

Modeling and Analysis of Post-Conflict Reconstruction

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The forces at play in reconstruction operations are a complex system of time-phased interlocking cause and effect relationships that are not always completely understood. A model capable of capturing the general dynamics involved in post-conflict reconstruction would provide insight to decision makers regarding potential policy alternatives. This paper demonstrates the viability of using systems dynamics modeling techniques to simulate the establishment of public order and safety in a post-conflict reconstruction operation (Phase IV operations). A high-level generic framework is developed that can be used as a general template for modeling post-conflict reconstruction. It is then demonstrated with a notional test case based on the Operation Iraqi Freedom (OIF) Area of Responsibility (AOR).

Keywords: Continuous system simulation, system dynamics

1. Introduction

Post-conflict reconstruction is the process of putting the pieces of civil society back together after a conflict. It includes the rebuilding of both physical infrastructure and the re-establishment of the intangible socioeconomic institutions that make civilized society possible [1]. The establishment of the rule of law, good governance, and social and economic well being all fall within the purview of post-conflict reconstruction [1].

Currently, there is no universally accepted model capable of capturing the dynamics involved in post-conflict reconstruction. Such a model could provide insight to decision makers investigating policies for a post-conflict reconstruction effort. This study offers a step toward building such a capability by describing a model to simulate the initial establishment of stability in a post-conflict environment.

This paper demonstrates the viability of using system dynamics modeling techniques to model and analyze post-conflict reconstruction. This is done by constructing a general model for simulating the initial establishment of security in a post-conflict reconstruction, applying this general model to a notional scenario, and analyzing the results using a designed experimental approach.

2. Background

System dynamics models represent social systems as webs of level values and rates of change interconnected by non-linear relationships, information feedback loops, and time delays [2]. System dynamics modelers build these interconnected webs of level values (i.e., state variables) and flow rates (i.e., rates of change) to represent how the various parts of complex systems interact with each other. Once the model representing the complex system of interest is built, computer simulation is used as “the means of inferring the time evolutionary dynamics endogenously created by such system structures” [2].

System dynamics methods are well suited for the simulation of complex social systems, such as the functioning of a government or the dynamics of international development [3]. Two examples of applications of system dynamics in these fields are *Urban Dynamics* and *World Dynamics*. *Urban Dynamics* is an application of system dynamics to the problem of urban decay [4]. In *World Dynamics* sustainable economic development is simulated on a global scale [5]. Several Web sites are dedicated to systems dynamic applications and methods. These include the Systems Dynamic Society Web page [6] and Kirkwood’s Systems Dynamic Resource Page [7], among others. The Systems Dynamic Society also sponsors a journal, *Systems Dynamics Review*, published by Wiley InterScience.

Recently, systems dynamics methods have been applied to the military sphere through the Strategic Management System (STRATMAS), a program to improve command and control [8]. Researchers involved in the development of STRATMAS have identified the need for “more integrated functional and coordinated command processes,” and have proposed the use of validated models in support of “rapid situation assessment and proactive command and control and crisis management” [8].

This research’s hypothesis is that a systems dynamics model provides an adequate capability for modeling and analyzing post-conflict reconstruction.

Since World War II the United States has become involved in a number of post-conflict reconstruction operations [9]. These operations range from the larger efforts of postwar Germany, Austria, and Japan, to the smaller and more limited operations in Lebanon, Grenada, and Panama. Over the years these operations, and others like them, have been studied by a number of researchers providing key lessons learned [9].

One such lesson is that security must be established for a successful post-conflict reconstruction operation. “Play to Win,” the final report of the Bipartisan Commission on Post-Conflict Reconstruction, concluded that security is essential to post-conflict reconstruction pointing out that while “every case is different, there is one constant — if security needs are not met, both the peace in a given country and the intervention intended to promote it are doomed to fail” [10]. For this paper, a military operation aimed at bringing about this security is termed a stability operation.

The development of security institutions is essential for the protection of the fundamental rights that make a free and fair civil society possible. Without a sense of personal safety, refugees and internally displaced persons will not return home, former combatants will not lay down their arms and reintegrate into civilian life, farmers and merchants will not engage in food production or business activity, and parents will not send their children to school or seek economic opportunity [10].

3. Post-Conflict Reconstruction Model

With the recent events in the global war on terrorism, it was decided that a generic model capable of analyzing post-conflict reconstruction in any failed nation would be useful in investigating Phase IV operations. A review of the literature, as outlined in Section 2, was conducted and a prototype model was generated including what was deemed to be the most relevant features and interactions within a national post-conflict reconstruction effort. The prototype model then was reviewed by subject matter experts from the study’s sponsoring organization. The subject matter experts provided guidance and suggestions

for additional features as well as desired interactions. The prototype model then was modified accordingly and again reviewed by the appropriate subject matter experts.

The resultant model developed in this study represents a stability operation and its environment as a network of interconnected level values and rates of change. The level values identify the state of the system. This study identified 23 level values. Each of these level values has one or more rates of change associated with it. Rates of change determine how the level values evolve over time. Together the level values and rates of change determine how the entire system evolves over time. Figure 1 shows the overall structure of the model. Level values are represented as rectangular boxes. Flows of people, resources, and so on, are represented as solid arrows. Rates of change are represented as arrow boxes (i.e., valves). Parametric inputs are represented as dashed arrows. All other factors that are exogenous to the model are represented as clouds.

The state variables selected for inclusion in the stability operations model were chosen to collectively describe the state-of-the-stability operation adequately enough so that macro-level policies can be examined using the model. As much as possible these variables were selected so that they represent directly measurable real world phenomena. The state variables used in this model fall into six basic categories: (1) the indigenous security institutions, (2) law enforcement, (3) the labor market, (4) insurgent activity and coalition military activity, (5) critical infrastructures, and (6) public opinion. Figure 2 shows a macro level view of the model’s architecture.

