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Simulation of Multicultural Factors in Terrorism Networks

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Simulation of Multicultural Factors in Terrorism Networks

An undergraduate honors thesis submitted to the

Department of Industrial Engineering

University of Arkansas

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Abstract

As globalization extends its influence to the far corners of the world, rapid developments and changes are taking place economically, socially, and environmentally. Cultural differences between and within organizations have become significant during the past few years as politics and marketplaces expand globally to include multiple nationalities, beliefs, and value systems. Unfortunately, terrorism has also felt the effects of globalization as organizations such as Al-Qaeda seek to expand their influence worldwide. Although a considerable amount of research has been conducted to identify key cultural factors that play major roles within organizations, simulation models that attempt to quantify cultural effects are few and far between.

In this paper, a simulation model utilizing system dynamics principles was constructed in order to investigate the possible effects of multicultural factors within Al-Qaeda. The model was constructed based on Chamberlain's system dynamics model (Chamberlain, 2007), and modified to include a sub-model containing cultural factors and effects. The time frame for the model was from 1990-2020, with the cultural factors taking effect in 2003. The results were analyzed to determine possible strategies for exploiting the existing cultural rifts within Al-Qaeda and among its recruiting base. It was concluded that cultural factors play a crucial role in Al-Qaeda's terrorism efforts, and that the development of effective policies regarding the multicultural nature of terrorism conflicts will be a valuable asset in the fight against terrorism.

Introduction

As globalization extends its influence to the far corners of the world, rapid developments and changes are taking place economically, socially, and environmentally. Organizations are key building blocks for society; businesses and governments are just two of the many types of organizations. Consequently, the study of organizations and how they react to both internal and external variables has significance. Economies and businesses are affected as multicultural teams become more common place and the marketplace spans national boundaries; peacekeeping missions and multinational coalitions require that governments interact and cooperate in order to succeed.

Since organizations play such a key role in society, being able to predict the behavior of organizations is an invaluable asset. How will an organization react to the departure of a key leader? Will an organization grow given certain hiring criteria? How does decision making flow? Can the execution of orders be improved? These are just a few of the questions that have significance in an organization. Organizational simulation is a tool that allows the testing of theories and predictions, and can play a vital role in answering many of these questions. Through simulation, better planning can be realized and valuable knowledge gained. The existence of complex supply chains confirms the interdependence of many organizations today; organizational simulation can provide a tool for companies to identify risks in the chain and plan accordingly.

The influence of globalization has also given rise to a host of problems. Terrorist organizations, such as Al-Qaeda, have become global players, recruiting members from across the globe. Their multinational and multicultural organizations have been operating constantly all over the world. Organizational simulation could be a useful tool for predicting terrorist behavior,

thereby providing valuable information to governments. Weaknesses could be identified and exploited, and risks mitigated.

Objective

A significant amount of research is currently being conducted in the area of organizational simulation (Chamberlain, 2007); however, the majority of the existing models do not take cultural factors into account. The continued research and development of effective organizational simulation tools and methods, particularly with respect to multi-cultural/multi-national factors, is a vital asset to organizations all over the world. Although a considerable amount of research has been conducted in the sociological arena on the specific factors affecting multi-cultural organizations (Klein & McHugh, 2005), the majority of these observations have been qualitative; the challenge, then, is to create an effective model that combines and quantifies multi-cultural factors into a valid representation of reality (Salas, Guthrie, Wilson-Donnelly, Priest, & Burke, 2005). The model should have the capability to function as a tool for predicting organizational behavior and the effects of a dynamic environment.

In this study, a simulation model representing the organizational behaviors and interactions of the United States and Al-Qaeda is constructed, with an emphasis on the multi-cultural and multi-national factors that may play a significant role. Through the simulation of this behavior, accomplished by drawing from the available research in the roles that cultural factors play within organizations, insights regarding possible countermeasures and disruption techniques are drawn from the data. The implications of this research would not be confined merely to anti-terrorism tactics; any organization containing elements of differing cultures and nationalities may benefit. Additionally, areas for further study will be identified and brought to light.

Methods

Several existing simulation techniques are applicable to organizational simulation; two are particularly relevant: agent based modeling and system dynamics modeling. Agent based modeling determines organizational behavior on a macro scale based on the individual behaviors of the members (Shaw & Pritchett, 2005); hence, the collective activities/behaviors of the group members determine the overall organization behavior. Each member (agent) of the organization is a distinct entity; this entity interacts with the other agents within an environment. The environmental factors affect the individual behaviors and interactions of the agents within the system; thus, organizational behavior is determined by individuals operating within a defined environment.

System dynamics focuses on the relationships between entities in an organization and the informational feedback between individuals; the nature of these relationships defines the behavior of the organization. At its foundation, the system dynamics method of modeling is built on *stocks* and *flows* (Eggers & Brown, 2002). Stocks can represent resource locations, state variables, or other values that change over time, while flows represent the rate at which the values of the stocks change. If two stocks are interrelated (e.g. available recruits and current members), a number of key factors may determine the flow from one to the other. The behavior of the organization is thus determined by the relationships of the stocks, as well as the flows between them.

Both of these modeling approaches have relevance to multi-cultural organizations; in this study, system dynamics was chosen as the modeling technique. System dynamics was chosen based on the conjecture that a high-level, holistic analysis of organizational behavior and interaction would be an accomplishable next step in analyzing multicultural effects. Hypotheses

regarding the possible impacts of these factors would be more easily tested in the absence of quantifiable cultural effects data. Sensitivity analysis and identification of significant factors would be beneficial in providing further knowledge with respect to specific cultural effects. With regards to future research, utilizing the system dynamics approach may provide assistance toward producing more quantifiable factors that could then be used as inputs for agent based models, or a combination of both techniques.

Base Model

In order to provide a basis for the integration of multicultural factors, an existing system dynamics model was investigated; Chamberlain's system dynamics model representing the "competition" between United States anti-terrorist activities and Al-Qaeda's organizational goals was selected. At the time of this study, Chamberlain's model was the most specific application of system dynamics to terrorist organizational and operational activities; subsequently, it was concluded that this model would be the best choice for modification and incorporation of cultural factors (see Figure 1 for an overview of the model).

As mentioned previously, systems dynamics is based on systems of stocks and flows; interactions between different stocks and flows create either *reinforcing* (designated with an "R" in Figure 1) loops or *balancing* (designated with a "B") loops. Reinforcing loops demonstrate relationships that feed growth or decay of variables, while balancing loops attempt to achieve equilibrium. These loops are built on fundamental relationships between variables in the model. In the diagram notation utilized by Chamberlain, inter-variable relationships with an "S" designate that if the variable at the tail end of the arrow increases/decreases, the variable at the head increases/decreases; the inverse is true of relationships designated with an "O": as a

variable at the tail of the arrow increases/decreases, the variable at tail of the arrow decreases/increases. Though Chamberlain's original model was constructed using Vensim, the model was reconstructed utilizing the AnyLogic simulation package.
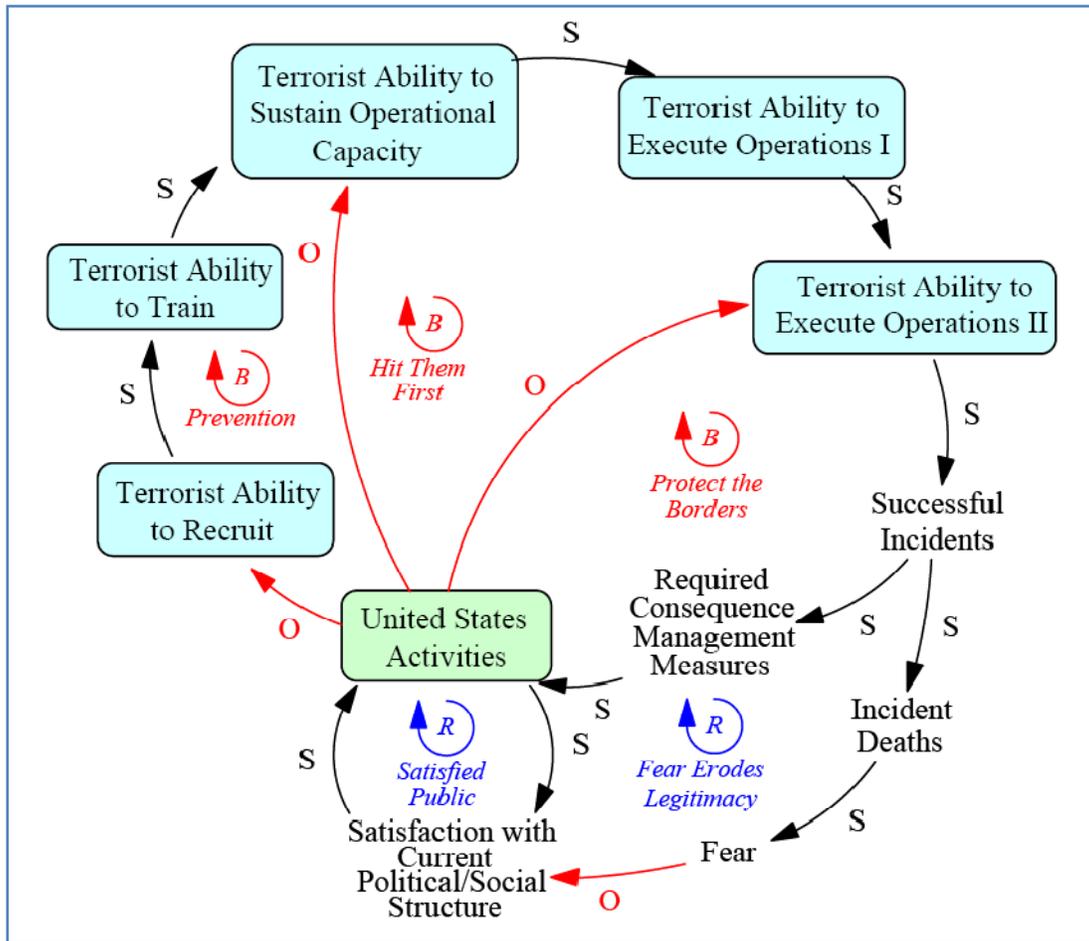

