

Modeling Homeland Security

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The events of September 11, 2001, have propelled the topic of homeland security to the forefront of national concern. The threat of terrorism within the United States has reached an unprecedented level. The potential vulnerabilities present in the nation's critical infrastructure, coupled with the destructive capabilities and deadly intentions of modern terrorists, pose extraordinary risks. The United States must mitigate these risks while at the same time balancing the associated costs and impact on civil liberties.

Currently, there is a need for effective methods and measures for assessing the security of the homeland from acts of terrorism at the aggregate, national level. This study develops a first-cut decision-analysis-based methodology for identifying and structuring key homeland security capabilities and facilitating the measurement of the United States' capability to execute these required capabilities.

Keywords: Homeland security, decision analysis

1. Introduction

America will become increasingly vulnerable to hostile attack ... States, terrorists, and other disaffected groups will acquire weapons of mass destruction and mass disruption, and some will use them. Americans will likely die on American soil, possibly in large numbers [1].

This prophetic statement by the Hart-Rudman Commission was proven true on September 11, 2001. The attacks on the World Trade Center and the Pentagon presented a definitive statement on the reality of terrorist threats to the American homeland. However, the threat of terrorism against the United States did not begin on 9/11. Indeed, the United States has combated terrorist acts throughout its history. Nevertheless, the face of terrorism has changed dramatically over the years [2]. Modern terrorist attacks against the United States, especially on the American homeland, began in the last decade of the 20th century and the threat continues to increase.

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Dr. Lani Kass at the National War College utilizes the following model of the threat to the American homeland:

$$\text{Vulnerabilities} \times \text{Intentions} \times \text{Capabilities} = \text{Threat}. [3]$$

Changes to these factors produce changes to the threat to America. Faced with limited resources, it is necessary to mitigate the risks associated with these factors. An examination of America's vulnerabilities and the intentions and capabilities of terrorists can provide great insight into the growing threat of terrorism.

The top-level objectives (referred to as objectives in this article) for homeland security in the 2002 National Strategy are:

- Prevent terrorist attacks within the United States;
- Reduce America's vulnerability to terrorism; and
- Minimize the damage and recover from attacks that do occur [4].

The entire nation must make every effort to execute these objectives in order to secure the United States homeland from terrorist threats and attacks.

Unfortunately, it is impossible to prevent every form of terrorist attack, reduce the vulnerabilities of every critical asset, or prepare to respond to every conceivable threat without unacceptable infringements on the rights of the nation's citizenry and astronomical resource costs. Accordingly, it is essential that decision makers at the highest levels of authority weigh these considerations in the development and implementation of homeland security strategies.

This study provides a decision support framework for Federal-level homeland security decision makers to leverage in the development and evaluation of alternative homeland security strategies, trading off both desired and undesired impacts. The desired impacts focus on preventing acts of terrorism while protecting and preparing the nation's citizenry for the possibility that attacks do occur. Undesired impacts include fiscal and logistical costs and possible infringements on the civil liberties that define the United States.

This study models the complex homeland security decision problem using three distinct hierarchies: homeland security, resource costs, and civil liberties. These hierarchies share the same purpose, to select the strategy that most favorably enhances the homeland security posture of the United States. In particular, the homeland security value hierarchy facilitates the identification of gaps in the United States government's capability to execute a number of critical sub-objectives and aids in the search for a strategy or set of strategies that close these gaps in the most effective manner.

The background section provides a review of the pertinent literature in the realm of homeland security and the decision analysis techniques used in this study. Next, the homeland security value hierarchy is developed, followed by the development of the resource cost and civil liberties hierarchies. Finally, the study ends with some concluding comments and recommendations for further research.

2. Background

A number of documents define homeland security, how it should be carried out, and who should be responsible for doing so. This brief review develops a clear understanding of what is valued at the federal level in homeland security and provides support for the application of decision analysis approaches to the homeland security problem. A more detailed review of the pertinent literature can be found in Pruitt [5].

The security of the American homeland has been a consideration since colonial days. However, the focus on protecting the United States from asymmetrical threats, such as terrorism, became prominent in the late 1990s [6]. A number of commission reports, panels, laws, and articles have considered the issue of homeland security [7–21].

The Hart-Rudman Commission lists six key goals for national security:

- Defend the United States and ensure it is safe from the dangers of a new era.
- Maintain America's social cohesion, economic competitiveness, technological ingenuity, and military strength.
- Assist the integration of key major powers, especially China, Russia, and India, into the mainstream of the emerging national system.
- Promote, with others, the dynamism of the new global economy and improve the effectiveness of international institutions and international law.
- Adapt U.S. alliances and other regional mechanisms to a new era in which America's partners seek greater autonomy and responsibility.
- Help the international community tame the disintegrative forces spawned by an era of change [20].

The recommendations of the Gilmore and Bremer Commissions [2,8,9] were in general agreement; the increased threat of vastly destructive terrorist attacks within the United States required significant government action to prevent such attacks and to prepare for the possibility that prevention fails. Addressing these concerns requires new thinking about laws, policies, and practices, and increased planning, training, and exercises.

Overall, the insight and recommendations offered by all three early homeland security commissions (Hart-Rudman, Gilmore, and Bremer) have significantly influenced current homeland security policies and action. The suggested development of a comprehensive strategy to secure the United States was realized in July 2002 when the Office of Homeland Security released the National Strategy for Homeland Security.

Efforts to secure the American homeland from terrorism, and thus respond to the National Strategy for Homeland Security, require a variety of difficult decisions encompassing an array of strategies and preferences. To ensure that these decisions are made in the most beneficial manner, an effective decision making methodology is required. Decision analysis provides such a methodology.