To define the general model, the indigenous security institutions (Figure 3) and the insurgent and coalition military activity (Figure 4) sub-models will be detailed. The other sub-models will be briefly summarized, but are depicted in Figures 5 through 8. The interested reader can find a detailed explanation of the model and support for the specific relations in [11].

3.1 Indigenous Security Institutions

The indigenous security institutions sub-model is comprised of three functional organizations: (1) the border patrol, (2) the civil defense force, and (3) the indigenous military. Each of these organizations influence the model in different ways. The level of border patrol personnel affects the number of international insurgents that can slip into the country. The number of civil defense personnel and the number of indigenous military personnel each affect the number of successful insurgent attacks on the country’s critical infrastructure and the rate at which insurgents are captured or killed. Figure 3 presents the structure of the indigenous security institutions sub-model. The state of the indigenous

security institutions is represented by six level values; its development over time is determined by 12 associated rates of change.

Unemployed persons are recruited into the training programs of the three security services and are reclassified as trainees of the border patrol, civil defense force, and indigenous military.

Trainees in the training programs are assigned to classes — each class takes a predetermined number of training days. Trainee attrition returns some user-specified proportion of the trainee class to unemployed status. Attrition rates vary by training program.

The number of active duty security personnel in each of the security services decreases as a result of that service's active duty attrition rate — the user-specified rate at which active duty security personnel separate and return to unemployed status. In addition, security personnel decrease as a result of being killed or wounded in action.

The killed-in-action rate of each of the security services is the rate at which the active duty security personnel of each of the services are killed. The security service personnel who are killed leave active duty status and are eliminated from the model.

3.2 Insurgent and Coalition Military Activities

The insurgent and coalition military activities sub-model is comprised of three level values and six rates of change. The level values are the number of coalition troops in the country, the number of insurgents in the country, and the number of insurgents being detained by the coalition. Figure 4 illustrates these levels and rates. The coalition troop level is influenced by two rates of change: (1) the coalition troop casualty rate and (2) the coalition troops in country rate of change. The coalition troop rate of change represents the net rate at which coalition troops arrive and depart the country. Changing these rates allows the modeler to test the effect of various buildup and draw down policies.

The coalition troop casualty rate is the rate at which coalition troops are killed, or wounded to the extent that they cannot function as effective troops. The coalition troop casualty rate is a function of the number of daily insurgent attacks, the likelihood of casualties, and the effectiveness of the troops. The coalition troop casualty rate impacts the number of coalition troops in the country. Troops that are killed or wounded are no longer available for operations. The allocation of the coalition troops in country between the different types of activities is a model parameter. Troops can be allocated into three different activities: crime suppression operations, border patrol operations, and counter insurgency operations.

In this model an insurgent is defined as anyone actively working to thwart the coalition through violence. The

model assumes that insurgents attempt to thwart the coalition by attacking coalition targets and targets viewed as sympathetic to the coalition. In the model these targets are assumed to be coalition troops, indigenous security forces, indigenous police, the civilian population, and critical infrastructure. Insurgents actively working to thwart the coalition also may commit non-insurgency related crime, such as running a protection racket, narcotics trafficking, or operating a car theft ring. The number of insurgents in the country affects the crime rate. However, people defined as criminals in this model do not engage in anti-coalition violence per se, and the number of criminals in the country has no influence on the number of insurgent attacks.

The proposed model uses a similar approach to simulating insurgency as [12]. It is assumed that based on a utility maximization calculation, people make a rational choice between joining the insurgency and being unemployed. The insurgent rate of change, the rate at which people transition from unemployed status to insurgent status, is a function of the rate at which insurgents are killed or captured and the number of people who are dissatisfied with the occupation.

In addition to the domestic insurgents who join the insurgency from the ranks of the unemployed, international sympathizers can travel to the country and join the insurgency. Of the total number of insurgents that try to enter the country, some percentage is turned back by the indigenous border guards and the coalition troops who are patrolling the borders. The distribution of the daily number of international insurgents that try to enter the country depends on factors specific to the modeled environment, such as the international perception of the legitimacy of the occupation and the international perception of the legitimacy of the insurgency.

Every day the level value of insurgents in the country is decreased by the insurgent killed or detained rate, the model's rate at which the insurgents are killed or detained by the coalition and indigenous security forces. Of the total daily number of insurgents apprehended some percentage are killed in the course of their apprehension and the rest are detained. The insurgents that are killed are eliminated from the model. The insurgents that are detained transition to the detained insurgents category. The rate at which insurgents are apprehended is a function of the total number of insurgents, the number of coalition military troops conducting counter insurgency operations, the size of indigenous military, the size of the civil defense force, and the number of tips the coalition receives on insurgent activity.

Every day a percentage of the detained insurgents are released. This represents those insurgents determined to no longer be a threat or there is insufficient proof to continue holding them. When formerly detained

insurgents are released, they return to unemployed status from which they may or may not rejoin the insurgency or the workforce.

The amount of insurgent activity is represented in the model by the number of attacks the insurgents make on coalition targets and targets perceived by the insurgency as sympathetic to the coalition. The number of insurgent attacks is a direct function of the number of insurgents in the country, the likelihood of attack, and their effectiveness rate.

3.3 Law Enforcement

The law enforcement sub-model simulates the amount of violent crime in a country as a function of the number of police officers and criminals in the country. This is done with four level values and seven rates of change. Figure 5 shows the structure of the law enforcement sub-model.

In the law enforcement sub-model the recruitment, training, and deployment of police officers are modeled in the same manner as recruitment, training, and deployment of security personnel in the indigenous security institution sub-model.

The criminal apprehension rate represents the daily number of criminals arrested. It is the rate at which criminals transition from criminal status to incarcerated criminal status. The criminal apprehension rate is a function of the number of criminals in the country, the number of coalition military troops working to suppress crime, the number of civil defense troops, and the number of active duty indigenous police officers.

