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SECURITY EFFECTIVENESS AND COUNTER TERRORISM EFFORTS: CASE OF AFGHANISTAN

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Abstract. The United States of America and the United Kingdom with the assistance of other NATO and non-NATO states initiated an international counter terrorism campaign the War on Terror (also known as the Global War on Terror (GWOT)). However, after more than ten years the War on Terror is still in the active stage. The pivotal issue regarding counter-terrorism actions in Afghanistan, considering how much money and energy spent on them, is whether such actions are effective or not. Dynamic system simulation approach was used to investigate interactions between counter-terrorism strategies used in Afghanistan (in the context of coalition strength) and the effectiveness of these strategies (in the context of terrorist strength). Data form different sources over a ten-year-period was used for analysis (2000-2010). It was found dynamic relation between recruitment rate of terrorist and coalition manpower that depends on time adjustments. However, further research is needed to get more precise results in finding causal loops in counter-terrorism system, thus this study should be evaluated only as a framework in further similar researches.

Keywords: Security, effectiveness, counter-terrorism, Afghanistan, dynamic system simulation.

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JEL Classifications: N7, F5, F6

1. Introduction

The United States of America and the United Kingdom with the assistance of other NATO and non-NATO states initiated an international counter terrorism campaign the War on Terror (also known as the Global War on Terror (GWOT)). This counter terrorism operation was launched in 2001 with the USA and UK invasion of Afghanistan in response to the September 11 attacks. This war was led against al-Qaeda and other terrorist organizations with the aim of destroying them. However, after more than ten years the War on Terror is still in the active stage. So after such a long period it is important to evaluate the counter terrorism efforts which were used during this War. Have counter terrorism strategies been enough effective during this period of time? Moreover, are these efforts effective in present days?

On September 11, 2001 al-Qaeda terrorists hijacked four commercial passenger jet airliners. The hijackers intentionally crashed airliners into U.S. public and governmental buildings killing over 3000 civilians. September 11 attacks were a series of coordinated suicide attacks led by al-Qaeda upon the United States. The United States responded to the attacks by initiating the War on Terror, attacking Afghanistan in order to destroy the Taliban, who had covered al-

Qaeda terrorists. The U.S. and allied armed forces invaded Afghanistan and overthrew the Taliban regime in 2001–2002. Operation Enduring Freedom (OEF) started on Sunday, October 7, 2001, when American and British aircraft and cruise missiles attacked Taliban and Al-Qaeda strategic objects.

Statement of the problem. The main problem of counterterrorism activities in Afghanistan is whether such actions have been effective or not. Both huge amount of money and human resources have been spent in Global War on Terror, hence it is important to know whether we are in the right direction in this battle or not. Furthermore, we have a right to know actual course of actions of counter-terrorism because we are those who pay for this "war" and we are those whose family members and friends are dying in this fight.

Rationale. Growing expenditures of counter-terrorism actions and endless deaths among coalition forces have become a major issue. Vast amount of money have been spent developing counter-terrorism strategies. Are these expenses cost-effective, or maybe these billions of dollars should have been spent, for example, developing social integration programs for Muslims or for infrastructure programmes in developing countries such as Afghanistan and Iraq. Creating reliable effectiveness measurement system might help policy makers in solving such dilemmas.

Furthermore, this study is significant because today governments are implementing contradictory anti-terrorism efforts not concerning about their utility and urgency. It is necessary to evaluate every anti-terrorism strategy and impact of that strategy before initiating it, in order to avoid mistakes. Regrettably, as Biddle (2004) notes, for all the significant research that judges military effectiveness, assessments of anti-terrorism strategies remain superficial. Differently from conventional army strategy, there are no robust figures which could be estimated. So how it is possible in reliable way to evaluate the effectiveness of counterterrorism efforts? Lum *et al.* (2006) admit:

"there is almost a complete absence of high quality scientific evaluation evidence on counter-terrorism strategies"

and according to Morag (2005):

"a concrete methodology for studying a state's ability to cope with wide-scale terrorism remains to be developed."

Consequently, demonstrable, measurable, effective progress against terrorism is the desired goal of all countries involved in the Global War on Terror. The U.S.A. and the U.K. are particularly interested in cost-effectiveness of these enormous costs on fighting the terrorism.

This article will provide a method of measuring counter-terrorism effectiveness. However, further researches on the subject should be done to find out other applicable methods of assessing counterterrorism.

Objectives of study. The purpose of this article is to assess the effectiveness of counter-terrorism efforts in Afghanistan. The main question which needs to be answered is "how does counter-terrorism strategies effect terrorism?" Therefore, this study investigates the cause and effects using System Dynamics approach. The article focuses on causes of insurgent strength which are mainly associated with delays and disruptions in countering terrorism.

Research question 1: What are the root-causes of implementing the particular counter-terrorism strategy in Afghanistan?

Research question 2: How does coalition strength in one side affect the number of insurgents on another side?

Research method. Advanced dynamic simulation model was adopted in this study in order to better understand the interactions between particular counter terrorism strategy and terrorism activities.

Assumptions and limitations. Evaluation of success or failure of counter terrorism can be indicated in terms of direct or indirect indicators. A main problem of researchers as well as governments seeking to examine effectiveness in counter-terrorism strategies is overconfidence on quantitative data such as terrorism acts, casualties, etc., especially on indicators which may relate with advancement but not explicitly assess the effectiveness, such as the quantity of money spent on counter-terror strategies. As terrorism consists of numerous elements and its activity depends on both internal (micro) and external (macro) factors, sometimes it is difficult to predict which particular casual made a significant effect on the increase or decrease of terrorism activities. Furthermore, because of terrorist organizations and government actions secrecy there is a limit available reliable data, consequently, this research cannot reflect precise results, just main trends and rough outcomes.

2. Measurement of the effectiveness

The governments, international governmental and

non-governmental organizations and, certainly, military are seized with understanding the effectiveness of counter-insurgency operations in areas like Afghanistan. International community is desperately looking for new methods to raise effectiveness. This is because there is a huge public pressure to curb the rising spending on these high-priced operations, besides, the noble intention to create everlasting peace and security in conflict zones such as Afghanistan and Iraq have been completed only partially, they failed to fulfill their promises made to the society of the world.

The ability of international and national institutions to promote the sustainable peace and security mostly relies on a capability to act constructively and collectively– to do the *right* things, at the *right* times, in the *right* ways, using the *right* means – and to measure in the objective way the effectiveness of complex operations (Meharg 2009).