Four basic sources of difficulty in decision making are the complexity of the decision, the uncertainty of the situation, the existence of multiple competing objectives, and conflicting perspectives from multiple stakeholders [22]. Complicating the process further is the fact that in most decision problems, various alternatives can lead to dissimilar outcomes [23]. Unfortunately, the homeland security decision context possesses all of these difficulties.

In the face of these complications it is important that decisions are made strategically. That is, decisions should

be made skillfully “in a way that is adapted to the ends we wish to achieve” [23]. By the DoD definition of strategy, this requires making decisions in a “synchronized and integrated fashion to achieve theater, national, and/or multinational objectives” [24]. When cast in the context of homeland security, a strategy must be a synchronized and integrated approach to achieve local, state, federal, and international objectives.

Keeney points out that, “Values are what we care about” [25]. Rather than starting with alternatives and evaluating which one is preferred (Alternative Focused Thinking – AFT), Keeney suggests that Value Focused Thinking (VFT) begins with defining the best possible option and works toward making it a reality [25]. A fundamental difference between the VFT process and the AFT process is that in VFT values are identified directly after a problem has been realized, whereas AFT defines the alternatives before the values [25]. With VFT, the creation and evaluation of alternatives are based on, and tailored to, what is important to the decision context and not simply focus on previously identified alternatives [25]. The evaluation and selection of an alternative is more accurately rooted in the decision maker’s values [25]. At the moment, however, what is valued in homeland security has not been clearly articulated. This study provides a step at such an articulation.

Keefe, Corner, and Kirkwood summarize the use of decision analysis throughout the 1990s in the energy industry, manufacturing and services community, medical field, and the military by reviewing 57 application articles in operations research journals [26]. Two significant national security VFT studies include SPACECAST 2020 [27] and Air Force 2025 [28].

In order to evaluate various space-related systems (i.e., capabilities) the SPACECAST team utilized the draft JCS Pub 3-14, “Military Space Operations Doctrine,” to develop a value hierarchy of the fundamental objectives guiding space operations [27]. This method of deductively developing the value hierarchy from previously established strategic objectives, visions, and doctrine is known as the “Gold Standard” [29].

In Air Force 2025, the study team had to identify the desired objectives and supporting technologies in a way that was “objective, traceable, and robust” for possible force requirements in the year 2025 [28,30]. Air Force 2025 was assessed as the “starting point for Value Focused Thinking within the Department of Defense” [30]. The applicability of the 2025 value model as a framework for future air and space doctrine was also noted [30].

There are two primary ways in which a value hierarchy can be constructed, with the decision of which method to utilize largely based on how well alternative solutions are defined [23]. With clearly defined alternatives, the value hierarchy can be developed by first identifying

evaluation measures and then grouping these measures into higher-level objectives; a bottom-up approach [23].

It is not clear, however, what the evolving alternative strategies for homeland security will entail. Thus, it is necessary to use a top-down approach [23]. When using the top-down approach, one begins with the overall fundamental objective — securing the homeland — and specifies lower level objectives for accomplishing this goal. By identifying key objectives from doctrinal literature, this study utilizes the “Gold Standard” method employed in SPACECAST 2020 and by others [26]. The organization and specification of these objectives is accomplished through a process known as affinity diagramming [31].

This affinity diagramming decision making process arranges ideas into a hierarchical structure that can be very useful in identifying common themes among a vast array of concepts [32]. Affinity diagramming not only helps to delineate all the factors in a given decision problem, but the subsequent groupings become the basis for strategies to solve the problem [33]. By breaking down complicated issues into broad categories, this technique provides structure to convoluted problems that have no clear solutions [34].

For this effort, a content analysis of five prominent homeland security documents was conducted to obtain a collection of key ideas and concepts. These documents were:

- The National Strategy for Homeland Security, released by the Office of Homeland Security
- The Department of Homeland Security, released by President George W. Bush
- Executive Order 13228: Establishing the Office of Homeland Security and the Homeland Security Council
- Securing the Homeland Strengthening the Nation, budget released by President Bush
- Homeland Security: The Strategic Cycle, released by the ANSER Institute for Homeland Security

The content analysis led to the extraction of 363 objectives related to securing the homeland from terrorist threats and attacks [5,35]. Using this collection of homeland security objectives, common themes and issues were grouped together to form a value hierarchy and identify the required capabilities needed at the federal level. The objectives were first grouped according to the three main objectives incorporated in the National Strategy’s definition of homeland security: prevention, vulnerability reduction, and response preparedness. Each of these groups was further sub-grouped in order to validate, and in some cases supplement, the doctrine-based definition. This method not only assists in the completion of the value hierarchy, but also provides

quantifiable support for the objectives that are included. The resulting value hierarchy is discussed in the next section.

3. Homeland Security Strategy Evaluation

This section presents a value hierarchy for homeland security.

3.1 Modeling Homeland Security

The fundamental objective of the homeland security value hierarchy is to capture how well a particular strategy secures the homeland from terrorist threats and acts. The development of this value hierarchy requires the identification of what is valued in the homeland security posture of the United States at the national level. It is important to note, “homeland security is focused on terrorism in the United States” [4]. Though terrorism is of worldwide concern, homeland security addresses terrorist threats to, and acts within, the United States. The National Strategy for Homeland Security defines homeland security.

Homeland security is a concerted national effort to prevent terrorist attacks within the United States, reduce America’s vulnerability to terrorism, and minimize the damage and recover from attacks that do occur. [4]

This definition establishes the three overarching objectives associated with the United States’ homeland security posture:

- The prevention of terrorist attacks;
- The reduction of America’s vulnerability to terrorism; and
- The preparedness to respond to terrorist attacks that do occur.