Figure 1: Sub-Model Interactions (Source: Chamberlain, 2007)

Chamberlain's model was made up of six separate sub-models, each representing different aspects of the struggle between the United States and Al-Qaeda. These sub-models interacted to represent the overall system behavior of both organizations. At the highest level of abstraction, the model represents the battle between conflicting ideologies: Al-Qaeda's use of terrorism tactics to institute a fundamentalist Islamic caliphate, and the United States' pursuit of democracy to establish safety and security in the global environment. Success of either ideology leads to reward and decreases the resources available to the competition, while losses lead to

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escalation of activities to regain lost ground. The six sub-models and their activities are summarized below; for details, please consult "Systems Dynamics Model of Al-Qa'ida and United States 'Competition'" by Todd Chamberlain (Chamberlain, 2007).
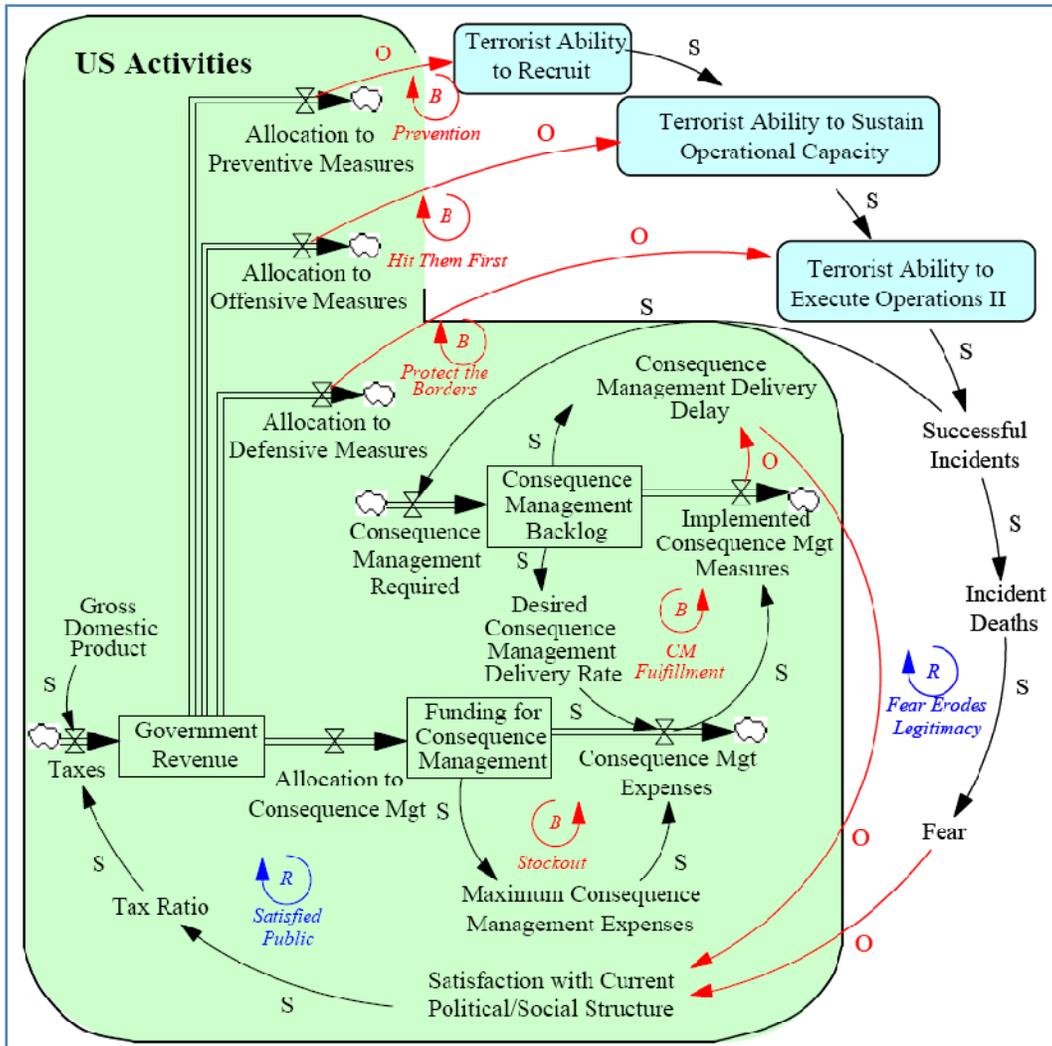
United States Activities

Figure 2: United States Activities Sub-Model Diagram (Source: Chamberlain, 2007)

The United States Activities sub-model, shown in Figure 2, represents the actions taken by the United States to counter Al-Qaeda's terroristic activities. The resources utilized for response activities are allocated from the United States Federal budget; in turn, the available

funds are then distributed over four separate categories. Three of the categories are implemented in order to prevent Al-Qaeda from conducting terroristic activities, and include: preventative measures, offensive measures, and defensive measures. Each of these measures has an effect on particular aspects of Al-Qaeda's organizational operations. Preventative measures decrease Al-Qaeda's ability to recruit additional members from disenfranchised populations. Offensive measures mitigate Al-Qaeda's ability to maintain operational capacity and to provide training to new recruits. Defensive measures decrease the execution of planned terrorist attacks. The fourth category receiving funds from the Federal budget is consequence management. These funds are utilized in the recovery phase after a terrorist attack in order to repair the resulting damage.

The number of successful terrorist incidents conducted by Al-Qaeda effects the satisfaction of the public with the government; this in turn affects the revenues the government employs in order to fund the four categories.
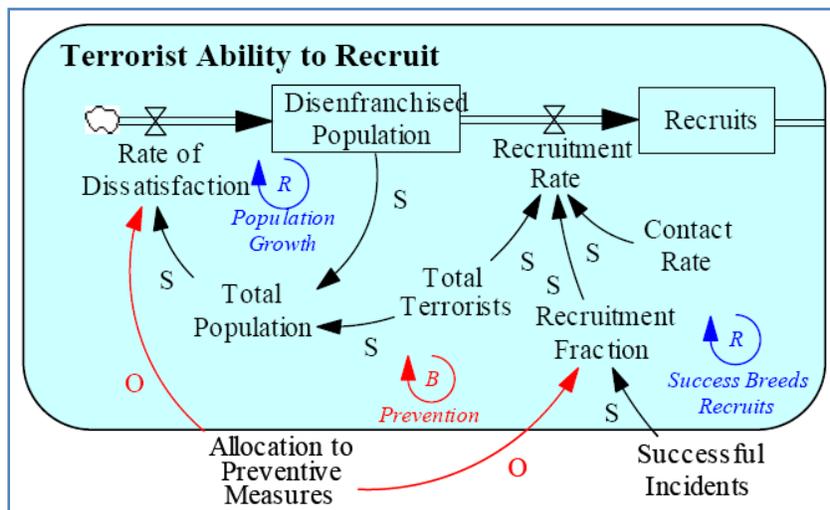
Terrorist Ability to Recruit

Figure 3: Terrorist Ability to Recruit Sub-Model Diagram (Source: Chamberlain, 2007)