It is understandable that an armed forces is effective to the extent that it uses its capabilities to destroy the hostile military while keeping save its own units—holding situational (role as attacker or defender) and environmental factors (natural barriers such as mountains, forests, or the weather), force size, and weapon technology constant (Biddle 2004; Dupuy 1992). Consequently, three outcomes could be presented: firstly, military effectiveness is an inherently dyadic concept, that is, it can only be measured in relationship to the adversary a military is fighting (Pollack 2002). Secondly, military effectiveness is associated to, but conceptually distinct from victory and defeat on the battleground. Armed forces might be acting very effectively but still may fail to accomplish missions, operations, or entire campaigns. Measurement of military effectiveness has to focus on the losses an army incurs and the losses it inflicts on its adversary in the course of action (Millet *et al*. 1988). And finally, an effective employment of military capabilities is the key factor of military effectiveness. While the size of armed forces, situational, environmental, and technological aspects may make a huge impact on operation results, an effective military utilizes these conditions for effectively employing its forces in order to destroy its enemy (Brooks 2006).

Effectiveness is the term mostly used to refer to the measurement of the goal attainment, therefore interconnecting the final result of an activity to its primary aims. Put another way, an operation would be effective if the end results are the same as the established goals. Thus, assessing the effectiveness of an operation, first of all, requires clear, explicit and quantified goals (Sherman 2009). Various subjects could be evaluated against effectiveness, such as time, materiel, people, resources, and money. It could be measured in terms of outputs, outcomes, effectivity, goal attainment, cost-effectiveness and macro impact (Mosselman and Prince 2004). Effectiveness encompasses not just the extent to which an operation goal has been accomplished, but also the non-intended and non-planned outcomes of such actions.

The concept effectiveness is omnipresent in humanitarian aid, international relations and politics, defense and security, and though it has various specific implications as defined above, it continuous to remain ambiguous, furthermore there is no a common perception of its effect related to international full-spectrum operations. Fundamental questions remain whether the multinational strategic counter-terrorism campaigns are promoting or exacerbate living conditions in places like Iraq, Somali, and Afghanistan. Some scientists suggest that interventions can actually do more harm than good and cause unintended negative consequences among conflict-affected populations (Aoi *et al.* 2007).

The description of effectiveness may differ between various disciplines of science. A conventional feature of these definitions is that effectiveness is perceived as an alteration resulting from some actions, hinted at looking for effective means to achieve the objects set. Metrics of effectiveness are defined as the output or end result of this process (Konu *et al.* 2009).

In public administration sector, effectiveness is regarded as an element of institutional productivity assessment. It relates to the competency of service actions or complete service systems to generate various desired outcomes that can be related to positive changes in client well-being. Effectiveness also includes adequacy, the ratio of service provision coverage to service needs, and targetability, which measures how the services reach those who need them. The substantial task of service providers is not only the quality of service and the satisfaction of a client, but also cost awareness of services. High quality service does not necessarily mean that costs will rise or decrease. It may also mean a better cost–quality relationship or, in other words, that the relative utility of the service from the perspective of service recipient improves (Simonen *et al.* 2009). In management, effectiveness re-

lates to getting the right things done. Drucker (2006) reminds us that effectiveness can and must be learned.

There is a common consensus in economic science that cost-effectiveness analysis (CEA) and cost–benefit analysis (CBA) are two core methods which could be used to measure the effectiveness of an activity, program or strategy. A third method, cost-utility analysis, is often used as an extension of CEA. All approaches presuppose a well specified intervention, e. g. military operation, and a no-intervention condition, or control group, against which the intervention is compared. These three methods are broadly applied in health care industry; however they with some modifications could be successfully transferred in other industries such as defense and security. Generally, an intervention uses human, physical, or financial inputs to improve economic, social, political or military outcomes. The intervention may be a small scale program or a large scale policy shift (McEwan 2012).

The substantial distinction between CBA and CEA lies in the assessment of the incremental results of an intervention as incremental utility or as incremental effects. In CBA, the incremental benefits of an intervention are the monetary gains in social surplus created by the intervention (Boardman *et al.* 2010). Practically, CBA of investments in human capital commonly evaluate utilities as the supplementary incomes and tax revenues gained by participators and governments, respectively. In other conditions, utilities may be assessed as averted costs, i.e. monetary costs to society averted as an outcome of the intervention, such as decreased criminality.

In CEA, incremental outcomes are expressed in non-monetary measures. In military operations, the outcomes may comprise quantity units such as number of troops deployed, casualties, completion of missions, or overall insurgents killed; and quality measures such as civil-military cooperation, development of democracy in a conflict region, strategic achievements, or social programs, etc.

A cost-utility ratio *C/U* reflects the incremental cost per unit of incremental utility (McEwan 2012). Cost-utility analysis could be successfully applied in counter insurgency operations, where interventions would have the dual objectives of reducing terrorism acts and also improving the situation in a conflict zone year by year.

Measuring the effectiveness of counter-terrorism is challenged by political context. From a political perspective, it is a reasonably simple task to estimate *short term* progress (and regression) of *tangible* complex operations (Center on International Cooperation 2006). The doctrines of military and non-military operations (maintaining security that preserves lives, providing humanitarian aid, developing the stability and security in the conflict zones) are often distilled into absolute, binary terms by the media and politicians seeking the short term output headline (Meharg 2009). Lives are being saved, or they are not. Stability is either present, or it is not. Humanitarian aid is either being provided, or it is not. However, assessing *intangible* intervention effectiveness from a *long term* perspective is more complicated and has a tendency to be over-simplified in the similar manner that short term results are. Behavioral and attitudinal changes in recipient populations occur over the long term (Meharg 2009); nonetheless, these are complicated to determine and even more complicated to relate to specific operational results. Majority of governments and armed forces tend to claim early success in post conflict peace-keeping operations only to be accepted later by external actors, institutions, scientists, and international organizations. Lacking suitable assessment models, organizations like UN, NATO and EU have been placed in discreditable positions in which the member countries was induced to disavow earlier claims of successful progress and acknowledge many far-flung failures. This inaccurate communication of inaccurate information, especially concerning the reality of campaign failure, has had a significant negative effect on campaigns' participants (soldiers, volunteers, etc.) moral and public opinion in places like Iraq and Afghanistan.

International joint operations are progressively multifunctional, inducing stakeholders to provide services across areas through a wide range of tasks and actions, embracing security, democratic governance and participation, humanitarian assistance and social well-being, economic stabilization and infrastructure, and justice and reconciliation (Meharg 2009). The desirability of accomplishing everlasting peace and security in post-conflict countries is compared against the feasibleness of reaching such ambitious goals. Achieving "just enough" in an operation, or what is now referred to as "good enough" operations, is weighted against reaching the most desirable results: everlasting peace and security. Desirable results are extremely costly actions for an international community with increasing

economic pressures, and it is not yet certain why such expensive operations (in both lives and money) has not yet accomplished its established goals.

It is impossible to evaluate all factors of military operation actions as not all results, impacts, and effects can be established during the planning phases of an operation. There is common understanding that it is not likely to be able to assess the *factual or real* longer term effectiveness of actions in multi-functional operations because of the impotence to measure the entire campaign, resulting in a readjustment towards preparedness and capability, rather than effectiveness.

