = Y_1 F^{ma}_1 + Y_2 F^{ma}_2 \quad (3)$$

where:

Y_1 and Y_2 are weighted value of indicators characterizing their value (calculated on the basis of statistical data and actual);

Z^{ma} – value assessment scoring of the terrorist macroenvironment. It is calculated on the basis of statistical and factual data and, depending on the value, can characterize the potential terrorist threat (potential terrorist threat levels appropriate to make a similar representation in the description of the balance model).

In the fourth phase, it is being estimated the current potential terrorist threats and being developed measures for its reduction on the basis of the actual scoring of the terrorist environment of appropriate level. The emphasis should be on reducing the quality of the indicators characterizing the solvency and motivated environment.

Similarly, using the data of balance models of terrorist micro- and macroenvironment, as well as additional information, areas of counter-terrorism can be justified on the basis of extrapolation of economic models of Taffler, Springeyt, Fulmer, Golder etc.

3. Results

Thus, in this publication the authors proposed procedure for the use of logical and mathematical models to estimate the potential of terrorist threat, obtained by extrapolating the existing economic methods for the purposes of theoretical justification areas of counter-terrorism.

During the preparation of this article the following interim results were obtained:

1) present the authors' definition of potentialof terrorist threats, that is determined as a complex concept which reflects the state of terror among the various microenvironment andmacroenvironment levels;

2) develop balance models of terrorist medium micro and macro level. Balance model of the terrorist microenvironment is determined by the Intangible assets, that characterise the theoretical readiness of a particular person to commit a terrorist act.The tangible assets reflect list of property (assets) and anorganizational structure to ensure the actual implementation of the crime and appropriate liabilities. Balance model of the terrorist macroenvironment is determined by the System forming assets, which are the basis for the main tasks of the environment. The System forming assets are divided into two components: the intangible and tangible assets. The main characteristic of intangible assets is the lack of material form, in spite of this, their value for a given level of the terrorist environment is decisive. Tangible assets are in tangible form and have the appropriate response. The Current assets reflect the property of the micro- and macroenvironment. This property is characterized by a constant changing of materials in dynamic.

The System forming liabilities are aimed for information categories, reflecting the fundamental liabilities, the main reasons, inducing the formation and maintenance of the existing terrorist environment.The Long-term liabilities and Short-term liabilities reflect the size of the environment's debts to the external and internal borrowing. External liabilities represent the amount of debt owed to non-residents of the state, internal – to residents, both in fact and in another case, the creditors may make individuals, legal persons and other states.

3) it is revealed that these balance models can be the informational basis to assess the potential terrorist threat and study areas of counter-terrorism.

4. Conclusion

The obtained results can be used by the executive authorities and law enforcement agencies for the purpose of increasing the effectiveness of the fight against terrorism through targeted influence on the most significant factors in the formation of the terrorist environment of micro- and macrolevels.

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