The Terrorist Ability to Recruit sub-model, given in Figure 3, is the first of five representing Al-Qaeda's organizational activities. Al-Qaeda relies primarily on the population of

disenfranchised individuals in order to fill its ranks with recruits. The actual rate of recruitment

depends on the attractiveness of joining Al-Qaeda, and the number of recruitment contacts made

by existing members. Preventative measures from the United States affect the growth of the

disenchanted population, as well as the number of potential recruits who accept the offer to join
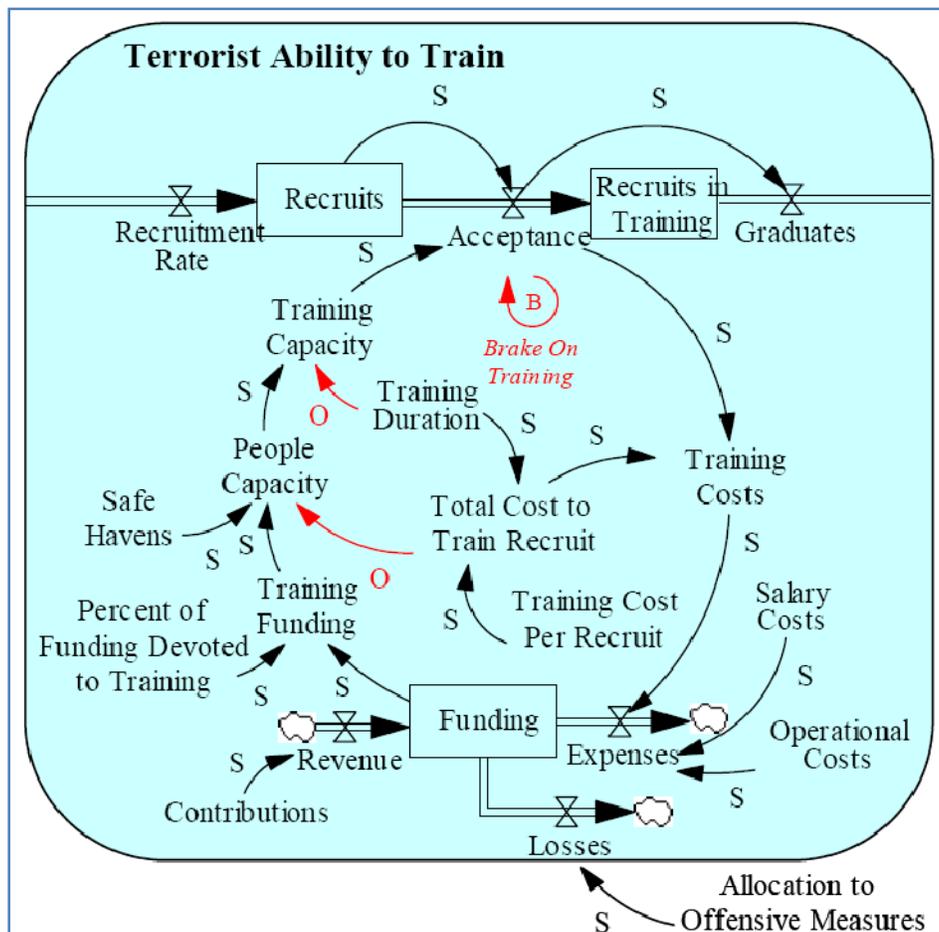
Al-Qaeda.

Terrorist Ability to Train

Figure 4: Terrorist Ability to Train Sub-Model Diagram (Source: Chamberlain, 2007)

Al-Qaeda's ability to train new recruits, illustrated in Figure 4, is heavily dependent on

the available funding and the accessibility of training camps. The maximum number of recruits

accepted into training at any given time is dependent on the percentage of funds available for

training. Funding is maintained through contributions from donors sympathetic to Al-Qaeda's cause; it decreases due to training expenses, as well as the effectiveness of the United States offensive measures in freezing terrorist assets. After an appropriate delay for the duration of training, graduates are added to the pool of terrorist available for attacks. One significant modification made to Chamberlain's model was made regarding the accessibility of training camps. Chamberlain's model assumes that recruits can only be accepted between 1993 and November 2001 (training camps were first available in 1993, and the training camps in Afghanistan were destroyed in November 2001). This assumption was modified so that Al-Qaeda's training capacity decreased 80% after November 2001, representing the increased difficulty of training due to the destruction of the Afghanistan training camps, but reflecting Al-Qaeda's continued ability to train recruits (albeit at a significantly decreased rate). In the interest of sensitivity analysis, an assumption of a 50% decreased was tested as well. Overall trends remained the same, although the number of terrorist deaths and captures increased in magnitude. Funding was slightly affected as more money was allocated to training.

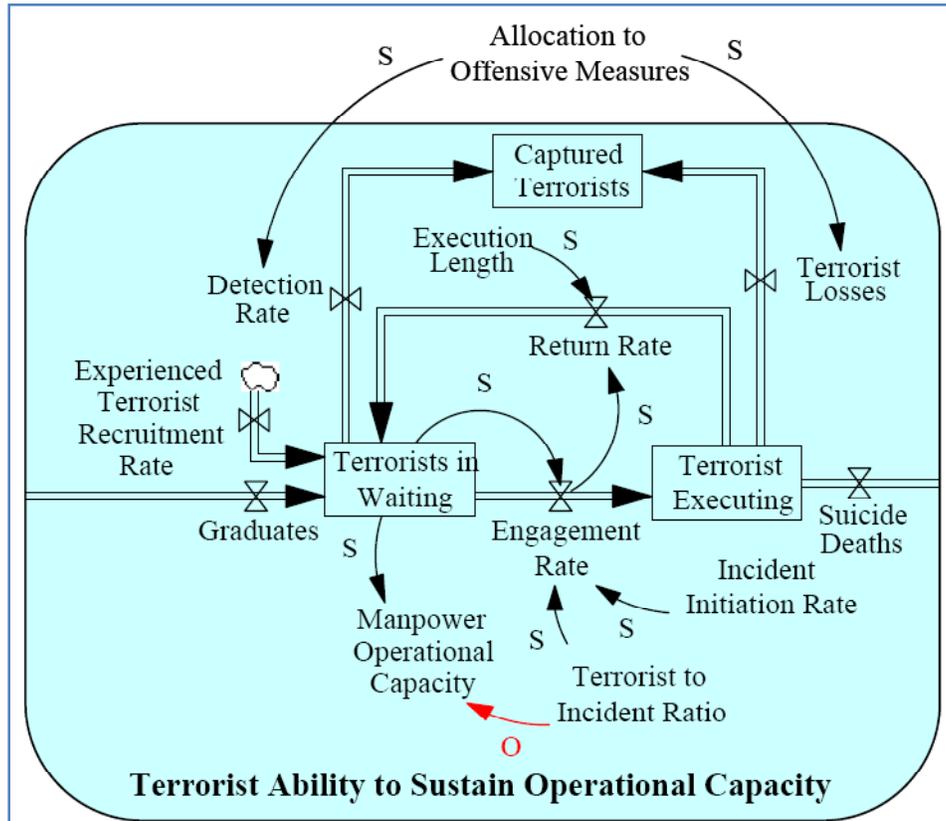*Terrorist Ability to Sustain Operational Capacity*

Figure 5: Terrorist Ability to Recruit Sub-Model Diagram (Source: Chamberlain, 2007)

The third Al-Qaeda sub-model, shown above in Figure 5, depicts Al-Qaeda's ability to sustain its numbers of trained terrorists. In addition to the members who completed training, the sub-model includes the addition of 300 terrorists from Al-Qaeda's merger with the Egyptian Islamic Front in 1998 (Hoffman, 2003). Terrorists waiting to execute orders engage in attacks at a rate determined by the average number of terrorists required per incident, as well as the number of incidents initiated. After execution of an incident, terrorists return to a waiting status. Terrorist losses are sustained during the waiting period (detection via United States offensive measures), or during execution of an attack (capture due to United States offensive measures or through suicide).

Terrorist Ability Execute I
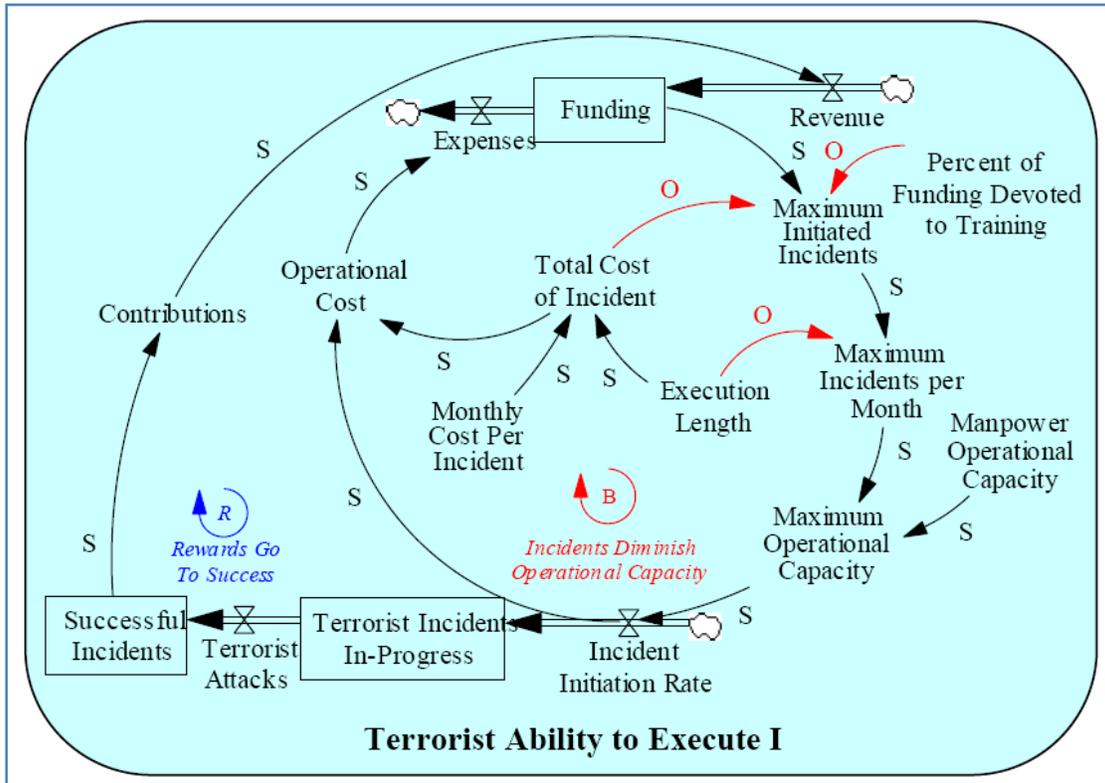
Figure 6: Terrorist Ability to Execute I Sub-Model Diagram (Source: Chamberlain, 2007)