There are no universal metrics, benchmarks or indicators between stakeholders, and each actor uses a very incomparable set of techniques and models to evaluate what is important to them.

David Galula (1964) in his prominent study *Counterinsurgency Warfare: Theory and Practice* argues that "political organization at the grass roots" an important metric. His personal account of pacification in Algeria allowed him to propose more explicit indicators – how often his soldiers fired their weapons, how safely he could move from post to post, how accurate was his population census, and how often mayors shared information with him on rebel activities. Nonetheless, measuring the degree of public support, as well as the rebels' dominance, remained doubtful. How, in instance, could the counter-terrorism agencies objectively assess political coercion? For armed forces personnel trained to rely upon indicators of terrain captured and enemy troops killed, Galula's approach was not altogether satisfying.

South East Asia expert Bernard B. Fall (1994) in similar way emphasized the complication of assessing effectiveness in an unconventional environment. Fall (1994) described victory in insurgency warfare as "the people and the army … emerg[ing] on the same side of the fight". He understood, though, that measuring success toward such victory needs appropriate metrics. Fall stated that trends in levels of security and population control could be plotted objectively on a map, given accurate reporting of assassinations, insurgent raids, and Vietcong taxation (in the case of Vietnam war). Evaluating "administrative control", however difficult, if done correctly, provided armed forces high-rank commanders with the most explicit measurement of the effectiveness of their activities.

However, Valeriano and Bohannan (2006) suggested, that measurement of a local military's strengths and weaknesses is more challenging, since it much more depends on the assessor's perception of the specifications for successful counter-insurgency war. The authors' questions for evaluating intelligence services, popular attitudes, and governmental agencies showed that measuring counter-terrorism effectiveness was difficult mission.

The Department of the Army's Field Manual (FM) 31-16 (1967) *Counterguerrilla Operations*, though thorough, proposed limited framework on how to measure the effectiveness in an unconventional warfare. The manual recommended staffs to evaluate the success of the rebels, their connectivity to the local population, and the effectiveness of their communications and intelligence networks. Besides, the doctrine advised that commanders have to evaluate the "effectiveness of measures to deny the guerrilla access to resources required by him".

Counter-terrorism manuals focused at the difficulty of measuring effectiveness and success in an unconventional environment. How was a commander to know if his troops had succeeded in forcing the terrorists to end their terrorism activities or just suspend them until the conventional danger had passed? If terrain has no tactical or operational value, how could commanders keep assess of their success against the terrorists? Lastly, how was a commander to measure the guerrillas' influence on the local population? These are questions which manuals have to answer.

Effectiveness versus efficiency. Efficiency and effectiveness are essential concepts in evaluating and analyzing the success of complex operations such as Global War on Terror. Although it is evident that evaluating and analyzing the success is vital phase of any operation, military commanders rarely comprehend the real meaning of efficiency and effectiveness.

An operation can be efficiently conducted without being effective. Efficiency is not assessment of success in the battlefield; it is rather an assessment of operational excellence or military capability. Thus, basically, it is only concerned with reducing costs (in broad sense) and increasing operational capabilities (Mouzas 2006). Effectiveness, in turn, is mostly focused on military's ability successfully perform the whole operation, i.e. to achieve their intended goals.

The difference of both variables (effectiveness and efficiency) could be shown on the simplistic framework

(Figure 1). Where, horizontal line denotes efficiency and the vertical line represent effectiveness. Here, the most efficient operation would be with the lowest cost, i.e. spent as little as possible money, human and technical resources, time and energy; subsequently, the most effective operation would be with the highest rate of performance, i.e. all goals are achieved. Additionally, framework is divided into four quadrants named with four letters. Each letter represents the status of operation:
A – uncompleted with high cost;
B – uncompleted with low cost;
C – completed with high cost;
D – completed with low cost.

Here it is worthy to mention that in everyday language, media and even in scientific literature the term effectiveness is, usually, used in broad sense, i.e. efficiency is used as an already integral part of effectiveness; according to this statement the effectiveness and efficiency framework could be explained in slightly different way: the letters would then represent the following statuses of operation:
A – very ineffective;
B – ineffective;
C – effective;
D – very effective.

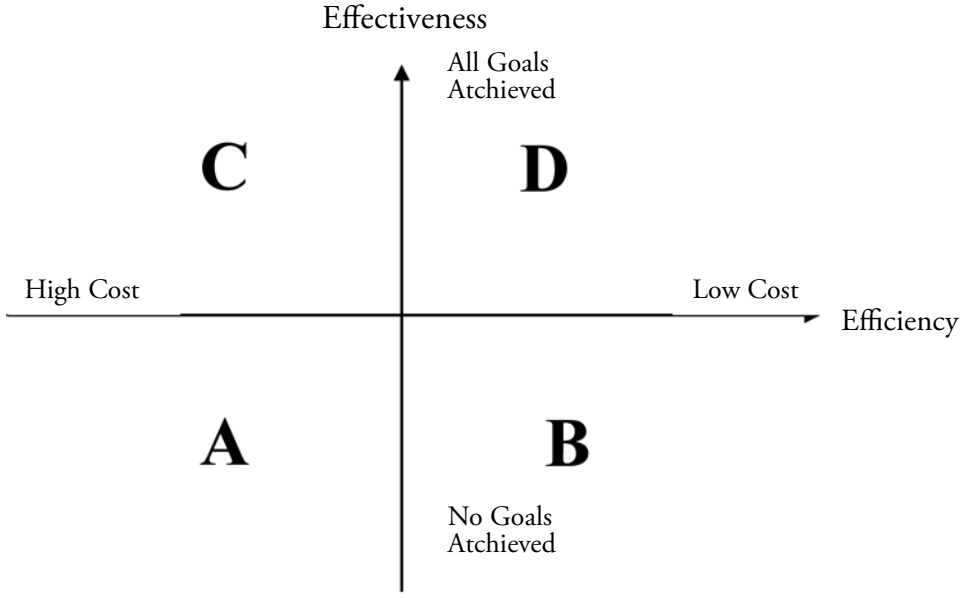

Fig.1. The framework of effectiveness and efficiency

Source: Mouzas (2006)

3. The dynamic system of the effectiveness of counter terrorism

A victory over terrorism could be seen as having been achieved when the committing of terrorist acts has stopped sustainably. According to Quaker Council for European Affairs (2007) a victory over terrorism would replace a culture of fear with a culture of respect, engagement, vigilance and solidarity. Effective counter-terrorist policies would ultimately lead to the cessation of terrorist, state and inter-ethnic violence.

Effectiveness means the capability of producing an effect, and is most frequently used in connection with the degree to which something is capable of producing a specific, desired effect.

