Enterprise Resilience of Maritime Container Ports to Pandemic and Other Emergent Conditions

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by

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with

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Abstract— **Emergent and future conditions that influence the global container port industry include pandemics, regulations, markets, technologies, environments, organizations, energy resources, workforces, supply-chain partners, and others. It is critical to simultaneously formulate and adapt multiple strategic plans of individual ports to the above stressors. The Port of Virginia (POV) generates 400,000 jobs, or roughly 11% of jobs across Virginia, and has an overall annual economic impact of $92 billion. POV is currently investing $800 million to expand its annual container throughput capacity by 40 percent by the end of 2020. This investment supports initiatives outlined in the port's 2065 master plan through the investigation of different scenarios that impact emergent and future port conditions. This paper describes the most and least disruptive scenarios of emergent and future conditions, including hybrid scenarios involving the COVID-19 pandemic. The degree of disruption is measured by the changes in priorities of a port's strategic plan, in particular for the rank order of investments by their individual contributions to the strategic goals of the port. The analysis described herein includes sixteen strategic goals, 31 strategic plan investments, and several dozen emergent and future conditions. The analysis assembles the emergent conditions into scenarios. The most disruptive scenarios are selected for contingency planning, enterprise risk management, and research & development. Seven scenarios are available for future exploration in detail: (1) Funding Decrease (2) Natural Disaster (3) Green Technologies (4) Pandemic (5) Increased Automation (6) Alternative Financing (7) Population Changes. Green Technologies, Pandemic and Alternative Financing are explored in detail in this paper. The results of this paper are thus both a methodology for any port to address its emergent and future conditions via its strategic plans, and also a case study of enterprise resilience of a major container port of the United States. The results will be of interest to port owners and operators, risk managers, transportation agencies, regulators, freight shippers, human resource managers, the military, and others.**

Keywords—Systems engineering, risk analysis, logistic systems, COVID-19, hybrid threats, emergent conditions, strategic plans

I. INTRODUCTION

Maritime shipping ports and their intermodal connectors are key points of infrastructure needed to support global supply chain, regional and global economic activity, transportation network systems, and job growth [1]. Ports must work to increase efficiency, use of technological systems, competitive nature to meet the demands of the growing world population and, especially, resilience to disruptive scenarios. Resiliency in the maritime shipping industry can be defined as "the ability of the system to bounce back after a shock and return to its normal value delivery levels" [2]. Manmade and natural disruptions can reduce or eliminate a port's ability to send and receive goods, therefore causing immense negative socio-economic and global supply chain implications. It is imperative that maritime shipping ports implement resilience practices into all systems. This will improve maritime shipping ports' ability to quickly adapt to disruptions, minimize losses, and remain competitive. Preparation for emergent and future conditions is a matter of utmost importance. This paper uses a scenario-based preference model to assess the resilience of maritime shipping ports by including criteria, initiatives, and emergent conditions to help define the most disruptive scenarios.

The model is developed and demonstrated in the context of POV as the COVID-19 pandemic evolves in early 2020. The elements of the method are criteria, initiatives, emergent conditions, and scenarios. The work will demonstrate how various emergent conditions disrupt the prioritization of initiatives aimed at bolstering a port's resilience. Scenarios were selected for further reporting to determine how a port should manage, plan for, and increase resiliency if an unexpected scenario were to occur. This paper first provides a detailed look at the methods and outlines the specific methodologies to be used. It demonstrates this using a case study of a container port including the following hybrid scenarios: Pandemic, Emergent Green Technologies, and Alternative Financing. The conclusion of this paper will emphasize the need and direction for future work to assist maritime shipping ports in their enterprise resilience.

II. METHODS

The following approach follows Hassler et al. paper "Multi-perspective scenario-based preferences in enterprise risk analysis of public safety wireless broadband network" [3]. This section describes a scenario-based preference model to identify competing initiatives in a system; assess the influence of scenarios to prioritize initiatives; and identify the most and least disruptive scenarios. Success criteria are developed to measure the potential of investment initiatives. These are based on goals set by stakeholders for the system. The set of criteria, $C = \{c_1, \dots, c_k\}$, derive from reviews of relevant third-party program analyses and literature reviews. Initiatives represent decision-making objectives in the form of technologies, policies, assets, projects, or other such investments. The set of initiatives, $X = \{x_i, \dots, x_k\}$, is developed through elicitation of stakeholder and expert opinions as well as from review of third-party analyses. This list is not exhaustive and can be expanded according stakeholder input. In the analysis, each criterion is given an importance level and assessed on whether it is impacted by the given initiative.