3.4 Labor Market

In this model every member of the country's labor force uniquely belongs to one of eight groups. Each person is either unemployed; employed in the private sector; employed as a trainee or active duty member of the police, the border patrol, the civil defense force, or the indigenous military; employed in a non-security related government job; a criminal; or an insurgent. As the model evolves over time, people move from one category to another as prescribed by the various rates of change. Figure 6 shows the structure of the labor market sub-model.

3.5 Critical Infrastructure

Critical infrastructures are vital to a state. They affect the local population's opinion of the occupation and the growth rate of the economy. Which infrastructures are critical and how many exist depends on the exact scenario being modeled.

In the illustrative model developed later in this

paper four infrastructures are included in the critical infrastructure sub-model: (1) potable water, (2) food, (3) fuel, and (4) electricity. The critical infrastructures were selected assuming they are essential for preventing humanitarian crisis or social unrest within the population. The level value of each of these infrastructures is measured in units delivered. It is this quantity of the critical resource ultimately delivered as compared to the quantity demanded that is assumed important in the model. No distinction is made in this model between a shortage of a critical resource due to insufficient production or insufficient distribution. In both cases the critical resource ultimately is not delivered and the effects on public opinion and economic activity are the same.

The development rates for the four critical infrastructures are modeled as functions of the baseline development rate, the number of insurgent infrastructure attacks, and the levels of other relevant critical infrastructures. The baseline development rate is an input. It represents an assumed potential development rate under peaceful conditions. The number of insurgent infrastructure attacks represents the daily number of insurgent attacks on the critical infrastructure and was discussed earlier. The development rates of each of the critical infrastructures also are influenced by the levels of some of the other related critical infrastructures. These interrelations are dependent on the exact scenario being modeled, and are tailored to fit the particular country of interest.

The overall structure of the critical infrastructure sub-model is given in Figure 7. Clearly, other key infrastructures could be modeled, such as fire protection, education, and health services, and could be incorporated as required.

3.6 Public Opinion

The public opinion sub-model influences the model in two ways. The number of people dissatisfied with the occupation influences the insurgent rate of change, and the number of people neutral to or satisfied with the occupation influences the number of tips the indigenous population gives on insurgent activities. Figure 8 gives the overall structure of the public opinion sub-model.

The public opinion rate of change is a function of seven variables: (1) the number of unemployed people, (2) the number of daily insurgent attacks, (3) the crime rate, and the shortage/surpluses of the critical resources of (4) water, (5) food, (6) fuel, and (7) electricity.

The number of tips on insurgent activity is the daily number of useful tips the coalition receives on insurgent activity. This number is a function of the number of people who are neutral to or satisfied with the occupation. The more tips the coalition troops

receive on insurgent activity the more effective they are at apprehending members of the insurgency.

4. Illustration of the Model

In order to demonstrate the application of the general model developed in this paper a notional scenario was developed based on the recent post-conflict reconstruction of Iraq coinciding with the end of the Saddam Hussein regime in May 2003. The parameters in the model were set to reflect, as much as possible, the notional scenario and the model was generated using Arena by Rockwell for typical simulation functions such as the event calendar and statistical data collection. User-defined functions representing the interrelationships between level values and their associated flows were coded in Visual Basic for Applications through the Visual Basic Editor provided with Arena. This model was then used to identify the principle drivers of security in the notional scenario using a screening experiment. In this experiment, seven parameters were selected as factors of interest: (1) the initial percentage of the population who is dissatisfied with the occupation, (2) the initial number of police officers, (3) the initial number of criminals, (4) the initial number of insurgents, (5) the baseline gross domestic product growth rate, (6) the training class sizes of the Iraqi security forces, and (7) the baseline infrastructure development rate.

The number of days from the start of the post-conflict reconstruction until security is established was selected as the criteria for measuring the effects of these factors of interest. For this experiment, security was said to have been established when the average number of deaths as a result of criminal and insurgent activity fell below a specified level for 30 days. Washington, D.C., which has an annual murder rate of 43 per 100,000 citizens, was used as a stopping criterion for this model [13]. When the 30 day moving average of deaths as a result of criminal and insurgent activity falls below this rate, security is deemed established and the simulation is stopped.

Three replications at each design point of a seven factor one-half fractional factorial design (2^{7-1}) were chosen for the screening experiment. This experiment varied each of the seven factors of interest between a low value and a high value, and recorded the output value. This resolution VII design enables one, two, and three factor interactions to be tested without the complications of lower order aliasing [14].

In the experiment, the low value of the initial percentage of the population that was dissatisfied with the occupation was set at 30%. This number was chosen to reflect the results of a State Department survey of Iraqis in November 2003. In that survey 71% of respondents are reported to have said that they would feel less safe if

the coalition left Iraq immediately [13]. The high value was arbitrarily set at a dissatisfaction level of 60%.

The low value of initial police officers was set at 10,000 to reflect the initial number of police officers in Iraq in May 2003. The Brookings Institution reports that in May 2003 there were between 7,000 and 9,000 police officers in Iraq. The high value was set at 30,000 so that the effect of an additional 20,000 police officers could be evaluated.

The initial number of criminals was set at a low value of 50,000 and a high value of 100,000. There is little data on the number of criminals in Iraq in May 2003, so in this notional example the high value was set at twice the level of the low value enabling the effect of the initial number of criminals on the number of days until security is established to be tested.

The low value of the baseline GDP growth rate was set at 26%. This value reflects the International Monetary Fund's forecast of the growth rate of Iraq's economy in 2004 [15]. The high value was set at twice the low value to reflect an even more optimistic economic growth rate.

The low value of the training class sizes for the Iraqi security forces was set at 1,000 individuals per class [16]. The high values were double the low values to examine the effects of faster training on establishing security.

The low value of the baseline infrastructure development rate was a multiplicative factor applied to the initial development rates for water, food, electricity, and oil production rates described in the Section 3.5. The high levels were set at twice that to examine the effects that faster infrastructure development has on establishing security. The high and low factor levels are summarized in Table 1.