Measurement is the objective representation of objects, processes, and phenomenon (Finkelstein and Leaning 1984). Measurement captures information about these systems through their attributes (also known as characteristics, features, or properties). These attributes can be either directly or indirectly observable (Cropley 1998). Although objective, an important distinction is that measurement is also an abstraction.

Measurement begins by identifying the system of interest and the attributes to be used in defining the system as depicted in Figure 2.

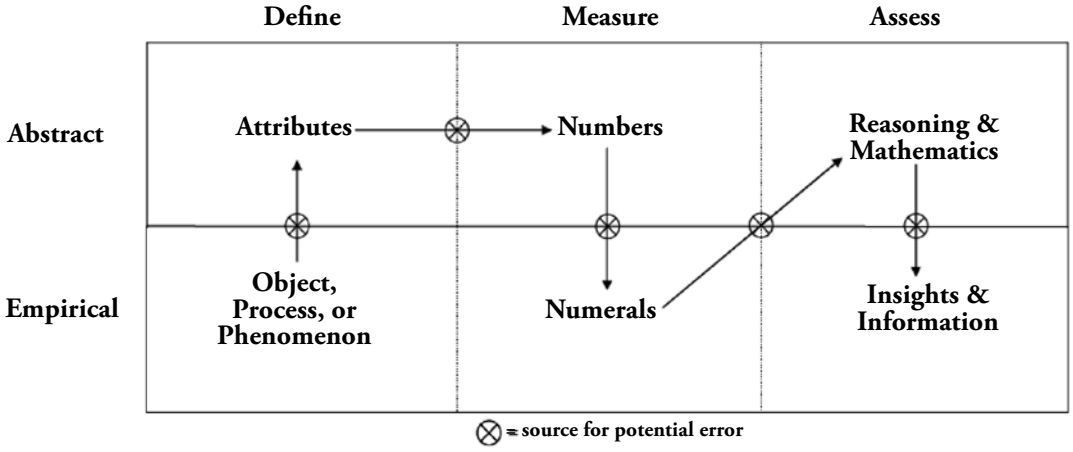

Fig.2. Stages of Measurement

Source: Bullock (2006)

Once the attributes are identified, observations or data collection, on the system attributes can take place. Finally, measurement, indicator, or metric are need to be evaluated. Referring back to Figure 2, scales can be a source of error since a measure will always contain any error inherent in the construction of the scale (Potter 2000).

Measurement of the effectiveness of the system. As it is discussed above, effectiveness means the capability of producing an effect, and is most frequently used in connection with the degree to which something is capable of producing a specific, desired effect.

Measurement is applied to a system within a specific context (Morse and Kimball 2003). Before measurement planning can begin, however, a framework for conceptualizing measures is needed.

A measure of effectiveness (MOE) concerns how well a system tracks against its purpose or normative behaviour (Sproles 1997). In other words, a MOE determines if the right things are being done.

Useful construct for conceptualizing a system is an input-output model (Figure 3). Inputs can consist of either controllable or uncontrollable factor. These inputs enter the system and are 'transformed' into outputs. The input-output model is quantifying the impact of an input, which is fundamental to understanding and control of any system (Kaydos 1999; Neely *et al.* 1997).

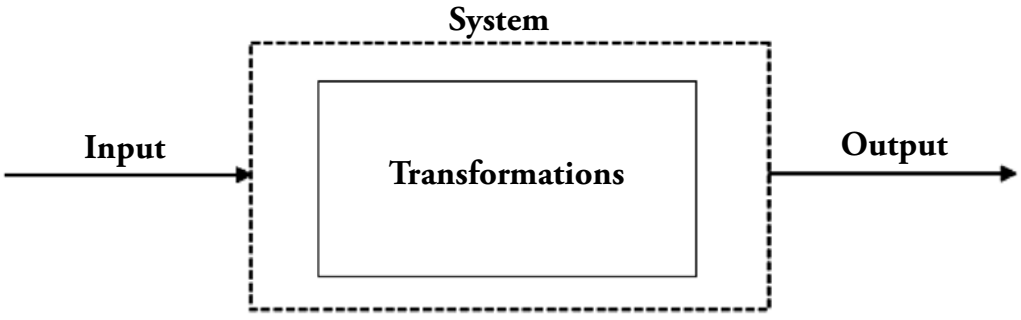

Fig.3. Input-Output Model

Source: Sproles (1997)

A core component of the input-output frame is defining system boundaries. The boundaries of a system are where attributes of the system interact with attributes outside the system. Visualising a network of linked input-output systems, where outputs of one system are the inputs of others, could be very helpful in defining boundaries of system.

The main issue in understanding which inputs link to which outcomes is establishing and connecting the cause-effect linkages between the strategic, operational, and tactical levels as well as the impact of inputs and environmental factors on each of these levels (Ka-

plan and Norton 1996; Sink 1985).

The cause-effect interactions can be problematic to identify because the output of one system may be the input of another system and some of the systems may be hidden or inaccessible (Leonard 2004). Additionally, there may be a dynamic delay between a system input and when the impact of that input is seen. Further, for systems in dynamic environments, the cause-effect relationships can change over time (Kaplan and Norton1996).

Obviously, counter-terrorism is very sophisticated system with huge amount of inputs and with different outputs. Therefore, first of all, it is necessary to define the boundaries of this particular system, after that to define attributes of this system and to measure them, and, finally, to evaluate the effectiveness of counter-terrorism efforts in fighting terrorism by using results of measurement. Properly constructed model based on this representation can then be used not only for assessment but also for forecasting the behaviour of the system.

4. Methodology

Purpose of study. The objective of this research is to assess the effectiveness of counter-terrorism efforts in Afghanistan using theoretically-based, but empirically usable approach. To achieve this goal required the following new contributions.
1. Define the system and its purpose.
2. Define elements (subsystems) of the system.
3. Define the model.
4. Define attributes of the system.
5. Define measures of the attributes.
6. Measure the system.
7. Define the state of the system.
8. Create the model using dynamic simulation program.
9. Analyse the model.

Choice of the research method. The selection of the research method gives possibility scientifically to answer the research questions in the most suitable approach – within the given limits of time, budget and skills (Ghauri and Gronhaug 2002). The availability of few suitable research methods was assessed, and it was decided to choose System Dynamics as the modelling and simulation paradigm in this study. The contributors that mainly had impact on the choice of simulation are the following:
(1) Possibility to access to statistical data.
(2) Insights from the literature review.
(3) Almost complete absent of empirical studies in measuring effectiveness of counter-terrorism.

System Dynamics proposes to explicitly investigate how feedback loops affect the system behaviour. Specifically, a System Dynamics analysis can be described as a process that involves the following steps: (1) Development of an understanding of the system based on a closed-loop system approach; (2) capturing and modeling the feedback structures in the system by using causal diagrams; and (3) development of a simulation model based on stock and flow diagrams, and mathematical equations.

