

**Thesis Project Portfolio**

**Managing Operational and Environmental Risks in the  
Strategic Plan of a Maritime Container Port**

(Technical Report)

**Using the Framework of the Social Construction of Technology to Analyze the  
Adoption of Automation and Digitalization at the Port of Virginia**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science  
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Bachelor of Science, School of Engineering

**Benjamin I Mendel**

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Department of Engineering Systems and Environment

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## **Sociotechnical Synthesis**

Shipping trends in technology, regulation, energy and environment require maritime container ports to adapt their operations to better suit current and future conditions. This paper focuses on innovative solutions in three main areas of interest for ports: (1) clean energy technologies, (2) alternative financing and (3) automated process technologies. In the technical paper, these areas of interest are explored using the Port of Virginia as a case study. Results are derived using scenario analysis methodology drawn from systems, risk and resilience analysis. Investment strategies in renewable energy sources are evaluated and project funding approaches, including the use of green bonds, are explored. AI systems relevant to port operations integration and container security are also described. The key results of this paper are twofold: (1) a demonstration ranking of initiatives for a port strategic plan and (2) a ranking of scenarios by their disruption on initiative impact. The results of the case study are of interest to the strategic planners at industrial ports and the maritime industry.

This STS research paper will use the framework of the Social Construction of Technology (SCOT) to analyze and explore how human action and social influence drive the relatively slow adoption of innovation at the Port of Virginia, specifically automation. It will also analyze the social benefits and challenges of automation for the port and surrounding areas. Because such analysis has not been done specifically for ports, it will study other related sectors and extrapolate the analysis to the port. The paper will first analyze the main stakeholder groups of the Port of Virginia by looking at their motivations and interests. Then, a close look at labor issues at the innovative Port of Rotterdam as a case study will show how stakeholder interests can come into conflict. Finally, it will discuss how the analogous construction sector has handled automation, and this will be compared and contrasted to the port.