Emergent conditions are stakeholder beliefs or values, future events, or trends that could impact how initiatives are evaluated. These emergent and future conditions could potentially disrupt the prioritization of initiatives by posing danger to the system or exploiting vulnerabilities. The set of emergent conditions $E = \{e_1, \ldots, e_i\}$, are drawn from stakeholder interviews and third-party literature. Scenarios, $S = \{s_1, \ldots, s_k\}$, are made up of one or more of the given emergent conditions and represent the most crucial challenges or risks that face the system.

After criteria, initiatives, and scenarios have been established the initial assessment can begin. An assessment of each criterion j for the stakeholder perspective p is performed. This assessment is performed through stakeholder interviews and expert elicitation. Three relevance options are offered: high, medium, and low. These options correspond to weights decided upon by experts and stakeholders. The normalized assessments form the entries w_{jB}^{p} in the $m_B \times n$ baseline impact matrices w_B^p for the stakeholder perspective, p. After baseline weights are created the criterion are again assessed for each scenario s_k. Through stakeholder input each criterion is given one of five relevance measures based on how it changes under a given scenario. These measures are decreases, decreases somewhat, no change, increases somewhat, and increases. Each measure is assigned a ratio for change. This reweighting is done for each scenario and the stakeholder perspective. The scores form the entries w_{jk}^{p} in the $m_k \times n$ impact matrices W_k^p for scenario s_k and the stakeholder perspective p.

Following the establishment of baseline criteria weights, reweighting of criteria for each scenario, and stakeholders' perspectives, each criterion is then assessed on whether it is addressed by a given initiative. This is also performed through stakeholder interviews and expert elicitation. The available levels of impact for initiatives assessments are strongly agree, agree, and somewhat agree. These assessments correspond to weights decided upon by stakeholders and experts. Thus, entries x_{ij}, the score initiative x_i receives for criterion c_j, in an impact matrix X_i is created for each initiative. These are the same across all stakeholders as each perspective is considered. In summary, the criteria are first given a relevance measure in the baseline scenario for each perspective, then each criterion is reweighted based on the different scenarios. Criteria are then assessed on whether they are addressed by each initiative. A score for each initiative is then created under each scenario through linear additive value function shown in (1).

$$V(x_i)_k = W_k X_i \qquad (1)$$

Given a score for the initiatives, each can now be ranked and prioritized such that: if a given initiative's score under a given scenario is *higher* than that of another initiative under the same given scenario then the first initiative should be prioritized higher. Once arriving at a score for each initiative under each scenario the initiatives can be ranked where $R(x_i)_k^p$ represents the rank of initiative x_i under scenario s_k for the stakeholder perspective p. Thus, a disruptiveness measure for each scenario under each perspective, $D(s_k)^{\,p}$ can be obtained by using sum of square ranking illustrated in (2).

$$D(s_k)^{\,p} = \sum_{i=1}^{n} (R(x_i)_b^p - R(x_i)_k^p)^2 \qquad (2)$$

Thus, it can be illustrated to stakeholders which scenarios are most and least disruptive to the system based on the outputs of (2). The purpose of these scores is to determine a ranking of the most and least disruptive scenarios.

III. DEMONSTRATION

This section demonstrates the application of the methods presented to the world-wide container ports from the perspective of POV. First, a set of criteria $C = \{c_1, \ldots, c_k\}$, are listed in Table I and identified through discussion with POV. These initiatives were taken from POV 2065 Master Plan and included completed, current and future initiatives. There are 31 total initiatives shown in Table II. The set of emergent conditions, $E = \{e_1, \ldots, e_i\}$, and future scenarios are displayed in Table III. Both were sourced through third-party analyses, as well as discussions, with POV.

With the help of stakeholders and independent research, each of the initiatives were assessed qualitatively against all 16 criteria. The initiatives were assessed if they strongly address, addresses, somewhat addresses, or does not address the criterion for POV. These assessments were then converted to quantitative scores. The relative importance of the criteria was reevaluated at different scenarios. The importance of the criteria and scenarios were then assessed qualitatively if each scenario were to decrease, somewhat decrease, neutral, somewhat increase, or increase the criteria. The resulting method created a ranking of resilience of each initiative and the disruptiveness of each scenario.