The next Al-Qaeda sub-model, shown in Figure 6, captures the relationship between funding, total number of available terrorists, and number of initiated incidents. The number of incidents initiated depends on the amount of funding available, and the number of terrorists required for each incident; either factor may act as a constraint. Successful incidents increase contributions to Al-Qaeda from sympathetic donors.
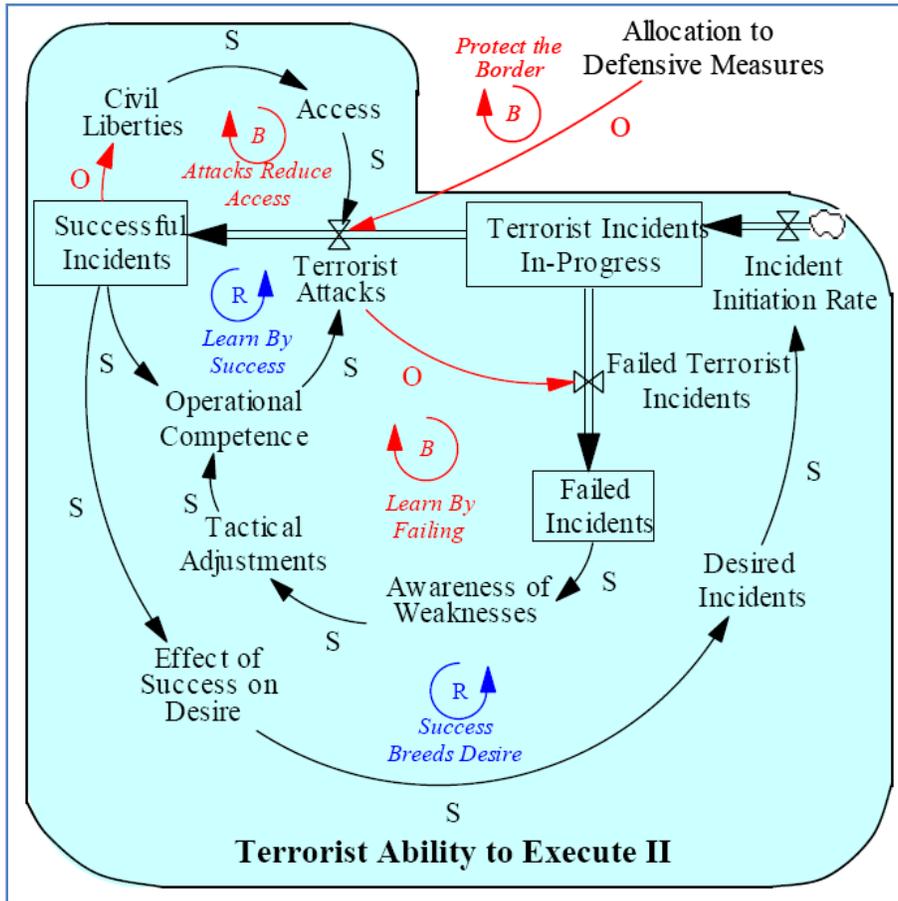
Terrorist Ability to Execute II

Figure 7: Terrorist Ability to Execute II Sub-Model Diagram (Source: Chamberlain, 2007)

The final sub-model representing Al-Qaeda, shown in Figure 7, focuses on the execution of incidents. After incidents have been initiated and are in progress, success depends on the United States' defensive measures. As the number of successful incidents increases, access to the United States is decreased as security increases; this affects the future success of incidents. Failed attacks represent a learning opportunity for Al-Qaeda, and its operational competency is increased as a result, leading to higher rates of success in the future. There is also an escalation factor, since successful incidents increase the desire for more incidents in the future.

Base Model Validation

Having determined the overall structure of the model through Chamberlain's article in the *Journal of Homeland Security and Emergency Management*, the challenge lay in determining the mathematical relationships between the factors in the model as well the values for the data used in the model. Efforts to obtain Chamberlain's values for model inputs were unsuccessful, so estimation based on background research and frequent trial and error adjustments to the model in order to match the results of Chamberlain's original work. The simulation model was run for the period from 1990 to 2001 and the results are displayed in Figure 8 and compared with those from Chamberlains paper which are given in Figure 9.

In general, results for the number of successful terrorist incidents, number of failed terrorist incidents, terrorist deaths, and terrorist captures were remarkably similar to Chamberlain's results (Figure 9). Number of incident deaths yielded by the model was also comparable to the number produced by Chamberlain's, with the difference primarily being in the steepness of the exponential curve; the reconstructed model has over 1000 incident deaths by the 250th week (year of 1994), while Chamberlain's does not reach the same threshold until 1999. Though the ending magnitudes were very similar, long term trends may differ. These five benchmarks were of greater importance than the others due to the existence of actual data; Chamberlain compared his model results with historical data regarding the number of successful and unsuccessful terrorist incidents, as well as the number of terrorist who were captured or died during the course of a terrorist incident. Consequently, these results were very encouraging with regards to the validity of the recreated model.

The total number of terrorists and the funding available to Al-Qaeda represent the greatest departure from Chamberlain's model. Though the ending number of terrorists was

