

## Computational Modeling USAFRICOM Concerns—Sahel

USAFRICOM's **enduring objectives** include mitigating violent non-state actors as well as political and natural disaster crises. These challenges are especially acute in African countries that are part of the Sahel or adjacent to it. NSI developed and interrogated **computational models** to represent the **COMPLEX INTERRELATEDNESS** of factors (nodes) that determine the operational environment (OE) in the Sahel.

### KEY FINDINGS

#### CHANGE IN THE SAHEL WILL BE SLOW ... MOSTLY

Empirical analysis of the system model showed most relationships between nodes are linear and gradual suggesting system change will be slow.

**HOWEVER**, a few relationships have the potential to change rapidly:

- **global warming** accelerates the rate of **epidemic** crises
- **political violence** and **factionalized elites** accelerate the rate of **terrorist attacks**

#### GOVERNMENT EFFECTIVENESS IS A CRITICAL DRIVER OF BOTH NEGATIVE & POSITIVE CHANGE

#### GOVERNMENT EFFECTIVENESS, GRAND CORRUPTION AND INTERNAL WAR ARE MUTUALLY REINFORCING

- Together these impact factors like **terrorism**, **malnutrition**, and **irregular emigration**
- **Government effectiveness** and **corruption control** is the **STRONGEST** relationship in the entire system; they are mutually reinforcing. **Increased government effectiveness** increases the state's abilities for **corruption control** and vice versa, creating a virtuous cycle or a vicious one if either is decreased.

#### TERRORISM IS A KEY DISRUPTOR IN THE REGION

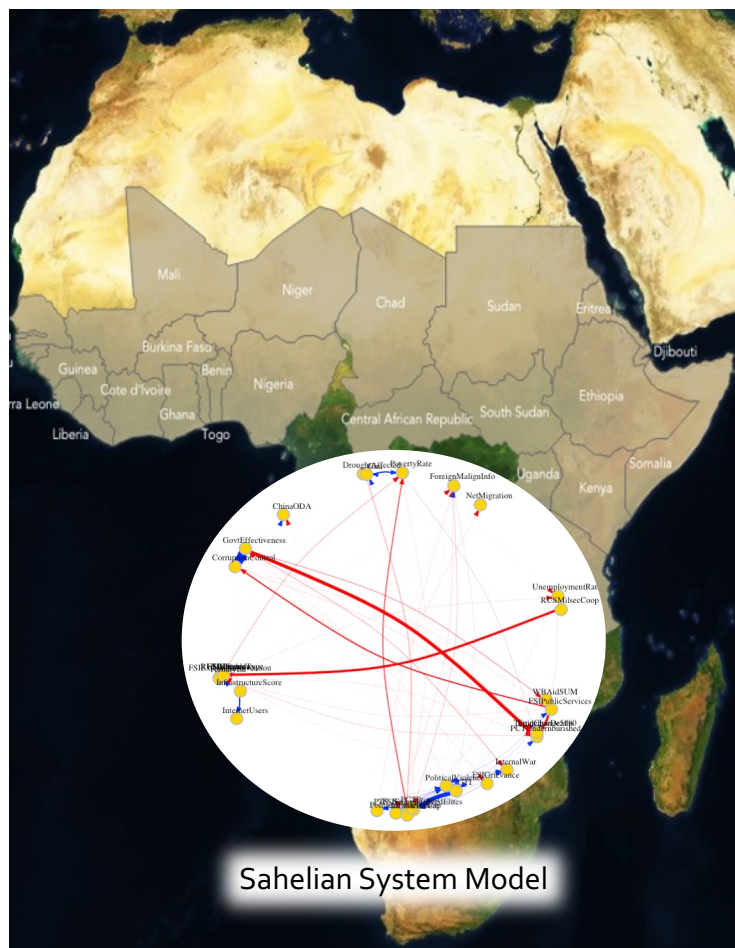
**Terrorism** is self-reinforcing; once it begins, it is positioned in the system to **beget more terrorism** in multiple ways.

#### Modeling Caveat



The models used in this analysis are still under construction and refinement.

Computational models systematically capture complex interactions that elude qualitative analyses and traditional statistics. However, models are imperfect abstractions of the complex world with which decision makers deal. All models, including those presented here, should be taken as a starting point for further analysis and to produce better validated and more completely specified models.



Sahelian System Model

*The Sahelian system model consists of 32 nodes and 77 connections between them*

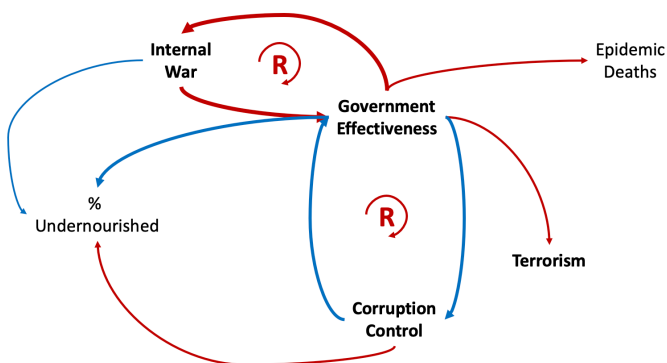
## Sahelian Network Model Results

**Computational models** use mathematical operations or computer code to represent systems. Two types of computational models were used to represent the interrelatedness of the nodes that represent key USAFRICOM concerns in the Sahel: **network** and **system dynamics**. **Network models** represent the arrangement of nodes to one another and provide insights into how the arrangement of nodes gives them the potential to influence and be influenced by other nodes or the system overall. **System dynamics** models track the flow of influence between nodes and throughout the system.