Data collection. To analyse the counter-terrorism system and its effectiveness only secondary data were used. Data were collected using different sources. The suitability of different sources were assessed, and it was chosen the source which provided the most reliable and comprehensive data. The reliability of source was maximized by gathering data from governmental databases. However, not all data was possible to find using governmental data bases, therefore over sources were used. Data over a ten-year-period was used for analysis (2000-2010)**.**

Analysing civilian casualties in Afghanistan it was used even five different sources: The UN Assistance Mission in Afghanistan (UNAMA); The Afghan Independent Human Rights Commission (AIHRC); The Afghanistan Rights Monitor (ARM); Human Rights Watch; and Professor Marc W. Herold's insights. All of them provided different numbers; e.g. civilian casualties' interval was between 11,443 and 14,240 civilian deaths.

It was used main three sources to collect statistical data of terrorism acts and number of terrorists: Global Terrorism Database (GTD), Worldwide Incidents Tracking System (WITS is the U.S. National Counterterrorism Center's database of terrorist incidents) and The Violent Extremism Knowledge Base (ISVG).

Finally, U.S. Homeland Department, NATO, ISAF sites were used to gather data of coalition troop number on the ground in Afghanistan.

5. Analysis of results

It was used Powersim Studio software package to build advanced dynamic simulation model of counter-terrorism system.

Simulation was used to better understand the interactions between the number of insurgents or terrorism acts and the strength of coalition troops. Counter-terrorism strategies often experience international pressure in using overestimated strength of military to counter much smaller units of insurgency (i.e. using military power non-effectively). The first step in solving this problem is to build a model that would explain the relevant interactions. Roughly speaking, counter-terrorism effectiveness consists of two main components increasing or decreasing the military strength to match an effective or desired level of military and keeping number of troops high enough to cover what decision-makers expect military demand will be in future. To have strategic advantage and to be safe, decision-makers keep several times as many soldiers in Afghanistan as they believe will be needed to counter terrorism.

Most often the assumptions about future military demand are based on the current rate of terrorism that includes number of terrorists and number of terrorism acts committed by them. The current terrorism rate constitutes the real demand the coalition forces faces. The strategy formulating the expected military demand is simple. When the beliefs about future counter-insurgency need change, this affects the desired strength of military and the rate at which policy-makers recruit troops. The process described above suitable for measuring the recruitment rate of insurgents as well.

Causal loop diagram. The causal loop diagram shows the feedback processes that control the insurgents manpower (strength) and coalition manpower (strength). The diagram contains two reinforcing and two balancing feedback loops (Figure 4).

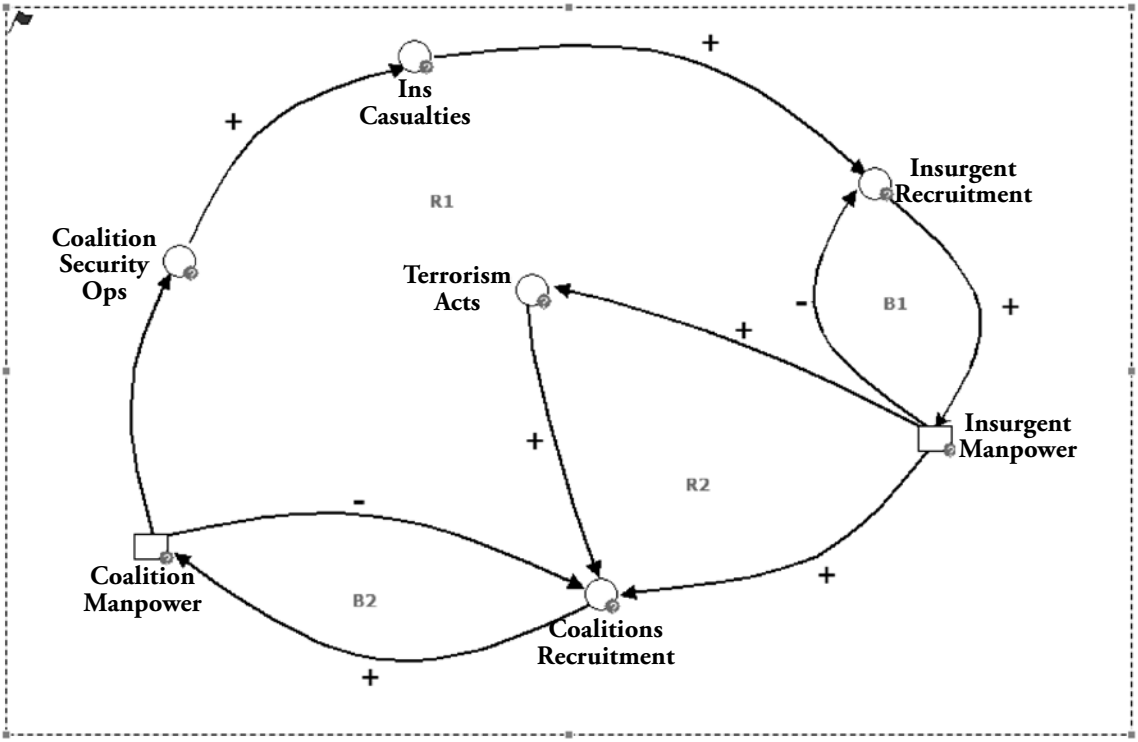

Fig.4. Causal loop diagram

Source: prepared by author

B1 is balancing (or negative) feedback loop depicting the causal relationship between insurgent manpower and insurgent recruitment rate. An increase in insurgent manpower will reduce insurgent recruitment rate.

B2 is another balancing loop that shows the relationship between coalition manpower and coalition recruitment rate. An increase in the coalition manpower leads to decrease of coalition recruitment rate.

R1 is a reinforcement (positive) feedback loop depicting the causal relationships among insurgent casualties, insurgent recruitment, insurgent manpower, coalition recruitment, coalition manpower and coalition security operations. An increase in the insurgent casualties leads to an increase in insurgent recruit-

ment to make up for the shortfall. The higher insurgent strength, the greater the coalition recruitment rate which, in turn, increase coalition manpower. The growth in coalition manpower, increase the number of counter-terrorism operations which leads to higher rate of insurgent casualties rate.

R2 is another reinforcing loop that shows the direct causal relationships among insurgent manpower, terrorism acts and coalition recruitment rate. An increase in insurgent manpower leads to an increase in the rate of terror acts; more terror acts require more coalition troops be recruited to handle an increased number of terror acts.

Model. As it could be seen from the model (Figure 5), the number of insurgents and the strength of coalition represent an accumulation of fighters, in our case insurgents and troops. The number of insurgents and the number of military strength must be increased and decreased in some way. The recruitment is a flow of fighters that adds to the number of insurgents and coalition strength, while casualties drain both.

