Criminal Investigations and Network Analysis
A DHS CENTER OF EXCELLENCE

GEORGE MASON UNIVERSITY

RUTGERS

Detecting Criminal Disruption of Supply Chains Study

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Criminal Investigative Processes

SUMMARY

Deliberate disruption of a licit supply chain remains a threat to our global economy and national security. This project models both supply chains and criminal organizations to simulate multiple attack scenarios for the purposes of identifying supply chain vulnerabilities, discovering likely attack scenarios and the necessary criminal organization capabilities, and developing mitigations as well as indicators and warnings.

PROBLEM STATEMENT

The project is meant to prove the concept that observable data, when combined with prior knowledge of a licit supply chain and a criminal organization, may be used to detect the planned, current, or past disruption of the supply chain by a criminal organization. The goal is to use simulation to identify possible ways that criminal organizations might be able to disrupt or damage important supply chains, such as those for a drug manufacturer, to examine approaches to provide warnings, and to identify possible ways to prevent, mitigate, or repair this disruption. We proposed (a) understanding and modeling specific licit supply chains, (b) understanding and modeling specific criminal organization operations and capabilities, and (c) combining parts (a) and (b) to identify potential data sources of value and associated indicators and warnings.

APPROACH

We apply a combination of agent-based discrete event simulation and stochastic optimization to model supply chains, their interactions, and ways that criminal organizations might attempt to attack them. Our approach models possible attack points, develops indicators that can alert authorities and supply chain operators about pending, active, or past attacks, and offers what-if analysis to consider ways to mitigate vulnerabilities and reduce attack impacts. The project uses both subject matter expertise and automated distributed optimization techniques to develop and calibrate the models.

RESULTS

The development of a drug and vaccine supply chain has been completed, and several disruption scenarios and required capabilities of criminal organizations have been identified. The supply chain and disruptions have been implemented and integrated in a simulation environment, the effect of the disruptions have been measured, and early warning signals and mitigation strategies are being studied and developed. Automated model calibration strategies, via distributed stochastic optimization methods, are being integrated with the simulation framework to analyze worst-case disruption scenarios and related optimal mitigation strategies.

ANTICIPATED IMPACT FOR DHS

Since this project began there has been a dramatic increase in attention paid to supply chains, their impact on the global economy, and their exposure to disruption. The results of the project will advance research into how DHS can build models of supply chains, pose what-if questions regarding optimal ways to disrupt them given specific amounts and kinds of resources and know-how, examine how to make supply chains more robust against attacks, to identify and mitigate attacks before and while they occur, and to repair damage after the fact.