Factor	Low	High	Code
Initial Dissatisfied People	30%	60%	A
Initial Police Officers	10,000	30,000	B
Initial Criminals	50,000	100,000	C
Initial Insurgents	10,000	20,000	D
Baseline GDP Growth	26%	52%	E
Baseline Iraqi Security Forces Class Size (1,000)	1x	2x	F
Baseline Critical Infrastructure Development Rate	1x	2x	G

Table 1. Screening experiment high- and low-factor settings

5. Results

Three replications at each of the 64 design points were run for a total of 192 simulation runs. The output data is summarized in Figure 9. Table 2 provides a list of the one, two, and three-way interactions that were significant at an individual 95% confidence level for the log-linear regression model used.

The mean number of days until security was established across all of the simulation runs was 317 days with a standard deviation of 80 days. This output data was fit to the log-linear model expressed below to identify the one, two, and three factor effects [17]. A is the initial number of dissatisfied people, B is the initial number of police officers, C is the initial number of criminals, D is the initial number of insurgents, E is the baseline GDP growth rate, F is the class size of the Iraqi security forces, and G is the baseline infrastructure development rate.

$$\beta_0 + \sum_{i \in I} \beta_i X_i + \sum_{\substack{i, j \in I \\ i \neq j}} \beta_{ij} X_i X_j + \sum_{\substack{i, j, k \in I \\ i \neq j, j \neq k \\ k \neq i}} \beta_{ijk} X_i X_j X_k + \epsilon$$

Where

$$I = \{A, B, C, D, E, F, G\}$$

$$X_i = \text{The level of factor } i \forall i \in I$$

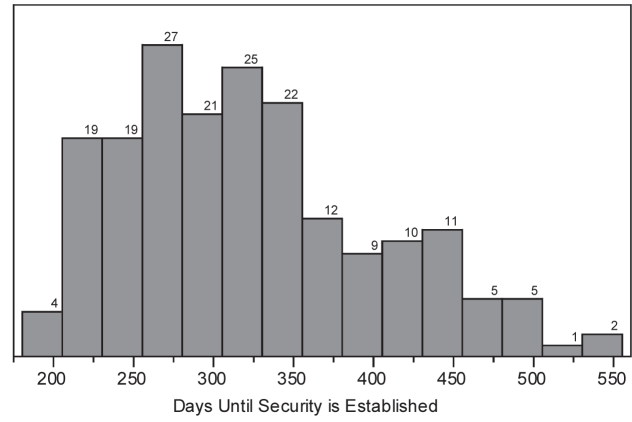


Figure 9. Screening experiment output histogram

The overall model had an R squared value of 0.98.

The factor with the largest impact on how long it takes to establish security, based on the screening experiment, is the initial percent of the population dissatisfied with the occupation. The next largest impact factor was the baseline infrastructure development rate.

In this notional scenario, the number of people initially dissatisfied with the occupation has a significant impact on how long it takes to establish security in the post-conflict reconstruction. As seen in Table 2, the regression model indicates that the number or days until stability

Term	Estimate	p-value
Intercept	5.727	<.0001
A: Initial Dissatisfied People	0.185	<.0001
B: Initial Police Officers	-0.029	<.0001
C: Initial Criminals	0.013	<.0001
D: Initial Insurgents	0.029	<.0001
E: GDP Growth Rate	-0.058	<.0001
F: ISF Training Rates	-0.045	<.0001
G: Infrastructure Development Rate	-0.126	<.0001
A: Initial Dissatisfied People*E: GDP Growth Rate	0.016	<.0001
A: Initial Dissatisfied People*G: Infrastructure Development Rate	-0.020	<.0001
C: Initial Criminals*F: ISF Training Rates	0.006	0.0345
D: Initial Insurgents*G: Infrastructure Development Rate	-0.011	0.0002
E: GDP Growth Rate*F: ISF Training Rates	0.010	0.0005
E: GDP Growth Rate*G: Infrastructure Development Rate	0.007	0.0112
A: Initial Dissatisfied People*E: GDP Growth Rate*F: ISF Training Rates	-0.011	0.0004
A: Initial Dissatisfied People*E: GDP Growth Rate*G: Infrastructure Development Rate	0.006	0.0278
D: Initial Insurgents*E: GDP Growth Rate*F: ISF Training Rates	-0.008	0.0046

Table 2. Significant factor parameter estimates

is achieved is positively correlated (indicated by the positive coefficient) to the number of initially dissatisfied people. While this value cannot be directly affected by coalition forces once the reconstruction has begun, it may be possible to influence these conditions by how the coalition conducts pre-reconstruction operations and how rapidly civilian support programs can be brought into effect for reconstruction. This result suggests that efforts to win over the populace during earlier phases of operations, coupled with the rapid establishment of reconstruction support, has a demonstrable effect on how much time establishing security is likely to take.

In this notional scenario, the critical infrastructure development rate after hostilities significantly impacts how quickly security was established. Table 2 showed that the critical infrastructure development rate was negatively correlated (indicated by the negative coefficient) with the number of days until stability is achieved. This intuitively makes sense since public satisfaction is impacted by the availability of critical resources, water, food, electricity, and oil, that are tied to infrastructure development. This suggests that having an actionable plan in place to rapidly restore civilian utilities as soon as the hostilities are over could reduce the amount of time it takes to establish security and potentially save lives.

While a notional example, this example shows the power of this systems dynamics approach. Additionally, the regression model allows inferences into the impact of varying initial conditions on the response variable, the number of days expected before stability is achieved, without having to rerun the simulation model. This allows for timely responses to “what-if” questions that later can be fully vetted by running the simulation model.

6. Conclusions and Areas for Further Research

The model developed in this paper demonstrates how the complex problem of establishing security in a post-conflict environment can be devolved into more manageable components. By allowing aggregation of assumptions about simpler questions such as the effectiveness of troops, the growth rate of an economy, and construction of infrastructure, one can estimate the answers to larger questions such as, “How long will it take to establish security in a given country?”