In order to prevent terrorist attacks, it is necessary “to detect terrorists before they strike, to prevent them and their instruments of terror from entering our country, and to take decisive action to eliminate the threat they pose” [4]. To reduce America’s vulnerability to terrorism it is imperative that the nation’s critical infrastructure and key assets are thoroughly assessed and that every effort is made to protect them [4]. Finally, in order to have the capability to minimize the damage and recover from terrorist attacks, it is necessary “to improve the systems and prepare the individuals that will respond to acts of terror” and to “be prepared to protect and restore institutions needed to sustain economic growth and confidence, rebuild destroyed property, [and] assist victims and their families” [4]. These sub-objectives correspond to the second tier of the value hierarchy in Figure 1. Based on a detailed analysis of homeland

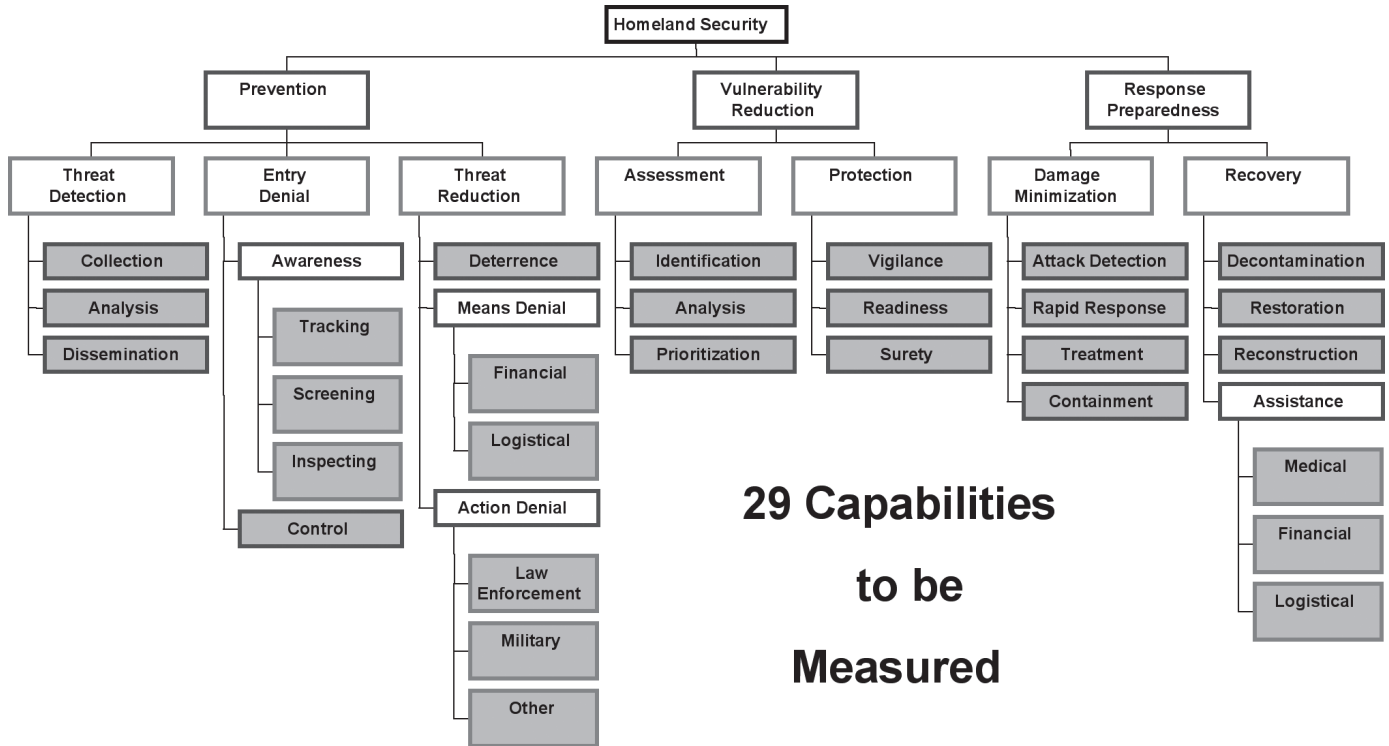


Figure 1. Homeland security value hierarchy

Homeland Security Objectives Definitions
Prevention: Actions undertaken to detect terrorists before they strike, to prevent terrorist weapons and those who would use them from entering the United States, and to eliminate the threat they pose (modified from National Strategy).
Vulnerability Reduction: Actions undertaken to assess America's critical infrastructure and key assets and to make every effort to protect them from possible terrorist attacks (modified from National Strategy).
Response Preparedness: Actions undertaken to build and maintain the capability to minimize the damage of and rapidly recover from terrorist attacks that occur within the United States (modified from National Strategy).

Table 1. Homeland security value definitions

security resources, these sub-objectives are further specified to establish the full value hierarchy. The tiers of the value hierarchy, branching from the fundamental objective, are referred to as the objectives, the sub-objectives, and the capabilities (shaded) for defining the capability measures for evaluation. The 29 capabilities provide the final detail required to define the homeland security value hierarchy.

A value hierarchy should be designed so its components are mutually exclusive and collectively exhaustive [23]. Each of the three first-tier objectives is defined in Table 1 to ensure these characteristics are maintained. The definitions separate the objectives by the timing of the attack (mutually exclusive) and the objectives cover all areas of concern (collectively exhaustive).

Detailed definitions for the value hierarchy are provided in Pruitt [5] and will not be repeated here. To provide further clarification, each of the three objectives associated with homeland security are discussed below.