reasonably close, the trend displayed by the chart is obviously much different. Due to the lack of information on the original model, the reconstructed model may be lacking a factor not mentioned in Chamberlain's article. Nevertheless, the trend displayed by the recreated model appears to be valid; numbers remain low until the opening of training camps, when the number of terrorists spikes quickly until funding reserves are decreased, slowing the rate of acceptance. This would also explain the trends in terrorist funding, as revenue builds up to around $28 million, and then falls quickly when the training camps become available. Chamberlain's model reaches a peak of $70 million in 1998, and it was concluded that an additional source of income not mentioned in the article must have been present (the article indicated an average of $10 million per year). Regardless of the magnitudes, the trends displayed by the results from the recreated model would seem to be reasonable considering the events occurring at different times during the simulation run, and fairly representative of reality. Additionally, no data was available with respect to the total number of terrorists and the available funding; consequently, deviation from Chamberlain's model on these particular points in not as significant.
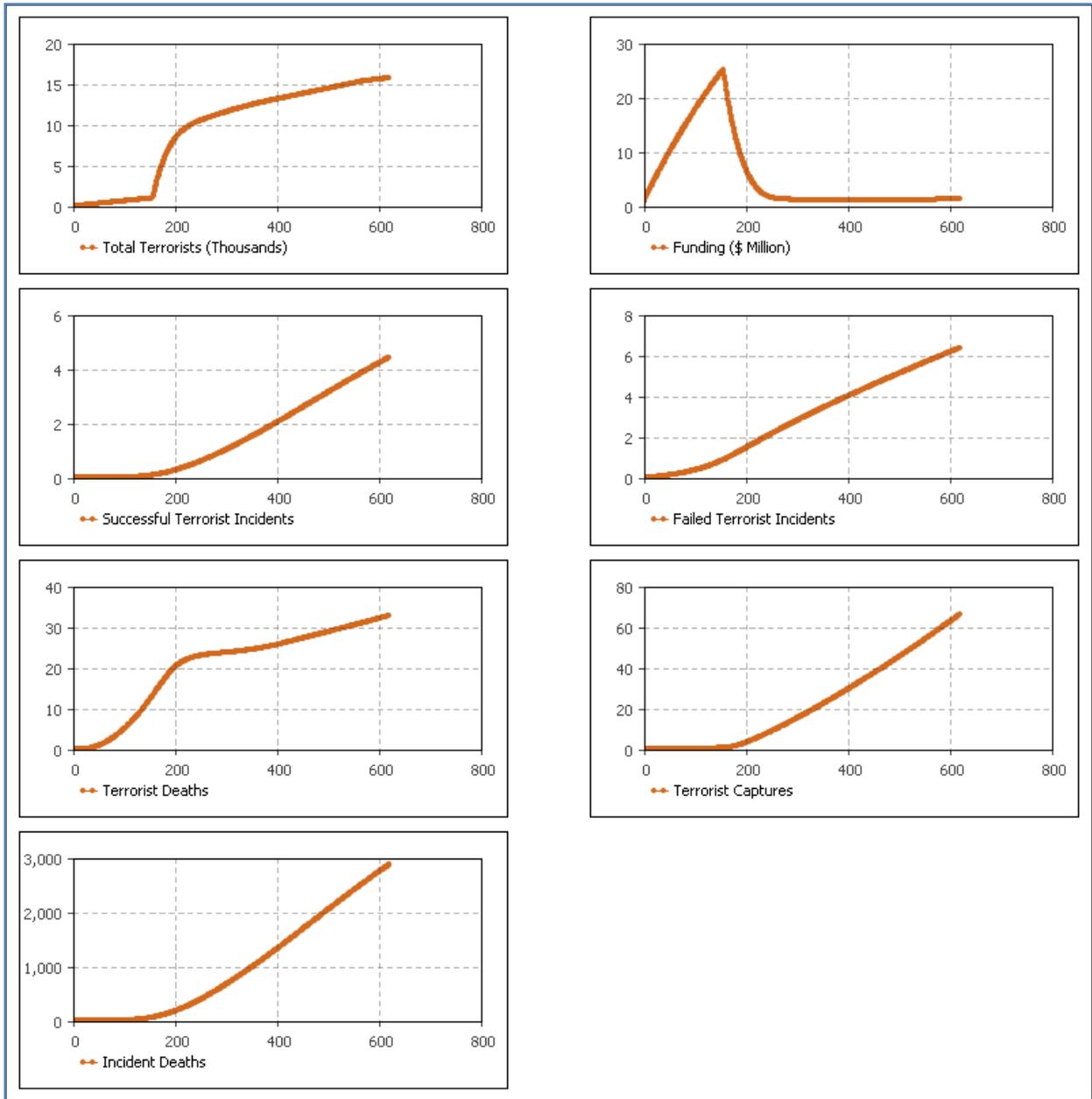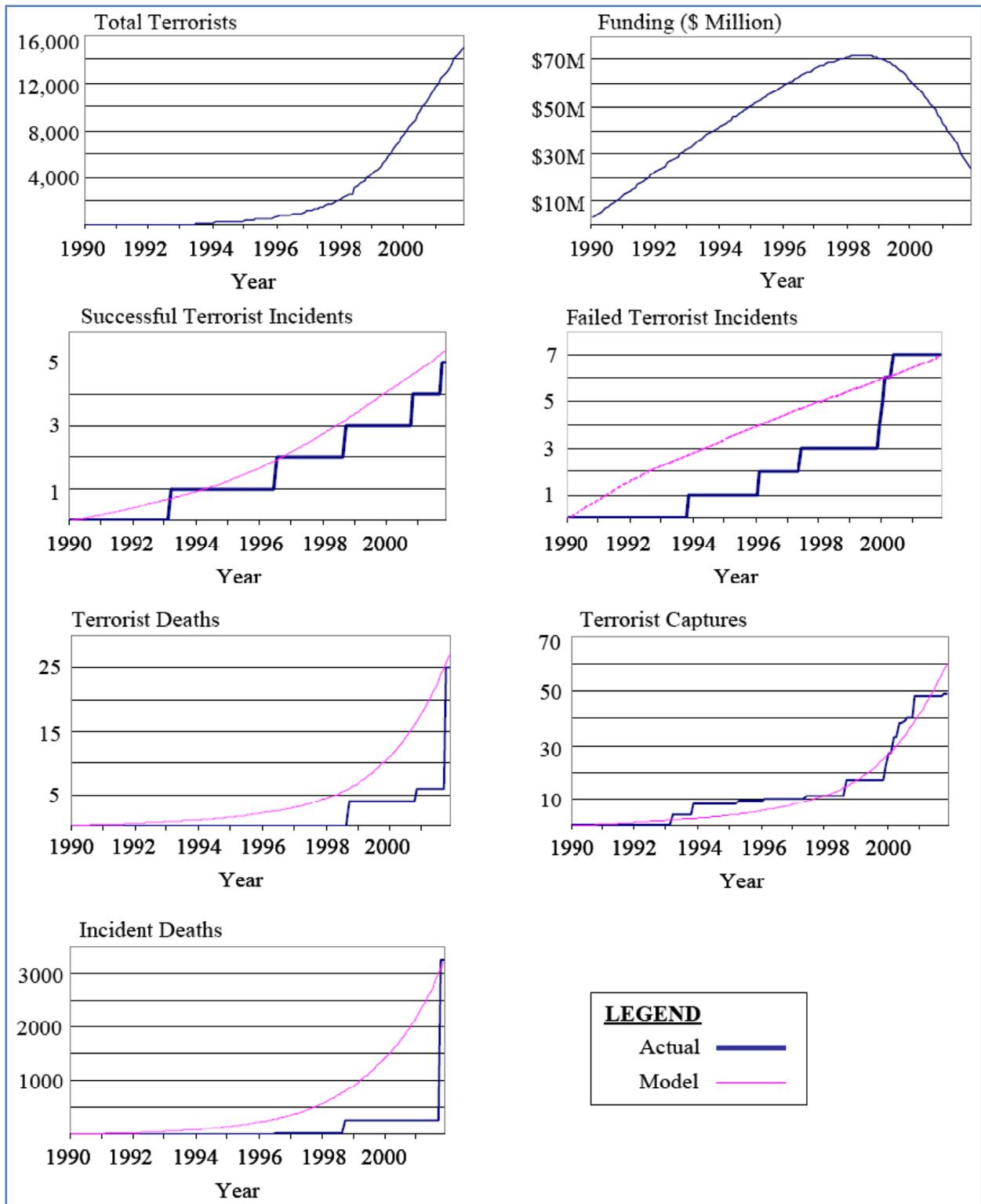
Figure 8: Validation Results

Figure 9: Chamberlain Model Results Compared to Actual, 1990-Sept 2001 (Source: Chamberlain, 2007)

Having concluded that the model was a good representation of Al-Qaeda's organizational

activities from a holistic, high level, a seventh sub-model was created in order to take

multicultural factors into account. These factors were then linked to relevant factors in the original model in order to determine the possible effects.

Multicultural Effects Sub-Model

Ever since the events of September 11, 2001, the United States has experienced great tactical successes in the fight against terrorism. Military operations in Afghanistan and Iraq were swift and met relatively soft resistance; Al-Qaeda suffered the loss of many leaders and members, as well as training camps and other resources. However, it is becoming clear that the fight against terrorism will not be resolved quickly as evidenced by the continued conflict in Iraq and Afghanistan; rather, it may continue indefinitely. Given the long term nature of the mission, it is possible that assigning too much attention to tactical victories may not be the most beneficial approach. A more effective method may be to focus on long term strategic goals. Given the clash of ideologies and cultures represented by the struggle between the United States and Al-Qaeda, determining the significance of multicultural factors may be crucial in developing an effective and appropriate strategy.
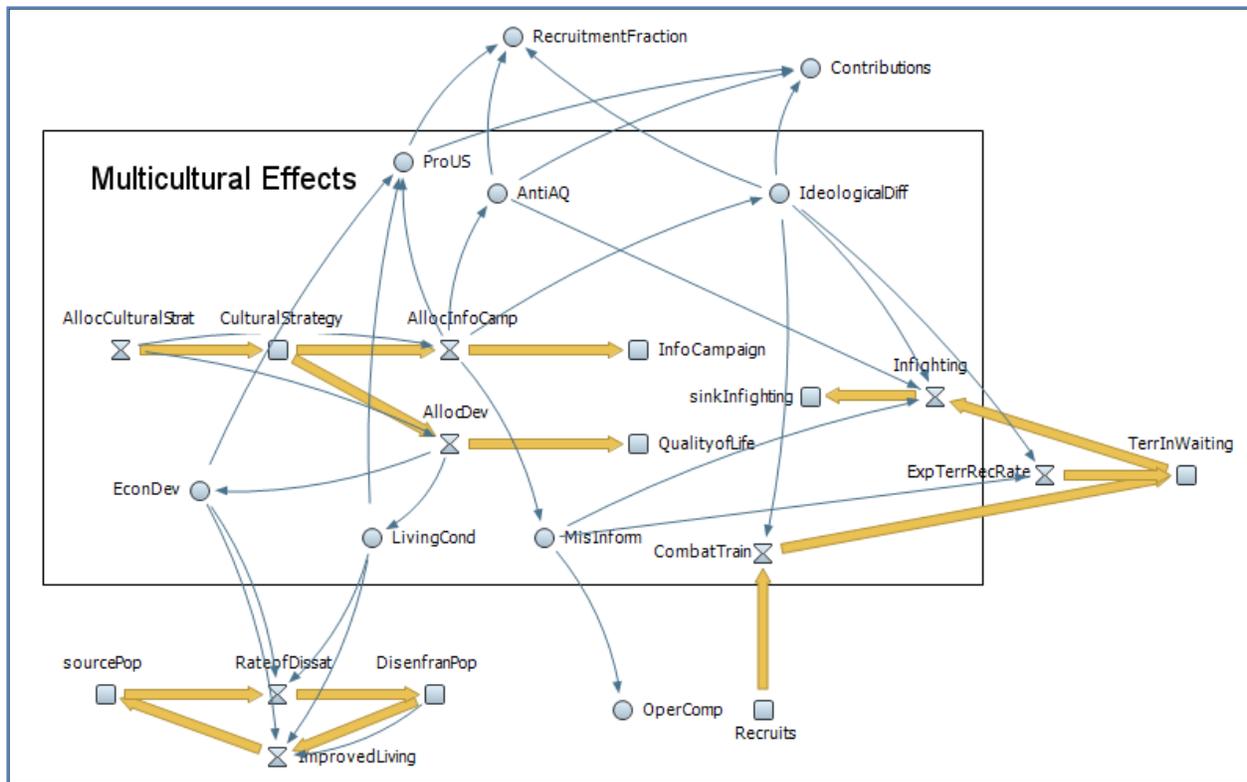
Figure 10: Multicultural Effects Sub-Model

The Multicultural Effects sub-model, Figure 10, was built on an additional line of funding, not present in the original model; although an existing line of funding could have been used (preventative measures), it was decided that a new line (AllocCulturalStrat in Figure 10) would provide greater distinction for analyzing the effects of the multicultural factors. Additionally, two new flows were introduced and established a connection with the number of terrorists waiting for deployment: Infighting and Combat Training. Infighting decreases the number of terrorists waiting for deployment and affects the total number of terrorists; combat training represents the increased training capacity available to Al-Qaeda due to insurgencies and combat zones that have served as training grounds for new recruits. The Terrorist Ability to Recruit sub-model was modified to contain a flow (ImprovedLiving) that decreased the population of disenfranchised individuals; this balanced the original flow representing the growth of the disenfranchised population.