Currently, a major obstacle to modeling post-conflict operations are the uncertainties, limited knowledge, and lack of data on such operations. These limitations make model validation a significant challenge. Caution should be used when conducting an analysis with a model that has not been fully validated. However, even without traditional validation “exploratory models,”

of the type developed in this paper, can be useful for investigating “the implications of varying assumptions and hypotheses,” and for highlighting promising areas of further study and model improvement [18]. Two ways the model presented here could be further developed would be by applying the model to operational data or by expanding the model’s scope or fidelity.

The model requires data on a wide range of subjects. Data is needed on the effectiveness of troops, police officers, and other types of security forces. Economic data is required to dynamically model the growth of the country’s economy. Data on the construction of infrastructure is needed, as is public opinion data. Not all of this data is immediately available, but one of the aims of the development of the model in this paper was to highlight what data is needed, identifying the information needs of future post-conflict operations.

If the model developed in this paper were applied to a scenario using operational data, a wide variety of potential policy alternatives could be identified and tested. Bounds could be set on how long establishing security is likely to take, the amount of resources needed to produce an outcome could be estimated, and assumptions about various aspects of stability operations could be tested. The application of such a model could help decision makers employ forces more effectively, saving money and, more importantly, lives.

This study is a step in developing a comprehensive post-conflict reconstruction model. It was undertaken with the aim that its greatest contribution would be as a jumping off point for further research into how to simulate post-conflict reconstruction. Besides applying the model to operational data, one of the most promising areas for follow on research is in expanding the model. The model developed here can be expanded in two general directions: by increasing its fidelity or by increasing its scope.

The high-level model developed here can be applied to infer macro-level policy implications, such as how quickly police officers need to be trained, but its fidelity is insufficient to provide insight on more micro-level decisions, such as where those police officers should be deployed throughout the country. One way to increase the fidelity of this model is to include different regions of the country as separate but interconnected parts of the whole. Different ethnic groups in different parts of the country could be modeled individually, allowing security to be established in the model in one or two regions of a country while other regions are still volatile.

Another way that the fidelity of this model could be increased would be by modeling the effectiveness of different types of troops differently. For instance, a military police officer could be modeled to be more effective in a crime suppression role than an infantry unit dragooned into a crime suppression role. Different

training programs also could be modeled to create troops with different skill sets. An indigenous border guard trainee who has undergone a three month training program could be modeled as being more effective than an indigenous border guard trainee who has only undergone a week long training program. Other factors such as equipment, experience, and the number of translators could all be included to increase the model's capabilities.

The model's scope also could be expanded. The model proposed here is primarily focused at simulating only one of the primary challenges faced in post-conflict reconstruction. Other challenges could be included. For instance, governance and participation could be included in the model by simulating the standing up of various

parts of a government prior to holding elections. The mood of the populace could be simulated dynamically and could be used to simulate the outcome of an election. The economic aspects of the model could be expanded to simulate the longer term recovery of a country's economy. A larger set of infrastructures could be included, such as communications, the media, transportation, education, agriculture, and manufacturing.

This approach to modeling post-conflict reconstruction has promise. History has shown that effective post-conflict reconstruction is critical not only in the states where conflict has occurred, but also for long-term global stability. Modeling efforts should be pursued that can help decision makers better execute the establishment of stable states.

