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Surface Transportation Supply Chain Security: Creating a Blueprint for Future Research

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COVID-19 highlighted the criticality of the world's surface transportation supply chains, when imported supplies of medial protective equipment, ventilators and glass vials to hold vaccine were inadequate for Americans' needs. Ninety percent of the world's trade goods travel by surface transportation, using maritime, road and rail assets.[i] Self-driving vehicles for port operations and cyber systems to manage cargo container movements adds efficiency, but also vulnerabilities to hacking. Today's large container ships, complex port operations and choreographed forward movement of the containerized cargo by rail and truck require an integrated approach to improving surface transportation supply chain security (STSCS). Researchers interested in developing new security strategies for STSCS would benefit from an understanding of the current challenges, available scholarship in the field, and a blueprint for future research that would create practical benefits. This research engaged industry experts and transportation scholars to create these tools.

Study Methods

The research began with an extensive literature review of existing works on multi-modal and inter-modal STSCS. A second line of research sought out practical security literature created by adversaries. These two streams of scholarship were converted into bibliographies to assist scholars in studying STSCS. Next a Delphi workshop was convened of experts on maritime, road and rail modes from the United States (US) and European Union (EU), where the challenges facing each element were explored through presentations and discussion. The product of the workshop was this report, which includes a blueprint for areas of future research on STSCS.

Findings

1. The introduction of SCADA systems and cyber technology into the maritime sector has left ships vulnerable to malign interference, using the ship's internet connectivity to disrupt navigation and operation of the vessel. Efficiency demands the use of

such systems, but experience shows that hacking can create a crisis at sea.

2. Port security challenges are managed by international cooperation, inspections of containers in foreign ports, scanning with sensors at destination ports, and vigilance by maritime security organizations. Ports are increasingly automated, with self-driving cars and multiple cranes with one operator. Cyber systems time the arrival of trucks for container off-loading from ships to ensure rapid movement out of the port.
3. The melting Arctic Ocean has created new trade routes through turbulent waters, threatening the pristine environment. Ports on Russia's north shore will change supply chains within the European Union's Schengen area.

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4. China's trade dominance has led to the Belt and Road Initiative, which is comprised of an overland railroad to Poland, and a maritime Silk Road to Africa, transiting the Suez Canal to the Mediterranean Sea and its newly built port in Greece.
5. Chinese investment in transportation infrastructure around the world created challenges to international stability: ports designed for cruise ships, but also for military vessels; and investments leading to debt diplomacy in small nations.
6. Public Safety Power Shut-Offs in California, intended to prevent wildland fires, have left the Los Angeles/Long Beach complex, the largest container port in the nation, and Oakland, the largest food exporter to Asia, without power. Further, the forward movement of cargo is impeded by loss of power to traffic control devices and railroad signals.
7. COVID-19 demonstrated the US's dependence on essential goods from China. This has caused a reassessment of the role of imported goods in critical sectors, and of the need for domestic production.

Policy/Practice Recommendations

STSCS needs additional research to determine how best to secure the surface transportation supply chain against adversaries using cyber, trade and financial weapons, as well as against traditional crime. The challenges are legion.

Value of US Logistics

Mode	Value (USD)
Motor carrier	668 billion
Parcel	104.9 billion
Rail	88.4 billion
Air freight	76.5 billion
Water & ports	457 billion
Pipelines	53 billion

Source: Council of Supply Chain Management Professionals, 2019.

[i] United Nations Conference on Trade and Development. *Review of Maritime Transport*, 2019. https://unctad.org/en/PublicationsLibrary/rmt2019_en.pdf

About the Principal Investigator

Frannie Edwards, MUP, PhD, CEM, is professor and director of the Master of Public Administration program at San José State University, and Deputy Director of the National Transportation Security Center at the Mineta Transportation Institute (MTI). She is a Certified Emergency Manager with over 20 years' professional experience in California.

To Learn More

For more details about the study, download the full report at **transweb.sjsu.edu/research/1937**

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