3.1.1 Prevention

Prevention of terrorist attacks within the United States has been acknowledged as the first priority in homeland security [4]. JP 1-02 defines prevention as, "the security procedures undertaken by the public and private sector in order to discourage terrorist acts" [24]. Discouragement of terrorist acts involves a variety of activities. The prevention of terrorism, as it is categorized in this research, focuses on the threat itself, and is aimed at known or suspected terrorists, terrorist groups, and their support, and applies to the Intentions and Capabilities portions of the Kass threat model.

In order to **detect** (bolded print identifies sub-objectives and capabilities in the value hierarchy) terrorist threats to the United States, it is necessary to first **collect** information pertaining to terrorists and their activities. Once the data is collected, it must be **analyzed** to produce useful intelligence and **disseminated** to the appropriate user. Moreover, once identified these individuals must be **denied entry** through United States land, sea, air, and space borders. In order to deny access to a given threat,

the appropriate agencies must develop an **awareness** of whom and what is approaching the nation's borders through **tracking, screening, and inspecting** at the points of entry, and have the capability to **control** the entry of people and goods.

Finally, the threat posed by these individuals must be **reduced** by removing the capability and/or intent necessary to carry out attacks. Actions taken to **deter** terrorism address the *Intentions* portion of the threat model, while actions aimed at the means of terrorist attack and the terrorists themselves address the *Capabilities* portion. The United States can **deny the means** of terrorist attack by targeting their **financial** support or by eliminating their ability to acquire the **logistics** (weapons and delivery systems) necessary to execute an attack. In addition to aiming at the means of attack, the United States can reduce terrorists' capabilities by **denying the actions** of terrorist personnel and their supporters. These actions can be pre-emptive or retaliatory and can be carried out by **law enforcement, the military, or by other** authorized agencies or organizations.

The *Prevention* branch specifies thirteen national level capabilities (shaded in Figure 1) that the United States must pursue in order to prevent terrorism. This national level effort to secure the homeland, by focusing on the intentions and capabilities of potential or recognized threats, must be complemented by vulnerability-focused actions aimed at reducing national weaknesses that terrorists might seek to exploit.

3.1.2 Vulnerability Reduction

Reducing America's vulnerability to terrorism focuses on weaknesses internal to the United States; the people, systems, symbols, facilities, functions, and events within the United States and applies to the *Vulnerabilities* portion of the Kass terrorist threat model. The critical infrastructure vulnerability reduction suggested by the President's Commission on Critical Infrastructure Protection (PCCIP), and mandated by Presidential Decision Directive 63 (PDD 63), is a crucial step in the effort to secure the United States from terrorism.

Vulnerability reduction, as it is defined here, only addresses the weaknesses of the nation that are associated with the threat of terrorism.

The first step to reducing vulnerabilities is to perform **assessments**, which are important from a planning perspective in that they enable authorities to evaluate the potential effects of an attack on a given facility or sector, and then to invest accordingly in protecting such facilities and sectors [4]. Because it is fiscally, logistically, and operationally infeasible to reduce all potential vulnerabilities, it is necessary to **identify** who and what is critical to the security, governance, public health and safety, economy, and morale of the nation. The efforts of the PCCIP, and other government agencies, constitute major strides toward accomplishing this identification. Once identified, these critical infrastructure sectors and key assets must be **analyzed** in order to evaluate the consequences of an attack and appropriately **prioritize** protection efforts. This analysis will depend, in part, on integrating terrorist threat capabilities and intent with identified weaknesses to establish precedence for protection.

Once the nation's critical infrastructures and key assets have been prioritized according to their associated vulnerabilities, efforts must be made to **protect** them from attack. Protective actions include pre-attack warnings to increase the alertness of potential targets, the establishment of contingency plans and procedures to prepare the appropriate sectors for addressing the consequences of an attack, and physical and cyber defense measures to secure potential targets from damage. Collectively, these efforts enhance the **vigilance**, **readiness**, and **surety** of the nation's critical infrastructure and key assets.

The *Vulnerability Reduction* branch specifies six capabilities (shaded in Figure 1) that the United States must pursue, at the national level, in order to reduce the vulnerability to terrorism. In addition, the nation must prepare for the possibility that an attack does occur.

3.1.3 Response Preparedness

The nation's preparedness to respond to acts of terrorism, in this study, focuses on activities performed during and after an attack has occurred. Response preparedness is aimed at the planning, training, equipment, and exercises necessary to prepare the personnel and systems responsible for responding to terrorist attacks within the United States and facilitating recovery from such attacks. The previous two objectives associated with securing the homeland focused on activities prior to the actual occurrence of an attack. The *Response Preparedness* objective addresses the activities necessary to prepare for managing the consequences of an attack that does occur.

Consequence management includes the immediate

need to **minimize the damage** of a terrorist incident by **detecting** the occurrence of an attack, **responding rapidly**, providing medical **treatment** to those affected, and **containing** the damage [4]. If an attack is not correctly identified and recognized, then the appropriate response cannot be developed and deployed. Additionally, treating victims to save life and limb and preventing the spread of the attack are paramount to minimizing the damage associated with a terrorist incident. Because the majority of this responsibility is in the hands of America's emergency first-responders, they must be prepared to react to an array of possibilities. The intent here is to capture federal capabilities that support these state and local efforts.

In addition to the immediate response to an attack, it is important that the United States prepare to **recover** from attacks over a long period of time. This recovery starts with the reconstitution of key systems, services, and facilities by **decontaminating** the site of the attack as necessary and **restoring** critical infrastructure. The eventual **reconstruction** of the systems, services, and facilities affected by the attack is also of considerable concern. While many of these concerns are local, federal support may be required. Finally, it is crucial that the federal government have the capability to **assist** state and local governments in aiding victims and their families with **medical**, **financial**, and **logistical** needs.