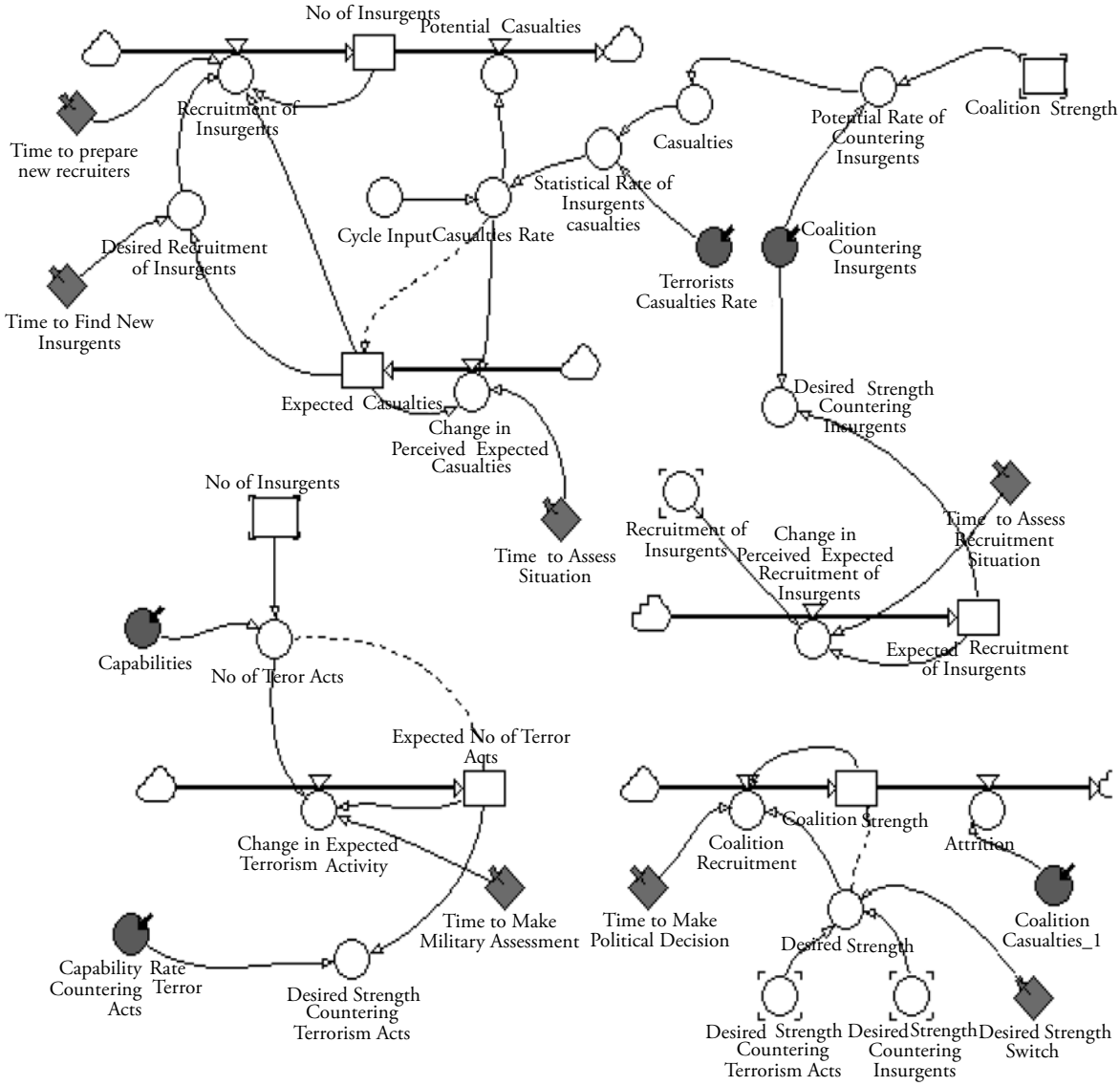

Fig.5. The model

The number of insurgents and the strength of coalition represent an accumulation of fighters, in our case insurgents and troops. The number of insurgents and the number of military strength must be increased and decreased in some way. The recruitment is a flow of fighters that adds to the number of insurgents and coalition strength, while casualties drain both.

The recruitment depends on several factors, including the difference between the actual strength of insurgency (looking from insurgency perspectives) or coalition (looking from counter-insurgency perspectives) and the desired strength. Since the recruitment flow rate dependent on the number of fighters, information link is created that shows this relationship.

To represent the difference between actual strength and desired strength in the recruitment equation (both insurgents and coalition), new variable is needed. Desired strength is not an accumulation of insurgency or coalition strength, but rather a value that is determined by decision-makers based on the current strength.

The third element of recruitment is the time it takes to make political decision in counter-terrorism case, or to prepare new insurgents in insurgency case. The time factor represents a delay in the system because in real situation, recruitment cannot instantly increase the strength of fighters. It takes time to make a decision, to train fighters and even physically transport them into the war theatre. In insurgency case, one-third of the discrepancy between actual and desired insurgency strength is corrected each month. Therefore, when the desired level of insurgency changes, it actually takes three months for the actual strength to change accordingly. In coalition case, one-sixth of the discrepancy between actual and desired insurgency strength is corrected each month. Therefore, when the desired level of coalition changes, it actually takes six months for the actual strength to change accordingly. However, the time could be changed manually in simulation, in order to find the optimal scenario.

To be able to correctly define number of casualties and desired strength, more variables need to be added to the model. Casualties decrease the strength of both insurgency and coalition. Casualties' rate variable represents injuries, deaths and arrests experienced during military operations in the period of ten years from 2001 to 2010. It represents an outside influence on the model.

Expected strength is an important part of this model because it translates changes in demand into changes in recruitment. Consequently, it takes statistical data (casualties' rate or recruitment of insurgents' rate) and converts it into action that controls how much terrorist organisations or coalition recruits fighters. Demand is not a physical accumulation like insurgency or coalition strength. It can seem like an abstract idea, with expectations about demand being even more abstract. However, the accumulations represented by levels (i.e. strength) do not have to be physical accumulations. Since delay needs to be introduced in the changes of expected demand, it is best to model it as a level. Flows are the only elements that change levels; therefore a flow is needed to represent the change in expected demand. Time factor is also needed to indicate how long it takes to assess situation and to issue reports or orders about real demand. It takes one month to assess new situation and issue new orders for insurgents, and it takes three months to evaluate terrorism situation and to issue orders for coalition. However, time could be changed manually in simulation.

Insurgents' leaders and U.S. military commanders and/or policy-makers use recruitment to cover desired strength; it should always reflect the expected demand. The insurgency strength the terrorism organisations wants to keep on hand should cover two months of expected casualties as it is time to find potential recruiters.