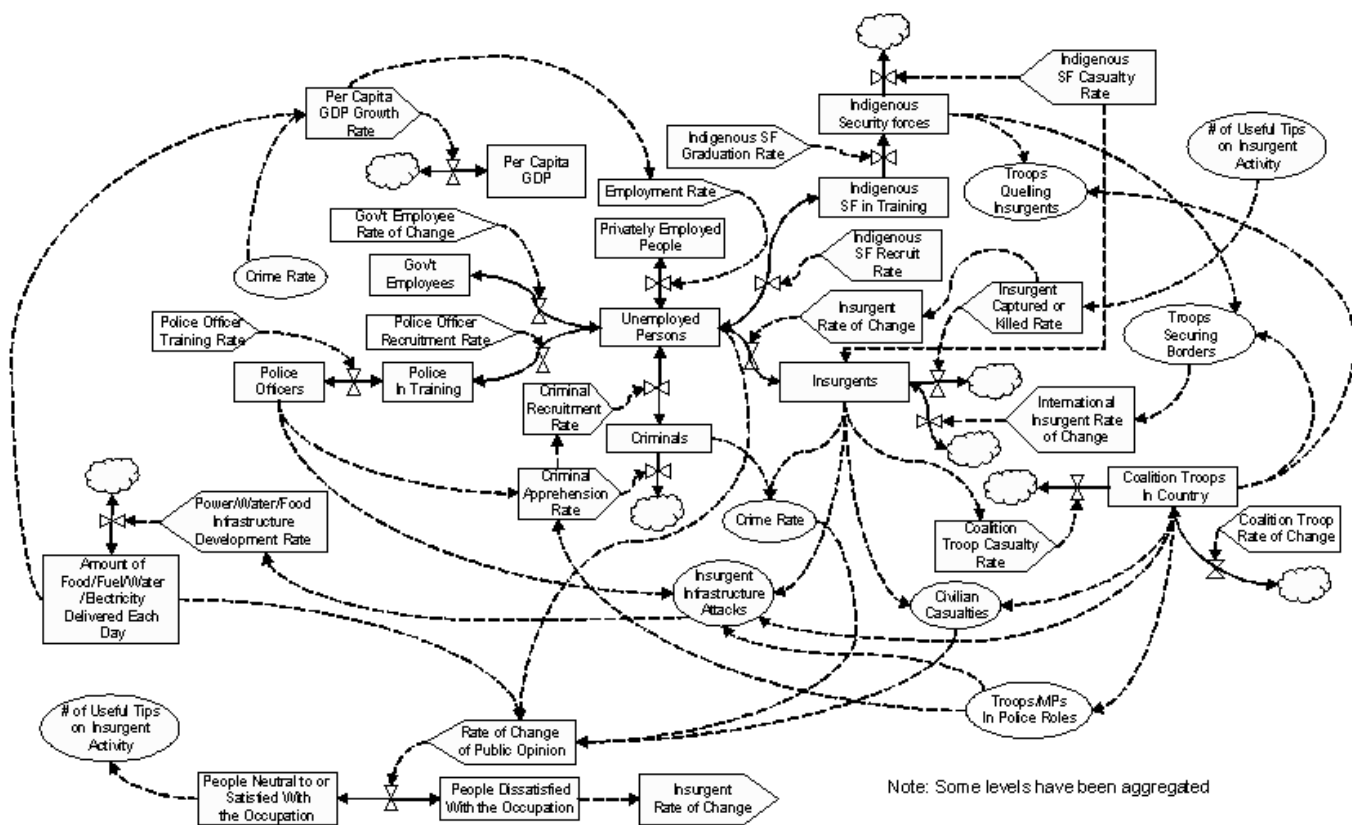


Figure 1. General post-conflict reconstruction model

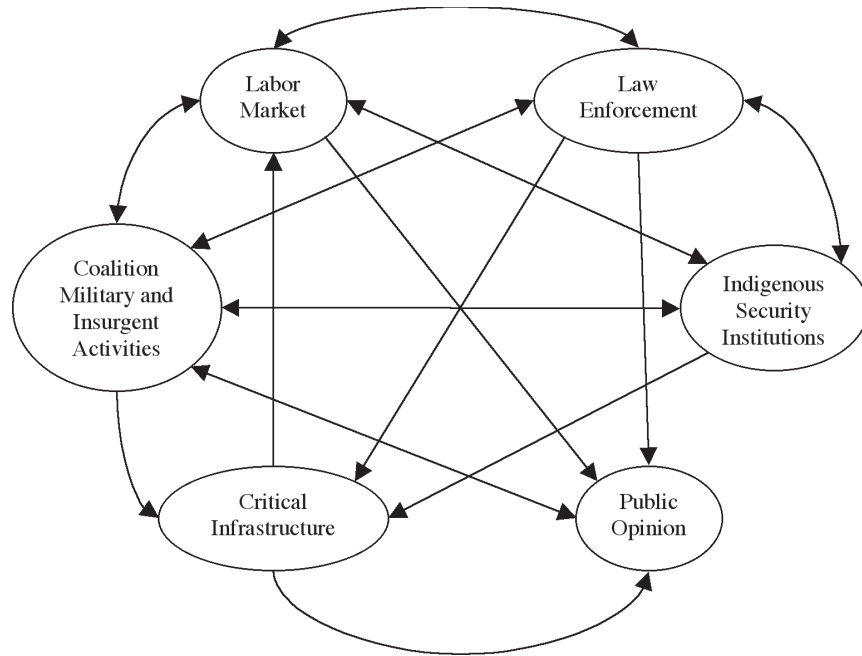


Figure 2. Macro level model architecture

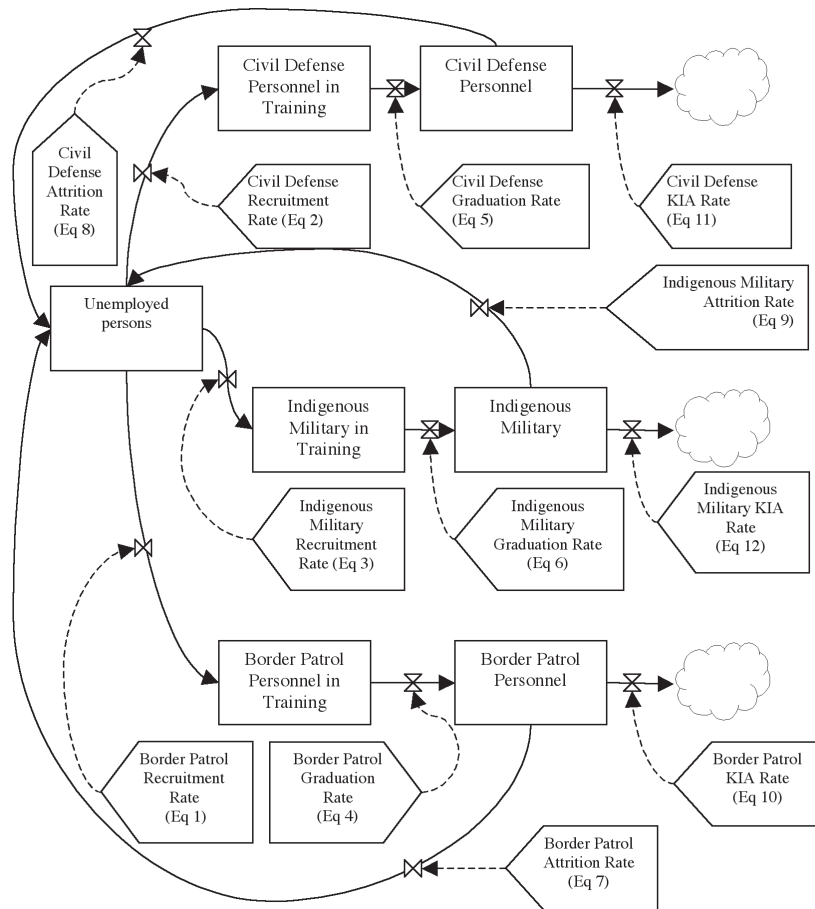


Figure 3. Indigenous institutions sub-model