The *Response Preparedness* branch of the value hierarchy specifies ten national level capabilities (shaded in Figure 1) that the United States must pursue to prepare to respond to acts of terrorism.

3.2 Measuring the Security of the Homeland

The objectives articulated in the top tiers of the homeland security value hierarchy given in Figure 1 ultimately must be translated into attainable national target capabilities. These capabilities are the lowest level in the value hierarchy and are used as capability measures, along with the respective value functions. Newly developed strategies to enhance security should target the improvement of the 29 critical capabilities delineated in the value hierarchy in Figure 1. In order to gauge the impact that a particular strategy has on each of these capabilities, proper clarification must be given to determine what type of improvements are desired.

3.2.2 Translating Capability to Value

While each individual homeland security objective is important in and of its own right, it is necessary to translate all 29 capabilities to value using single dimension value functions (SDVF) [23]. Based on the current level of capability, a capability gap can be defined. For example, the capability Inspecting under

Entry Denial could be defined from 0% to 100% of material coming across the borders. If the United States currently inspected 40% of all material coming across the border, this would result in a capability gap of 60%. It is assumed that the decision maker values closing the capability gaps to the greatest extent possible. The amount of this value further is assumed to be a function of the size of the capability gap itself. Thus when the gap is large, decision makers assign a relatively large value to even a small percent closure in the capability gap, but less value for the same percent closure of a small capability gap. Thus, the decision makers are emphasizing the “weakest link” in the overall capability structure. This approach captures the decision maker’s intent to close the respective targeted capability shortfalls.

Ideally, one would elicit the value function from the decision maker and subject matter experts for each of these 29 capability measures, perhaps in the shape of an S curve. Alternatively, the value functions could be parameterized by the current capability (see [5]) and implemented through the development of exponential SDVFs similar to those described by Kirkwood [23]. The possible conventional shapes used for value functions are four types of curves: linear, convex, concave, and S-curve. By using these functions, the decision makers can account for the value achieved by strategies that close the capability gaps associated with the sub-objectives. Burk, et al., suggest a two-parameter approach that allows S-curves to be developed for complex national level programs [36]. Specific SDVFs for the homeland security value hierarchy are not presented here, but notional functions are developed for the other hierarchies presented to demonstrate the approach.

One potential concern that has yet to be directly addressed is the possibility of dissimilar assignments of importance among the 29 critical capabilities defined in the value hierarchy in Figure 1. Weighting these capabilities in the value hierarchy addresses this issue of importance. By weighting the capabilities included in the value hierarchy, decision makers can account for their preferences and assign dissimilar levels of importance. Such weighting, though critical to the complete application of the value model, is dependent on the expertise provided by homeland security decision makers. As national priorities and threats change, changing the weighting, as described in the decision analysis literature, provides the opportunity to align the value hierarchy with the decision maker’s preferences and identified levels of importance.

4. Consideration of Resource Costs

“The national effort to enhance homeland security will yield tremendous benefits and entail substantial financial and other costs” [4]. Accordingly, a complete analysis of

the homeland security posture of the United States must consider the costs associated with attaining the desired level of security. By definition, the effort to secure the homeland from terrorism is a responsibility shared by the federal government, state and local governments, the private sector, and the American people [4]. Consistent with the scope of this research, the cost value hierarchy described in this section addresses the key role played by the federal government in allocating resources to homeland security. However, because reduced spending at the federal level can potentially lead to increased cost at the state and local levels, the allocation of resources at all levels of government are considered in the value hierarchy. Additionally, increases in security have the potential to negatively impact the United States economy as a whole or within particular sectors of the economy. This suggests that decision makers should balance where they commit their financial resources, the economic impact that the selected security measures may cause and the time and personnel required to carry out proposed security strategies. Figure 2 illustrates the resource costs value hierarchy.

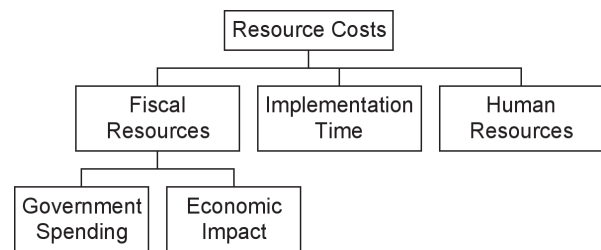


Figure 2. Resource costs value hierarchy

In the value hierarchy, *Fiscal Resources* accounts for the portion of federal, state, and local budgets that is allocated or mandated to implementing a proposed homeland security strategy as well as the economic impact of that implementation. *Implementation Time* accounts for the time necessary to completely implement all portions of a proposed strategy. Finally, *Human Resources* accounts for the acquisition of personnel required at the federal, state, and local level. These three costs are further clarified in the following sections.

4.1 Fiscal Resources

Any proposed strategy to secure the homeland should recognize the economic cost associated with its implementation. The Bush administration requested \$37.7 billion dollars in federal funds for homeland security for 2003 [12]. This number does not account for the homeland security costs directly apportioned from state and local budgets. According to Deloitte Consulting and Aviation Week, state and local governments were

projected to spend as much as \$5.1 and \$13.9 billion, respectively, in Fiscal Year 2003 above and beyond any monetary assistance from the federal government [37]. It was projected that all levels of the United States government combined could spend nearly \$60 billion on homeland security activities in FY2003.