The desired coalition strength, together with recruitment, determines how many troops on the ground the decision-makers want to have. Coalition capability shows how many insurgents (or terror acts) each soldier can counter in one year.

This model was built to analyse a certain problem, i.e. measurement of the effectiveness of counter-terrorism. The model therefore involves some of the adjustment possibilities that are added to the simulator (Figure 6).

In order to illustrate how different conditions influence a simulation, it was made for user to choose scenario for the coalition desire strength simulator. It is possible to choose between two scenarios: countering insurgency and countering terror acts. Different scenarios requires different strength of coalition because coalition has different capabilities countering terror acts and countering insurgents. Also it is possible to correct time to make political decision, time to make military assessment, time to recruit and prepare new insurgents. Consequently, it is possible to monitor how different time adjustments influence different variables.

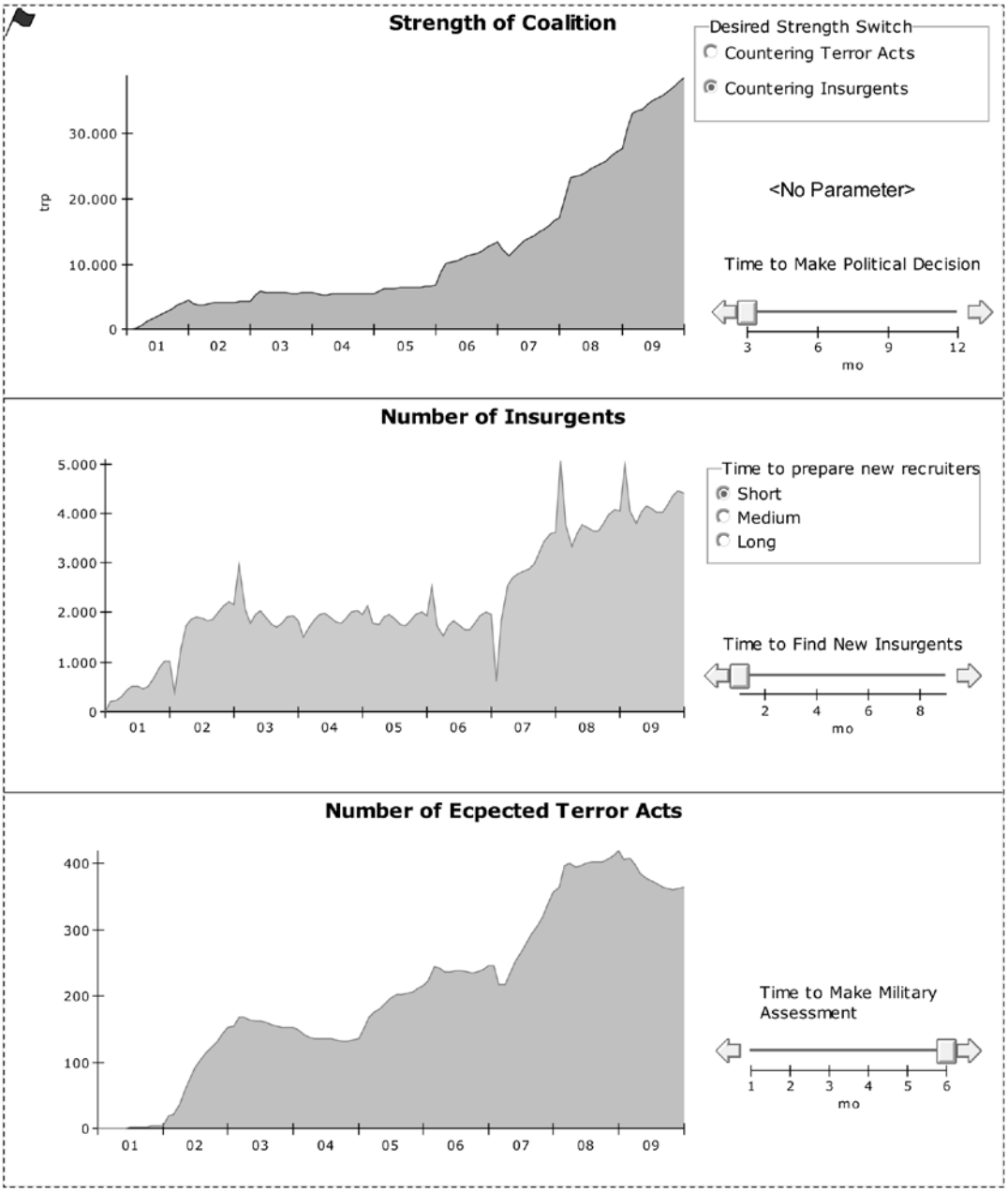

Fig.6. User interface

Source: prepared by author

Model behaviour. With statistical data on Global War on Terror in Afghanistan and the SINWAVE function added to the model, the behaviour of model started to oscillate. The SINWAVE function produces a time-dependent sine wave, with Amplitude as its amplitude, and Period as its period. The wave is shifted by the time Offset. Without any external inputs of data all the variables of the model would be constant, indicating that the model is in equilibrium. However, the model is knocked out of equilibrium by real statistical data, which vary every year during all simulation period (2001-2010). Statistical data brings the model out of equilibrium and reveals its dynamic behaviour.

As it could be seen from the graph bellow (Figure 7), rate of insurgent casualties fluctuates reflecting statistical data. Expected casualties follows slowly, and after a number of months it adjusts to the new level of casualties. Recruitment, however, increases suddenly as the casualties rate increases. To get a good understanding of why recruitment behaves as it does, behaviour of the two variables 'insurgent strength' and 'desired insurgent strength' must also be inspected.

Fig.7. Demand and recruitment of Insurgents

Source: author

The graphs below (Figure 8) show actual and desired recruitment of terrorists, and actual and desired coalition strength. The desired recruitment of terrorist increases immediately when the casualties rate increases, but due to the delay in recruitment, number of terrorists increases only after some time and cross the desired recruitment line only at the end of the year; when desired recruitment rate decreases suddenly because of lower casualties, actual number of insurgents decreases only after some time. The behaviour of actual and desired coalition strength could be explained in the same way.