### Network Node Centrality

**Government effectiveness** is positioned to be a key influencer on many USAFRICOM concerns.

Other nodes positioned to be influential include **terrorism**, **political polarization**, **political violence**, **factionalized elites**, and **fragile public services**.



### GOVERNMENT EFFECTIVENESS – CORRUPTION – CIVIL WAR NEXUS

**Government effectiveness** is at the center of two reinforcing relationships involving **corruption** and **civil/internal war** that accelerate their effects on other nodes.

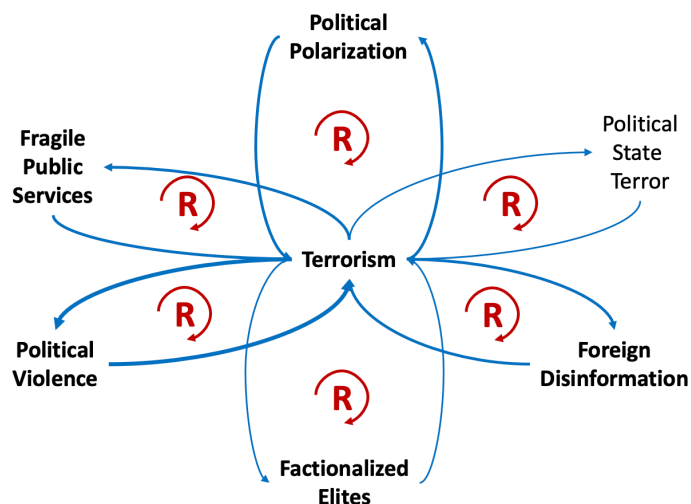
Addressing issues such as **malnutrition**, deaths from **epidemics**, and **terrorism** in the long run requires addressing the nexus that drives them.

### THE TERRORISM ENGINE

**Terrorism** is at the center of six reinforcing relationships involving **political polarization**, **state terror**, **foreign disinformation**, **factionalized elites**, **political violence**, and **fragile public services**.

These reinforcing relationships can greatly accelerate **terrorism**.

Successfully mitigating **terrorism** requires simultaneously addressing each of these relationships.



## Sahelian Network Model Results

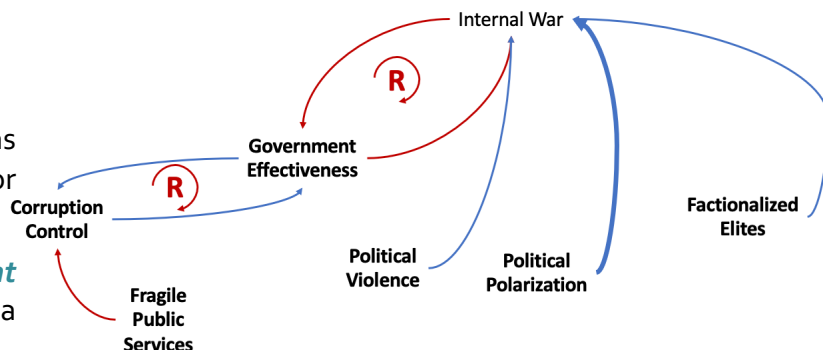
### System Dynamics Findings

#### THE GOVERNMENT EFFECTIVENESS – CORRUPTION – CIVIL WAR NEXUS IN MOTION

The Sahelian system dynamics model was composed of 23 nodes with 80 connections, or flows, between them.

As with the network model, the *government effectiveness—corruption—civil war* nexus is a key driver in the over all system.

*Political violence*, *factionalized elites*, and especially *political polarization* are *internal war* drivers.

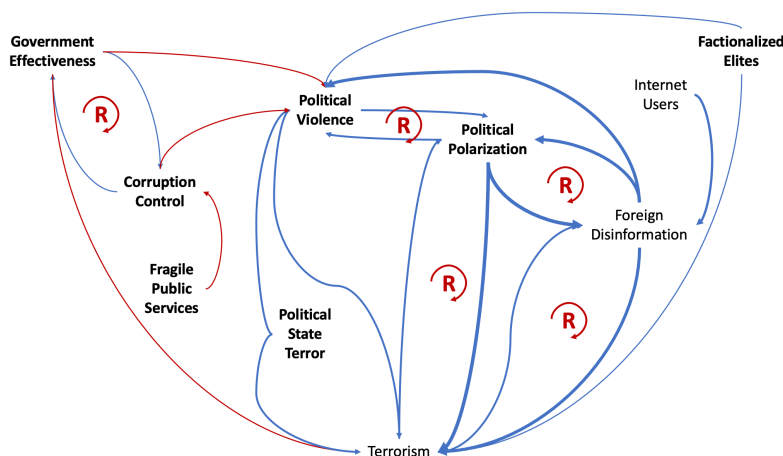


#### THE TERRORISM ECOSYSTEM

*Terrorism* is embedded in a complex ecosystem of nodes and other ecosystems such as the *government effectiveness—corruption—civil/internal war* nexus.

There are a number of reinforcing loops that accelerate change in the system, including *political polarization*, *state terror*, *foreign disinformation*, *factionalized elites*, *political violence*.

The combined effect of these reinforcing loops is *exponential increase in terrorism* through time.



#### THE EMIGRATION ECOSYSTEM

*Emigration* is driven by the *government effectiveness—corruption—civil war* nexus.

*Civil/internal war* and ineffective governance due to corruption are in a position to accelerate *emigration*.

*Political state terror* is another push factor that motivates *emigration*.

*Increasing income* within Sahelian countries actually *encourages emigration* since only people with financial resources can migrate out of the region.