It is assumed that lower dollar costs in **government spending** are preferred at all levels of government. The higher the cost of a strategy, the less value it achieves in the resource cost value hierarchy. It is necessary to carefully balance increases in security against the federal, state, and local budgetary allocations required. Accordingly, while the security model was focused at the federal level, government spending is measured and combined for all three levels of government (local, state, and federal).

In addition to reducing spending, homeland security decision makers must consider the potential **economic impacts** that enhancements in security might pose for the U.S. The recent hardships experienced by the airline industry, for example, can be attributed in part not only to the fear instilled on 9/11, but also to newly imposed time requirements that cause passengers delays necessary to accommodate required security measures. Every effort should be made to design security measures that avoid unnecessarily hindering American commerce. Any strategy must balance this consideration along with the need to enhance security.

4.2 Implementation Time

The urgency of the terrorist threat to the American homeland suggests that an effective security strategy that can be implemented quickly is preferred. However, much like the allocation of fiscal resources, it may prove necessary to allot more time for implementation in order to ensure a higher level of security. For instance, the creation of the Department of Homeland Security should increase the United States' capability to secure the nation from terrorism; however, it could take years to fully organize [38]. This does not necessarily imply that a long-term strategy is an ineffective one; it simply demonstrates how time is a factor that must be considered. In fact, a short-term, poorly-planned strategy could cause future problems that far outweigh the immediate benefit gained. Nevertheless, in general, the longer it takes to implement a particular strategy, the longer the United States remains unsecured. Therefore, shorter implementation time is preferred.

4.3 Human Resources

The Department of Homeland Security is merging 22 government agencies with critical homeland security missions and eventually will consist of more than

170,000 personnel [4,38]. Once fully operational, the new department will be "the third largest federal department in personnel terms" [38]. As one strategy for securing the homeland, the creation of the Department of Homeland Security demonstrates the importance of the personnel element. The acquisition, relocation, training, and management of personnel associated with a particular strategy incur various costs. It is assumed that the preference is to minimize the increase in the homeland security workforce, at the federal, state, and local levels, required to implement a proposed strategy. However, like the previous costs, this increase must be balanced in the overall consideration of the homeland security posture of the United States captured by the security value hierarchy.

4.4 Measuring the Impact on Resource Costs

The measures developed for the resource costs value hierarchy were defined separately and are summarized in Table 2. The dollar amounts for federal, state and local spending reflect the anticipated expenditures. Because efforts to train, organize, and equip local first responders (e.g., police, fire, and emergency personnel) are so essential to homeland security efforts, the local spending cost measure is given a higher upper bound than the state spending cost measure.

The SDVFs are defined for each cost measure and convert the varying x-axis scales defined in Table 2 (LOWER BOUND and UPPER BOUND) to value scales between 0 and 1. The shape of the value curve is provided in parentheses under each cost measure type. Detailed descriptions of the individual SDVFs for all resource costs measures are provided in Pruitt [5] and are not repeated here.

5. Consideration of Civil Liberties

The National Strategy for Homeland Security notes the importance of civil liberties:

Liberty and freedom are fundamental to our way of life. Freedom of expression, freedom of religion, freedom of movement, property rights, freedom from unlawful discrimination – these are all rights we are guaranteed as Americans, and rights we will fight to protect. Many have fought and died in order to establish and protect these rights; we will not relinquish them [4].

Though these freedoms are essential to the American way of life, they may potentially be infringed upon by efforts to secure the homeland from terrorism. It is necessary to recognize and consider how a particular homeland security strategy impacts the civil liberties of America's citizenry, as well as those accused of terrorist

TITLE	MEASURE UNIT	MEASURE TYPE	LOWER BOUND	UPPER BOUND
<i>Government Spending</i>				
Federal Spending	Total cost incurred in NPV	Billions of dollars per strategy (Linear)	0	1
State Spending	Total cost incurred in NPV	Millions of dollars per strategy (Linear)	0	140
Local Spending	Total cost incurred in NPV	Millions of dollars per strategy (Linear)	0	370
<i>Economic Impact</i>				
Impact on Economy	Potential impact of the strategy on the U.S. economy	Constructed	No Impact	Severe Impact
<i>Implementation Time</i>				
Strategy Implementation Time	Years required to implement all portions of the proposed strategy	Years (S-curve)	0	20
<i>Human Resources</i>				
Federal Workforce	Percentage change in workforce required	Percentage (linear)	0	100
State Workforce	Percentage change in workforce required	Percentage (linear)	0	100
Local Workforce	Percentage change in workforce required	Percentage (linear)	0	100

Table 2. Resource costs measures

activity. A newly proposed plan to secure the United States, for example, may dramatically increase the capability of the federal government to combat terrorism. However, this enhancement may be unacceptable due to its potential infringement on the fundamental freedoms that are the right of all Americans.

Concern for civil liberties centers on three primary freedoms that security efforts may impact; privacy rights, freedom from discrimination, and judicial rights. Unwarranted searches and intrusions into the personal affairs of innocent Americans would severely infringe on the right to privacy. Discrimination against individuals based on their beliefs or background is another potential negative impact of increased security. Finally, the judicial rights promised to individuals suspected of terrorism must not be neglected. Indefinite detentions or suspension of habeas corpus are only two ways in which these rights could be impacted. The value hierarchy in Figure 3 attempts to account for the potential impacts that security efforts may have on civil liberties.

Each of these values is further clarified in the sections to follow.