The assumed budget for allocation to cultural strategy (AllocCulturalStrat) was assumed to be $10 billion per year. These funds would be distributed through two separate channels representing the two main initiatives: an information campaign (AllocInfoCamp) and development campaign (AllocDev).

Information Campaign

The information campaign would consist of four main factors: distribution of pro-United States information (ProUS), distribution of Anti-Al-Qaeda information (AntiAQ), accentuation of ideological differences (IdeologicalDiff), and deliberate misinformation (MisInform). The first two factors would be focused on the mass audience Al-Qaeda seeks to target; if information was presented in such a way that the atrocities committed by Al-Qaeda (civilian deaths, targeting of Shi'ite Muslims, etc.)were brought to light, and in a context in which such organizational behavior could not be admired, the achieved effect would be to decrease the attractiveness of joining Al-Qaeda (RecruitmentFraction, Terrorist Ability to Recruit sub-model), as well as diminish the monetary support provided by sympathetic donors (Contributions, from the Terrorist Ability to Train sub-model), which would in turn decrease funding, affecting Al-Qaeda's operating capacity and ability to execute incidents. Communicating such information may also lead to infighting within Al-Qaeda, polarizing the members as ideological and cultural differences regarding Al-Qaeda's tactics emerge.

Similarly, distributing more pro-United States information would also affect the attractiveness of joining Al-Qaeda and the number of funding contributions. If such information could be communicated in a culturally relevant manner, highlighting the positives of the United States involvement (aid, economic development, pursuit of equality, etc.), one of the core

ideological (and in many ways, cultural) disagreements that drive terrorism would be addressed: hatred of the United States and its policies. This measure would not convince the most radical elements of fundamentalist groups, but would serve to mitigate the grossest mischaracterizations (Byman, 2003).

The third factor in the informational campaign would seek to highlight the existing cultural and ideological differences within Al-Qaeda. The most obvious example would be the decision to execute attacks targeting the Shi'ite Muslim sect, a polarizing and highly divisive action. There was significant outrage among Muslims at the idea that an Islamic organization would target its own people, once again highlighting the significance of Al-Qaeda's existence as a multicultural organization (Gunaratna, 2005). As Al-Qaeda interfaces with an increasing number of extremist organizations, it is inevitable that ideological disagreements, cultural differences, and divergence in objectives will occur (Byrn, 2004 and Boukhars, 2006). It is absolutely crucial to exploit these existing differences; information highlighting these dissimilarities should be distributed, at the very least to compete with Al-Qaeda's headlines. In this model, ideological and cultural differences (IdeologicalDiff in the Multicultural Effects sub-model) affect a large number of other factors: the attractiveness of joining Al-Qaeda (RecruitmentFraction), contributions (Contributions), the rate at which existing terrorist groups assimilate into Al-Qaeda (ExpTerrRecRate), and infighting between existing members (Infighting). A notable side effect is the consequence of increased conflict: recruits are provided with an additional training ground. This is evidenced by the conspicuous presence of foreign fighters in Iraq particularly; it is alleged that the conflict in Iraq is being used as a training ground for members of terrorist organizations among other things. In this case, increasing awareness of ideological differences results in an increased rate of training for new Al-Qaeda

recruits (represented by the CombatTrain flow from the Recruits stock to the TerrInWaiting stock).

The final factor regarding the information campaign is deliberate misinformation (MisInform). This factor was created specifically with regards to Al-Qaeda as a learning organization; attacks increase in effectiveness and lethality through information sharing between operatives and by experiments in attack operations (Hoffman, 2003). It has been suggested that targeting Al-Qaeda's learning ability is an essential tactic for mitigating its successes (Jackson et al., 2005). One method of disrupting the feedback loop would be to intentionally spread false information regarding Al-Qaeda's methods, introducing ambiguity into the learning process. Misinformation could cause ineffective methods to appear more attractive, belittle the effects of successful methods, and increase communication difficulties. If an existing cultural or ideological difference exists between Al-Qaeda and one of its strategic partners (Hezbollah, Hamas, etc.), misinformation would contribute to the possibility of miscommunication and conflict. In the model, these effects were represented by the factor MisInform, with Al-Qaeda's operational competency (OperComp), infighting within Al-Qaeda (Infighting), and the rate of assimilation of existing terrorists (ExpTerrRecRate) all being affected negatively.

Development Campaign

In many ways, the development campaign would simply be an extension of existing United States policies of foreign aid. It has been argued that long term anti-terrorism strategies must incorporate improvement to socioeconomic circumstances experienced by the disenfranchised population, the main resource of recruits for terrorist organizations like Al-Qaeda (Wulf et al., 2003). Basic living conditions such as electrification, running water,

sanitation, and a host of other resources available to the developed world have yet to be implemented in third world countries. The majority of the disenfranchised population has employment that is insufficient to meet their needs, or is unemployed. Education, which is vital to development, is unavailable, unaffordable, or ineffective. These issues are generally approachable by direct investment. In the Multicultural Effects sub-model, we account for these development factors as either economic (EconDev) or improvements to living conditions (LivingCond). Economic development would seek to establish a vibrant business environment to provide employment, while living conditions would be improved by implementation of basic utilities and services. Disenfranchisement and poverty create a culture that breeds discontentment and encourages fundamentalism; consequently, efforts to improve quality of life may have a significant, positive effect in the struggle against terrorism.

The most direct effect of the development campaign would be to decrease the number of disenfranchised individuals at risk for recruitment into Al-Qaeda, both through decreasing the rate of the dissatisfaction (RateofDissat) as well as introducing a decline in the existing disenfranchised population by improving quality of life. Another significant effect would be in the form of increasing the effectiveness of the pro-United States information measure (ProUS); the development campaign would provide affirmation of this information, as it would be demonstrated to the population that the United States has a legitimate, positive effect on development. The effects of the traditional animosity toward Western culture would be mitigated to some extent.

Model Results and Analysis

Having created a sub-model describing some key multicultural effects in the struggle between the United States and Al-Qaeda, the factors were integrated into Chamberlain's architecture. Related factors in the recreated model were linked to the multicultural factors, and a simulation was designed to run for a twenty year period (1990-2020) to determine the effects of the multicultural factors (with the Multicultural Effects sub-model being activated in 2003). It is important to note that after 2001, the United States increased budget allocations to defensive and offensive measures; this was reflected in Chamberlain's model, as well as the recreated model..