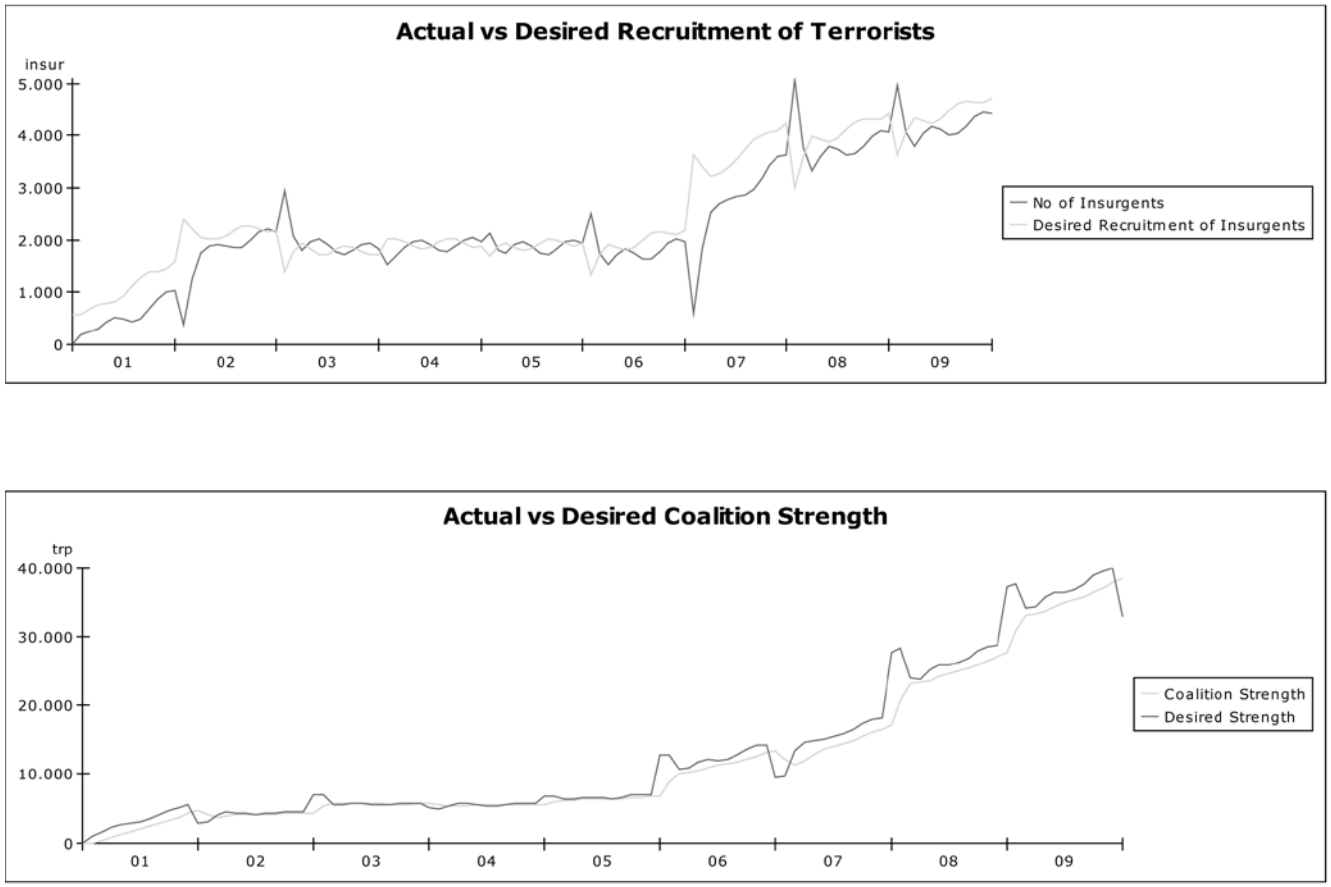

Fig.8. Actual vs. desired strengths of insurgents and coalition

Source: author

The results of the external data input such as insurgents' casualties, coalition rate of countering insurgency, coa-

lition rate of countering terror acts and rate of coalition casualties can be seen in behaviour of the other variables. Expected demand of coalition strength can be seen as increase, until it reaches the new level of insurgent recruitment. The rate at which it increases is slowing because the flow changes expected demand according to the discrepancy between recruitment of insurgents and expected strength of coalition.

When the number of insurgents or the number of terror acts rises, the desired strength of coalition rises as well because implementers of counter-terrorism strategy need more troops to handle the increase with its current capability to counter terrorism. Through the recruitment process, workers are added to the level of coalition strength, causing it to follow the desired strength after a delay (representing the time it takes to make political decision). The increase in the coalition strength cause more insurgent casualties (more terrorists are killed or captured), increasing the desired recruitment of insurgents. The behaviour of insurgent casualties' rate is quite similar to the behaviour of the coalition strength. The values are different, of course, but the shape of the curves is the same.

Until the recruitment rate of insurgents crosses above the casualties' rate, the desired recruitment rate is rising and the actual number of insurgents is still falling. After recruitment of insurgents rises above the casualties' rate, however, the desired recruitment of insurgents' rate starts to fall and the actual number of insurgents starts to rise. The desired strength of coalition also begins to fall, fallowing the recruitment rate of insurgents. The desired strength of coalition is still falling, but is still positive, so actual strength of coalition continues to rise. Once desired strength reaches the value of actual strength, however, it falls below and starts to bring actual coalition strength down with it.

With each iteration, it becomes clearer how the variables affect one another. The entire model is struggling to reach the equilibrium following the inputs of statistical data and sinwave function into 'casualties' rate' variable. The actual strength of insurgents is trying to reach desired strength, similarly, the actual strength of coalition is trying to reach desired strength, and desired recruitment of insurgents is trying to reach casualties rate. For the entire model to be in equilibrium, each of these parts must themselves be in equilibrium simultaneously.

Conclusions and recommendations

The main purpose of this article was to explain the causal chain between causes (a counterterrorism strategy) and effect (scores of indicators/effectiveness). That would help to justify the choice of particular counterterrorism strategy. Therefore dynamic system simulation approach was used to investigate causal loops.

First of all, in order to measure the effectiveness of counter-terrorism strategies, it needs to be analysed as a system that is made up of many different elements interacting with each other, all with their own indicators of success. Consequently, elements (or attributes) were defined. Once the attributes were identified, data collection on the system attributes took place. After that, data were analysed and measured.

Secondly, advanced dynamic simulation model was used to better understand the interactions among the elements of the system. Two balancing (negative) feedback loops and two reinforcement (positive) loops were identified in the system.

Finally, the behaviour of the system was analysed using various graphs. Model was simplified and tailored to any user. Therefore, it has been possible for user to change intervals in time variables such as time to make military or political decision, time to find and prepare new recruiters or time to assess the situation. So user of the model can find the most effective scenario by changing time values. In addition, user can choose the scenario of model as well (countering insurgents or countering terror acts). Results of model have indicated direct relationship between the number of terrorist or terror acts and coalition strength. The amplitude of difference between these variables depends on time assumptions.

Taking everything into consideration it is obvious that measurement of the effectiveness needs further researches, particularly in dynamic simulation context. This study should be evaluated only as a framework in further similar researches. Furthermore, the models of counter-terrorism effectiveness should incorporate soft variables (e.g., fear of civilians, perceived security etc.) and more process-related variables (e.g. funding, infrastructure damages) so as to explore the causes and effects more precisely.

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