5.1 Privacy Rights

The collection and analysis of information pertaining to possible terrorist threats is pivotal to the federal government's effort to secure the United States homeland. However, these activities potentially are in conflict with the privacy rights of America's citizenry. The increased public use of video and other forms of surveillance, the proposed creation of a national identification card, and increased government access to personal, financial, and communication records are a sampling of topics that have raised concern for individual privacy rights. Sections 201 through 225 of the USA PATRIOT Act, for example, address a variety of enhanced surveillance procedures including the authority to intercept wire, oral, and electronic communications relating to terrorism [7].

Each year, Privacy International and the Electronic Privacy Information Center (EPIC) perform the Privacy and Human Rights survey to review the state of privacy in over 50 countries worldwide [39]. In its analysis of the United States, the report noted that there is no explicit

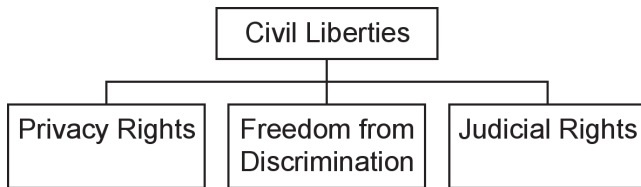


Figure 3. Civil liberties value hierarchy

right to privacy contained within the U.S. Constitution [39]. However, “the Supreme Court has ruled that there is a limited constitutional right of privacy based on a number of provisions in the Bill of Rights” [39]. The main provision referred to in a number of privacy-related Supreme Court cases is the Fourth Amendment [39]. This amendment, which addresses search and arrest warrants, states:

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized [40].

However, third party records, such as consumer marketing profiles or telephone calling records, are generally not protected in this way [39]. It is this type of information that the federal government wishes to utilize in order to track down terrorists [41].

While established in January 2002, the Information Awareness Office (IAO) within the Defense Advanced Research Projects Agency (DARPA) only began to attract public attention at the end of 2002 [41]. Led by retired Admiral John Poindexter, the IAO’s Total Information Awareness (TIA) project wished to detect terrorists by tracking their financial footprints [41]. IAO Deputy Director Robert Popp stated:

If terror organizations are going to engage in adverse actions against the United States it must involve people and those people will make transactions and those transactions will leave a signature in the information space [41].

However, in order to find “those people,” the IAO expected to data mine huge amounts of information about not only potential terrorists, but also innocent Americans. Many fear that sweeping enhancements in data acquisition could lead to the sort of abuses revealed by the Church Committee in 1975 [42]. These abuses included a variety of questionable investigative techniques and programs alleged to have been carried out by the FBI and CIA [42]. Popp further states, “This is the problem that we face, which is really, really hard.

You don’t necessarily know a priori the bad guy. That’s where you run into the issue of privacy” [41].

Thus, it is necessary to balance the effort to identify terrorists operating within the United States against possible infringements on the privacy rights of innocent Americans. Whatever steps are taken, the impact of this infringement on privacy should not outweigh the increase it provides in the capability to detect terrorist threats.

5.3 Freedom from Discrimination

The prevention of terrorism requires decisive action by law enforcement, the military, and other government agencies. The military actions carried out in Afghanistan or Iraq, for example, played a key role in combating terrorist networks. However, such actions, particularly when targeted at foreign terrorists, may unintentionally inflame worldwide prejudices. United Nations High Commissioner for Human Rights, Sergio Vieira de Mello, addressed the rise in discrimination against Muslims by stating, “Arabs and Muslims at large are experiencing increasing incidents of racial discrimination ... Singling out, finger pointing and ... even in some instances (violence)” [43]. The USA PATRIOT Act states that these acts of violence “should be and are condemned by all Americans who value freedom” [7]. The Act further states that:

the civil rights and civil liberties of all Americans, including Arab Americans, Muslim Americans, and Americans from South Asia, must be protected, and that every effort must be taken to preserve their safety [7].

In addition, many fear that the “war on terror” has led to racial or ethnic profiling of foreigners and cultural groups within the United States [44]. Since September 11, thousands of immigrants and foreign citizens have been detained and interviewed as part of the subsequent investigation [44]. An array of pundits has compared these detentions to the internment of U.S. citizens of Japanese descent during World War II. Though the Bush administration has repeatedly spoken out against racial profiling and insisted that these individuals were suspected terrorists, some argue that their selection was based solely on their country of origin [44].

Though every effort must be made to prevent terrorism within the United States, the federal government must be, and is, wary of the potential discriminatory nature of certain homeland security actions. Many actions could increase the security of the nation, but their capability to aggravate existing prejudices or instigate racial or ethnic profiling might make them unacceptable to the American public. We cannot secure the nation by denying the rights that define the nation.

5.4 Judicial Rights

Just as it is important that the federal government avoid unlawfully discriminating against individuals based on their racial or ethnic background, it is equally important that suspected or indicted terrorists not be denied the judicial rights established by law. Current concerns include the legality of detentions, access to legal representation, attorney-client privileges, and the right to a fair trial.

Similar to the Fourth Amendment rights potentially denied by new methods of collecting information about terrorists, Fifth and Sixth Amendment rights may potentially be impacted by efforts to bring terrorists to justice. The Fifth Amendment, which addresses rights in criminal cases, states:

No person shall be held to answer for a capital, or otherwise infamous crime, unless on a presentment or indictment of a Grand Jury, except in cases arising in the land or naval forces, or in the Militia, when in actual service in time of War or public danger; nor shall any person be subject for the same offense to be twice put in jeopardy of life or limb; nor shall be compelled in any criminal case to be a witness against himself, nor be deprived of life, liberty, or property, without due process of law; nor shall private property

be taken for public use, without just compensation [40].