The first simulation run did not incorporate the Multicultural Effects sub-model; this was to establish a baseline with which to determine what effects, if any, cultural factors would have on the continuing "competition" between the United States and Al-Qaeda. The simulation run time was 1560 weeks (30 years from 1990-2020) in order to provide ample time for factors to take effect; multicultural strategies tend to have more of a long term effect, while tactical actions have a more immediate effect.
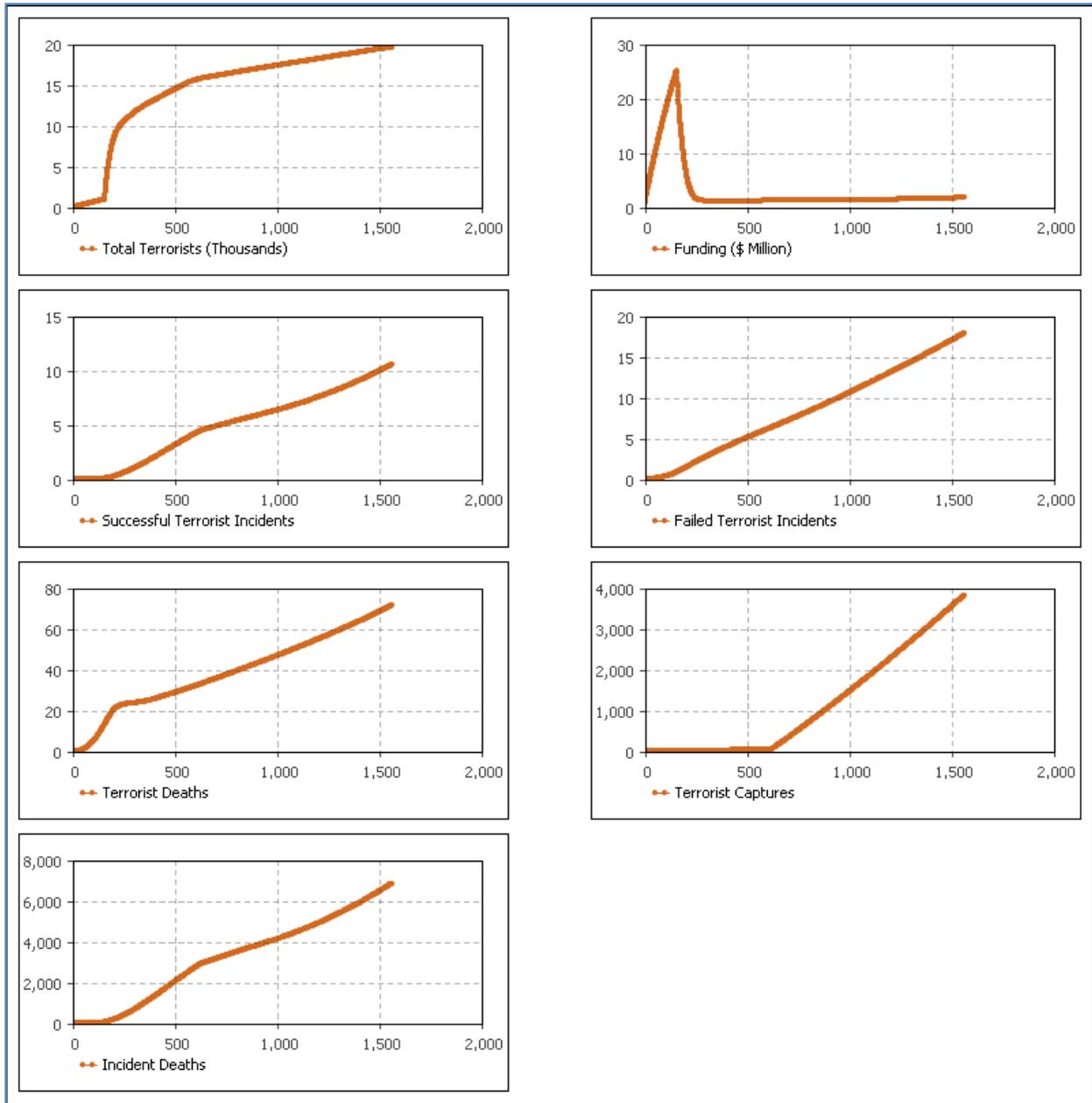
Figure 11: Model Results without Multicultural Effects

Results from the first simulation run (Figure 11) indicate a number of long term trends.

Over 30 years, the number of terrorists reaches 20,000, with an indication of stable growth.

Funding falls quickly as terrorist training camps are opened; after the initial surge in trainees,

contributions stabilize with an overall trend of slow, steady growth. The number of successful

terrorist attacks reaches 11 incidents and displays a growth trend, with a clear indication of a

decreased growth rate when the United States increased its allocations to offensive and defensive measures. As a direct result, the number of incident deaths demonstrates a similar trend, with around 7,000 casualties at the end of the simulation run. The number of terrorist deaths experiences a fairly stable trend of exponential growth due to its direct relation to the number of incidents attempted, ending at around 75; the number of terrorist captured, on the other hand, ends at around 4,000, with a clear increase in rates when defensive and offensive measures are increased by the United States. Failed incidents reach 18 by the end of the simulation run.

Having established a baseline for comparison, the simulation was run once again for 1560 weeks, this time with the Multicultural Effects sub-model activating in 2003. The results (Figure 12) indicate several interesting long term trends. The noticeable difference is in the total number of terrorists: when the multicultural factors are activated, there is a rapid modification to the trend. The total number of terrorists decreases, with rates leveling out until reaching 7,000 at the end of the simulation. This is a marked difference in comparison with the baseline model, which ended with 15,000 terrorists and a fairly stable trend, indicating a possible effect of ideological disagreements and infighting within the ranks of Al-Qaeda.

Funding maintains a trend fairly similar to the baseline model, as does the number of successful attacks; however, the magnitude is significantly different. Only seven terrorist incidents are successful, as compared to 11 in the baseline. The role of misinformation could play a heavy role in reducing Al-Qaeda's learning ability, and consequently impairing future attack attempts. Although the basic growth pattern appears the same, the magnitude is substantially reduced. The number of failed incidents remains similar to the baseline.
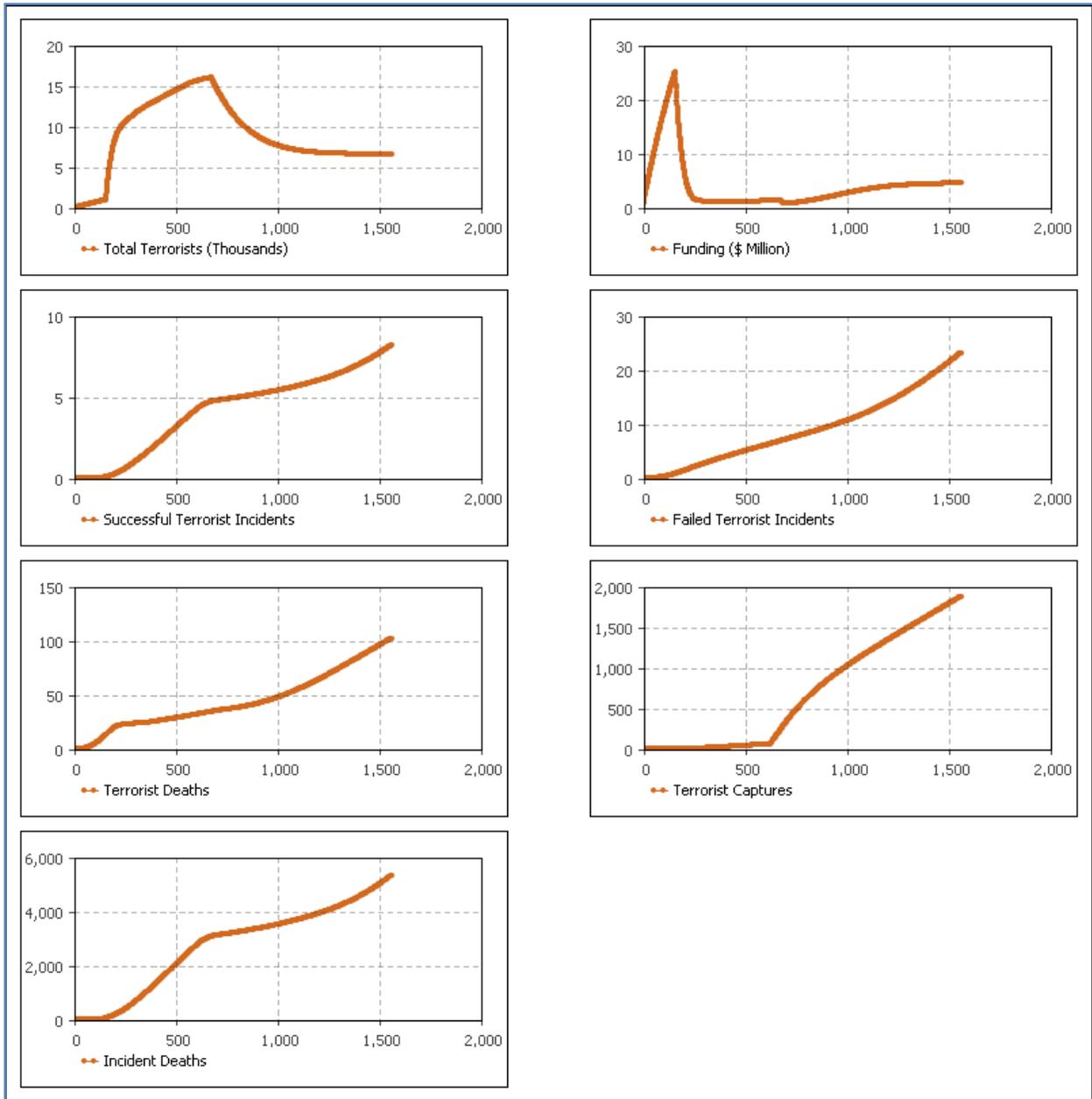
Figure 12: Model Results with Multicultural Effects

The number of terrorist deaths increases slightly from the baseline model (from 75 to just over 100), but the number of terrorists captured is noticeably altered from the baseline model (from 3,900 to 1,900). The growth trend is also markedly different. The decrease in terrorist deaths and captures is due to the decreasing number of total terrorists. The key statistic is the number of incidents deaths, which follow the trend of successful incidents. Total casualties from

incidents dropped from 7,000 to 5,500. This is a strong argument for the potential effects

multicultural factors could have in the fight against terrorism.

It is important to note that during the simulation run, the number of potential recruits was

never a bottleneck; there was always a large population of disenfranchised individuals. Hence,

the effect of the development campaign was somewhat limited. It may be tempting to conclude

that development should not be funded as heavily; however, this fails to take into account that

development provides a very public affirmation of the informational campaign, and that the

effectiveness of both policies would be much increased if implemented simultaneously.