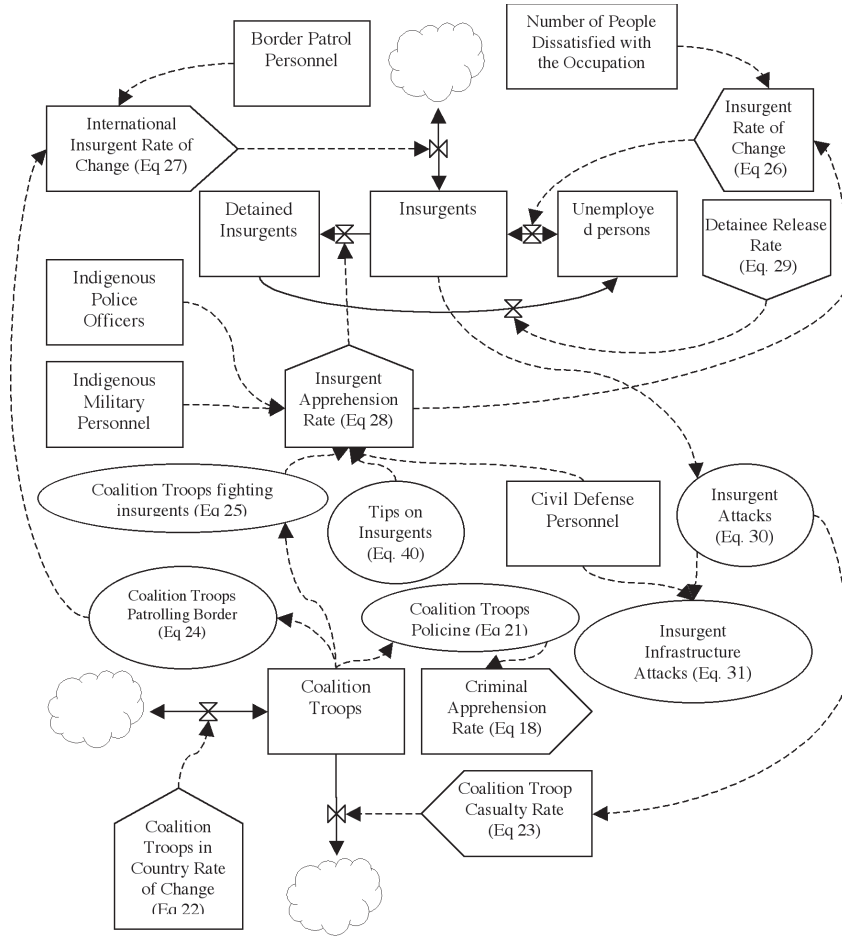


Figure 4. Insurgent and coalition military activities sub-model

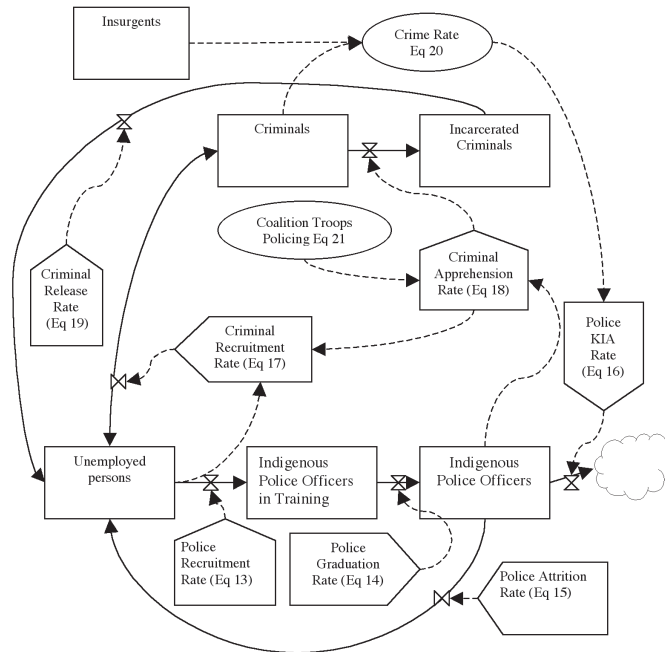


Figure 5. Law enforcement sub-model

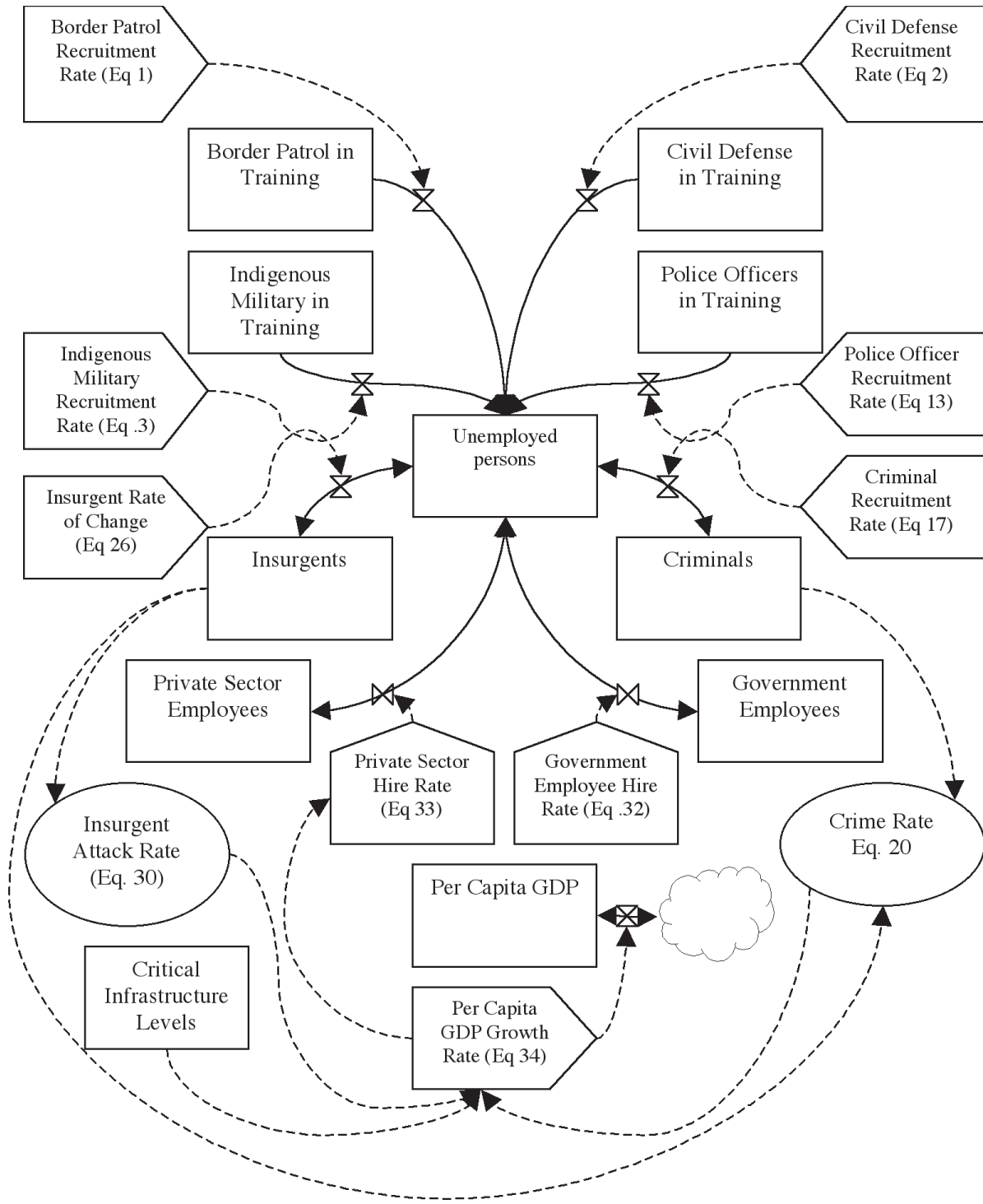