The Sixth Amendment, which addresses rights to a fair trial, states:

In all criminal prosecutions, the accused shall enjoy the right to a speedy and public trial, by an impartial jury of the State and district wherein the crime shall have been committed, which district shall have been previously ascertained by law, and to be informed of the nature and cause of the accusation; to be confronted with the witnesses against him; to have compulsory process for obtaining witnesses in his favor, and to have the Assistance of Counsel for his defense [40].

These two amendments dictate rights promised to Americans by law. Thus, all those who are entitled these rights must receive them. The question of who is and is not promised these rights, however, is in dispute. Much of this current dispute stems from the distinction between a material witness and a visa violator [45]. The government must be careful to ensure that its efforts to reduce the threat of terrorism do not unlawfully limit the rights of suspected terrorists. The right to a fair trial, representation, and other legal considerations should be administered when appropriate.

TITLE	MEASURE UNIT	MEASURE TYPE	LOWER BOUND	UPPER BOUND
<i>Privacy Rights</i>				
Fourth Amendment (Physical)	Potential impact of the strategy on Fouth Amendment rights?	Constructed	No Impact	Severe Impact
Fourth Amendment (Electronic)	Potential impact of the strategy on Fouth Amendment rights?	Constructed	No Impact	Severe Impact
<i>Freedom from Discrimination</i>				
Discrimination Issues	Does the proposed strategy present issues with discrimination?	Constructed	No Issues	Severe Issues
<i>Judicial Rights</i>				
Fifth Amendment	Potential impact of the strategy on Fifth Amendment rights?	Constructed	No Impact	Potential Impact
Sixth Amendment	Potential impact of the strategy on Sixth Amendment rights?	Constructed	No Impact	Potential Impact

Table 3. Civil liberty measures

5.5 Measuring the Impact on Civil Liberties

Similar to the resource costs measures, the measures for the civil liberties value hierarchy were developed separately and did not rely on the capability measure provided in the homeland security value hierarchy. Table 3 summarizes the measures developed for the civil liberties value hierarchy.

The SDVFs are bound from 0–1 to convert the varying x-axis scales defined in Table 3 (LOWER BOUND and UPPER BOUND) to value. Detailed descriptions, including the constructed scales, of the individual SDVFs for all civil liberties measures are provided in Pruitt [5] and will not be repeated here.

6. Conclusions and Recommendations

The terrorist attacks on September 11, 2001, forced the fundamental objective of homeland security to the forefront of national concern. Though an array of commissions and research groups had warned the nation about the potential for attacks within the United States, it was not until this grave day in American history that attention truly was focused on this threat. Thus to secure the homeland, the United States must have the capability to prevent attacks, reduce critical vulnerabilities, and prepare for the possibility that attacks do occur. This complex and poorly defined mission can be difficult to accomplish without the proper clarification of objectives, sub-objectives, and capabilities, and the ability to evaluate how well alternatives enhance those capabilities. This study takes a critical step in beginning to address these areas of difficulty.

The security of the homeland from terrorist threats and attacks is a fundamental responsibility of the Federal government. However, the execution of this responsibility runs the risk of potentially impacting other fundamental duties; namely avoiding excessive budgetary spending and infringements on civil liberties. The three hierarchies described in this paper (Homeland Security, Resource Costs, and Civil Liberties) provide a method for the federal government to employ in measuring the achievement of the objectives associated with each individual responsibility, as well as to balance them against one another.

By employing a “Gold Standard”-based decision analysis methodology, this study has clearly and comprehensively identified and defined the capabilities required for the federal government to secure the United States from terrorism. The hierarchies developed in this study provide a step forward in the field of homeland security, which continues to be ripe for future research.

6.1 Recommendations

The following recommendations are provided as guidance for further research in homeland security decision making. With a complete value model, the Federal government has the capability to help evaluate and rank newly developed homeland security strategies. This ranking would be based on the aspects that are valued in the homeland security decision context and would provide an objective, defensible, and repeatable method to support the allocation of federal resources. While the final decisions on such grave national issues always will require the considered inputs of the branches of government, such a model could aid in screening strategies and identifying “value gaps” in present proposals and provide insight regarding the change in proposal rankings given various changes in weighting.

The same approach could be used to evaluate the outcomes from various simulation studies sponsored under the auspices of homeland security. The ability to impact each of the given capability measures could be simulated and thus would provide the scoring data required to calculate the overall impact to homeland security. Each outcome would generate a separate overall score and the best simulation run (based on input parameters) would return the highest impact to homeland security.

This study addressed homeland security sub-objectives and capabilities at the federal level of government since the defense of the American people is a constitutionally defined responsibility. On the other hand, state and local governments, as well as the private sector, also have homeland security responsibilities. Local first responders and state emergency response personnel are essential in the effort to minimize the damage of terrorist attacks. Additionally, because nearly 85% of the nation’s critical infrastructure is owned and operated by non-government entities, the private sector must allocate scarce resources in the reduction of America’s vulnerabilities [4]. Consequently, further research could contribute significantly to homeland security decision support by performing similar studies at these levels of authority. The integration of this type of analysis at all levels of government and the private sector would provide the United States with a truly national capability to support decision making in the homeland security context. The development of a value hierarchy of value hierarchies would incorporate the decentralized decision making of state and local governments with the values held at the federal level.

This study is an initial step in modeling the complex and pervasive problem of securing the American

homeland from terrorist threats and attacks. As long as the critical infrastructures and key assets of the United States remain vulnerable and terrorists are capable of executing their deadly intentions, homeland security will be of imminent concern. The value hierarchies presented in this study were developed from the objectives defined in homeland security doctrine and provide insight into the difficult process of allocating resources to the development of effective strategy. This insight provides a foundation for the federal government to leverage in the continuing effort to accomplish one of the most vital missions facing the United States of America: homeland security.

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