Additional Scenarios

In addition to the comparison between the baseline model and the multicultural effects

model, several parameters were varied in order to provide insight for sensitivity analysis. A

number of scenarios were arranged with the goal of testing multicultural effects in different

situations.

The first scenario tested was one in which the distribution of the total cultural strategies

budget (AllocCulturalStrat) between the information and development campaigns was varied. In

the default multicultural effects sub-model, 90% of the cultural strategies budget was allocated to

development, and the remaining 10% to the information campaign. The new scenario split the

budget so that both campaigns received 50%. A second scenario reversed the default situation so

that 10% went to the development campaign, and 90% went to the information campaign. The

results can be seen in Figure 13.

Figure 13: Change in Campaign Allocations

The results indicate that increased allocation to the information campaign would be the most effective strategy for mitigating the growth of terrorism activities. As the allocation to the information campaign becomes more favorable, the multicultural effects are more pronounced. The 90% information 10% development model results show slightly decreased incident deaths (about 200 less), one less successful incident, and one more failed incident as compared to the 50%-50% model results. This is a marginal improvement, but both model results show significant improvement over the default results for the 10% information 90% development scenario.

These results would seem fairly reasonable; the United States already allocates a large amount of funding to development (allocation to preventative measures). In the model, the disenfranchised population is never a bottleneck, which may be a good indicator of reality: there will always be some individuals who are displeased with US policies, regardless of the aid provided by the US. However, the importance of development activities should not be disregarded; such activities serve to affirm the informational campaign, combining action with

words. In any case, reducing the funding for nation-building or other similar development activities would not improve long term perceptions of US policies, reducing the effectiveness of the information campaign.

The second scenario represents a situation where monetary contributions to Al-Qaeda increase by 50%; such an increase could be the result of a negative shift in opinion toward the US, or collaboration with other terrorism networks. This scenario was studied in the context of multicultural factors being in effect, and trends were compared to the situation where multicultural factors are not taken into account. From the results in figure 14, it is evident that multicultural factors are essential to mitigating terrorism activities. The growth patterns exhibited by the results where multicultural factors are ignored indicate exponential growth; for the results from the simulation including multicultural factors, the growth trends appear similar, but the magnitude of the effect is dampened significantly. Twelve more incidents are successful with 9,000 more incident deaths when multicultural factors are ignored. This demonstrates the importance of multicultural factors in specific relation to terrorist funding.

Figure 14: Terrorist Funding Increase Scenario

The final scenario addresses the possibly negative effects of ideological differences within terrorism networks. An example would be the conflict between the Shia and Sunni Islamic sects. Although such conflict could cause divisions within Al-Qaeda (such as the decision to execute terrorist attacks against Shia Muslims), it could also represent an opportunity to train additional recruits (Jehl, 2005). In the multicultural effects sub-model, this is taken into account by the flow "CombatTrain". For the final scenario (see figure 15), the first simulation run decreased this rate by 50%, while the second run was increase the rate by 50% in order to analyze the possible effects on terrorism activities.

Figure 15: Combat Training Rate Scenario

Results from the scenario were somewhat counter intuitive. Increasing the training rate decreased the number of successful incidents and incident deaths, while decreasing the rate caused an increase. This was due to the assumption in Chamberlain's model that 20% of the active members were paid a salary. As the total number of terrorists increases, an increased amount of funding is allocated to salaried members, decreasing the funding available for

conducting terrorist attacks. This assumption may lack a high level of validity, since Al-Qaeda

would most likely stop recruiting when funds decrease below a certain level.

Future Areas of Study

Several areas of future research regarding multicultural factors would be highly

beneficial. Further sensitivity analysis regarding the amount of funding allocated to cultural

measures would assist in determining acceptable cost/benefit ratios. Additionally, a multi-

disciplinary study of organizational behavior would be of great assistance in developing more

accurate numerical estimations of the factors for modeling inputs, increasing the reliability of the

model. Another avenue of exploration would be to develop an agent-based simulation model to

combine with the systems dynamics model; this would potentially allow for greater levels of

detail in simulating organizational behavior, and provide further insight for multicultural effects.

Conclusion

In summary, all benchmarks were impacted by the Multicultural Effects sub-model, with

the exception of the number of failed terrorist incidents. This highlights the potential advantages

of the United States developing a long term strategy for exploiting the multicultural factors

within Al-Qaeda. In order to succeed in combating terrorism, the United States must balance

tactical operations with strategies that attack the heart of the Al-Qaeda and similar organizations

(Muckian, 2006).

Al-Qaeda has experienced great success in the information war, and has been effectively

utilizing disinformation and mischaracterizations regarding the United States to foment anti-

Western sentiment. An effective response is critical in order to stem the tide of opinion and

neutralize Al-Qaeda's recruiting base (U.S. Department of State, 2007). Al-Qaeda has been the winner in the information war, and the United States must enact effective information policies to compete. Studies on the organizational weaknesses of Al-Qaeda must be continued, with emphasis on determining ideological rifts and methods of inciting internal dissension. Efforts to lift the disenfranchised population from poverty must continue, with funding being put to use for improved living conditions and economic development. These policies should supplement the information strategies to synergistically improve their effect.

Multicultural factors represent a key part of any international organization. Al-Qaeda, with members from all over the globe, represents such an organization. It is indisputable that these factors play a significant role, and the United States must adapt and develop its anti-terrorism policies in order to effectively combat terrorism.

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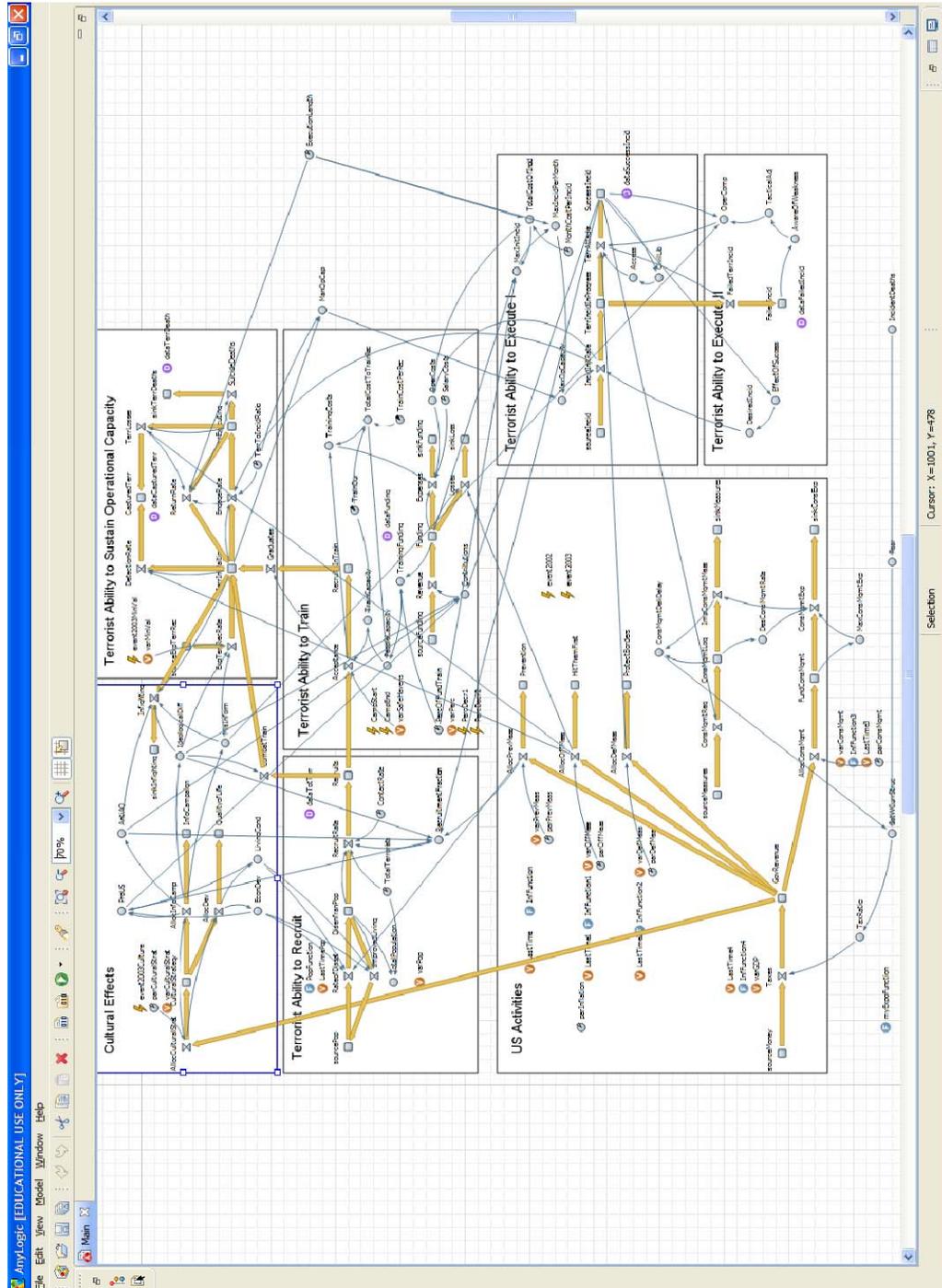
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Appendix:

Figure 16: Complete Model