Figure 6. Labor market sub-model

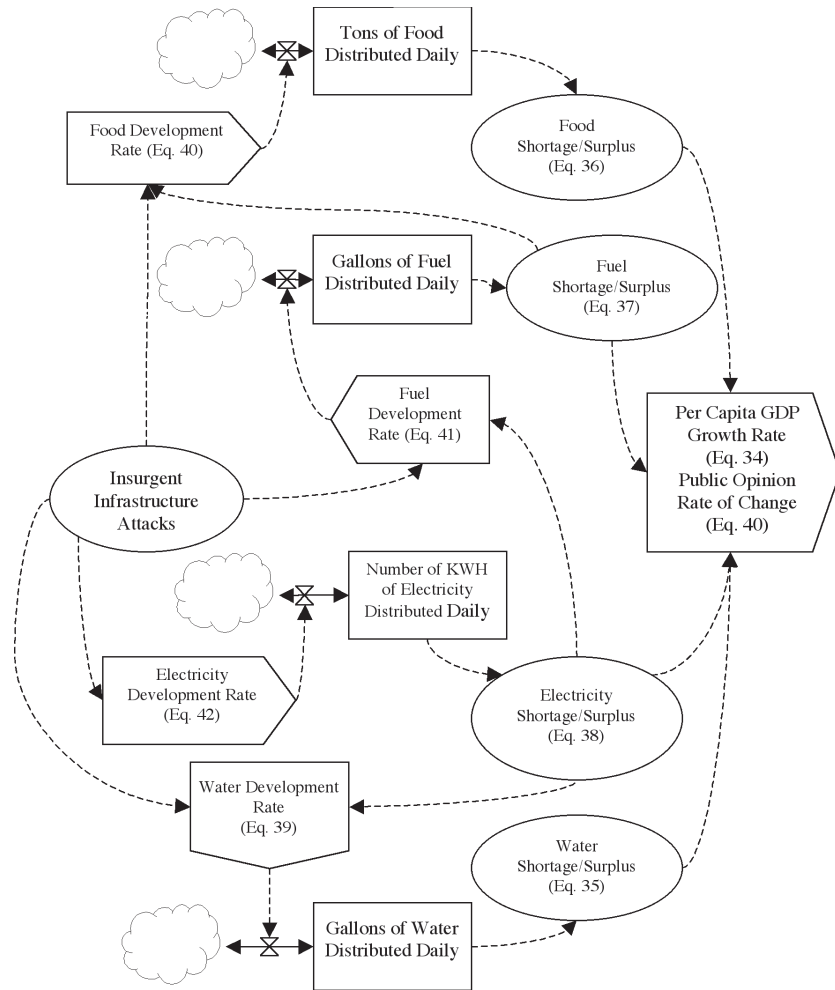


Figure 7. Critical infrastructure sub-model

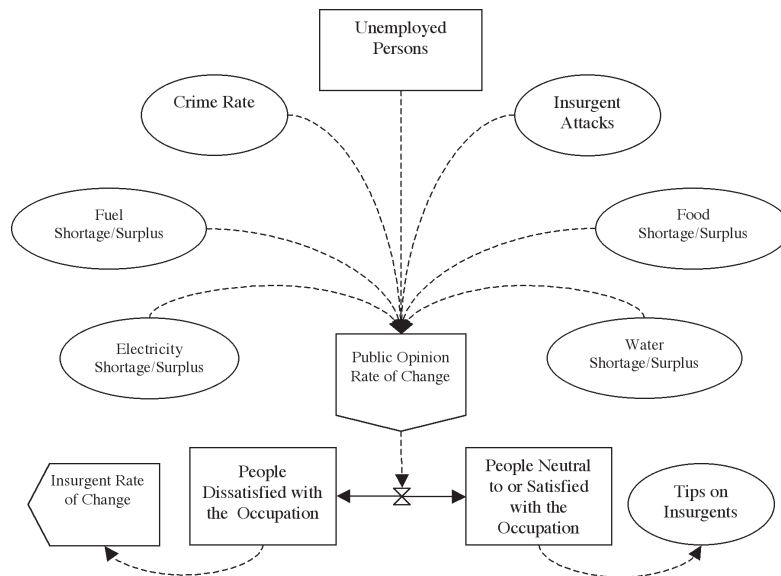


Figure 8. Public opinion sub-model

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