TABLE I. SUCCESS CRITERIA USED FOR SCENARIOS ANALYSIS

Index	***Criterion***
c.01	Cost Effectiveness
c.02	Keeping up with Industry Demand
c.03	Safety and Security
c.04	Economic Development
c.05	Global Port Standing
c.06	Sustainability
c.07	Global Connectivity
c.08	Low Operating Costs
c.09	Innovation
c.10	Fiscal Responsibility
c.11	Efficiency
c.12	Compliance with Regulation
c.13	Fast Turn Times
c.14	Fast Rail Import Times
c.15	Low Costs per Lift
c.16	Low Number of Crane Moves per Hour

TABLE II. INITIATIVES USED FOR SCENARIOS ANALYSIS

Index	*Initiatives*
x.01	NIT-01 North Gate and North Container Yard Construction
x.02	NIT-02 South RMG Design and Implementation
x.03	NIT-03 Customer Service Improvements
x.04	NIT-08 Miscellaneous Concrete and Pavement Repairs
x.05	NIT-11 South Berth Channel Widening
x.06	NIT-12 Ship-to-Shore Crane Electrical Upgrades
x.07	NIT-13 South Ship-to-Shore Crane Acquisition
x.08	NIT-16 Phase 3 RMG, Wharf & CRY Improvements
x.09	NIT-17 Pier 3 Demolition and Cold Storage Relocation
x.10	NIT-18 Third Street Rail Improvements
x.11	NIT-20 Shuttle Truck Acquisition
x.12	VIG-01 Terminal Operating System Upgrade
x.13	VIG-02 Phase 2 Terminal Expansion
x.14	VIG-03 Truck OCR Portal Improvements
x.15	VIG-04 Shuttle Carrier Rack Expansion
x.16	VIG-07 Phase 2 RMG Acquisition
x.17	VIG-10 Maintenance Dredging
x.18	VIG-11 VIG Rail Portal Improvements
x.19	PMT-02 Rail Improvements
x.20	NNMT-07 Adjacent Property Acquisition
x.21	VIP-01 Rail Capacity Expansion
x.22	RMT-06 Lead Track Repairs
x.23	RMT-09: Crane Replacement/Acquisition
x.24	RMT-10 Area B Expansion
x.25	RMT-11 Rail Expansion
x.26	CIMT-03 Craney Island Road-Rail Connector Right-of-Way Acquisition
x.27	CIMT-12 Ship-to-Shore Crane Acquisition
x.28	CIMT-13 Rail Mounted Gantry Crane Acquisition
x.29	CIMT-15 Craney Island Marine Terminal Phase 2 Construction
x.30	CIMT-17 Craney Island Marine Terminal Phase 3 Construction
x.31	CIMT-18 Craney Island Marine Terminal Phase 4 Construction

TABLE III. EMERGENT CONDITIONS AND SCENARIOS USED FOR SCENARIOS ANALYSIS

Scenarios	*Emergent Conditions*
s.01 Funding Decrease	e.01 - COVID-19
	e.07 - Small Nuclear Reactors
	e.14 - Extreme Flooding from Climate Change
	e.15 - Hurricane
	e.16 - Global Recession
	e.18 – Fewer Ships Call The Port of Virginia
s.02 Natural Disaster	e.14 - Extreme Flooding from Climate Change
	e.15 - Hurricane
	e.18 – Fewer Ships Call The Port of Virginia
	e.25 - Rail Network Disruption
	e.26 - Roadway Disruption
s.03 Green Technologies	e.04 - Liquified Natural Gas
	e.05 - Alternative Maritime Power
	e.07 - Small Nuclear Reactors
	e.08 - Container Weight Renewable Energy Storage
s.04 Pandemic	e.01 - COVID-19
	e.10 - Port Connectivity
s.05 Increased Automation	e.02 - Driverless Trucks
	e.24 - High Speed Freight Trains
s.06 Alternative Financing	e.19 - Green Bonds
	e.20 - Increased Government Grants
	e.29 - Domestic Manufacturing at Ports
s.07 Population Changes	e.01 - COVID-19
	e.24 - High Speed Freight Trains
	e.25 - Rail Network Disruption
	e.26 - Roadway Disruption
	e.27 - Norfolk Increased Population Growth
	e.28 - High Speed Passenger Rail - Norfolk -> D.C.

IV. ANALYSIS OF SELECT SCENARIOS

This section explores several scenarios that could impact priorities and/or offer opportunities to ports in the near future. The scenarios are as follows: Green Technologies, Alternative Port Financing, and Pandemic.

A. *Green Technologies*

i) Alternative Maritime Power (AMP): also known as cold-ironing or ship-to-shore power, provides ships with power allowing them to shut off engines while berthed. This practice has been utilized by the United States Navy for many years to reduce the need to burn fuel on ships. More recently, AMP systems have been implemented by some ports that service both cruise and large shipping vessels, in hopes of decreasing fuel costs and harmful emissions created by burning fossil fuels. In order to fully utilize AMP, both shipping companies and desired ports must have the requisite infrastructure in place. Ports must have cable reels, connection boxes and access to enough power to displace the need for the ship's engines. Shipping vessels must be either retrofitted or built with cables and connections to attach to the power grid at the port, as well as a transformer to change the shoreside power from high-voltage into low-voltage [4]. Fig. 1 depicts a proposed AMP system as it may be implemented portside.

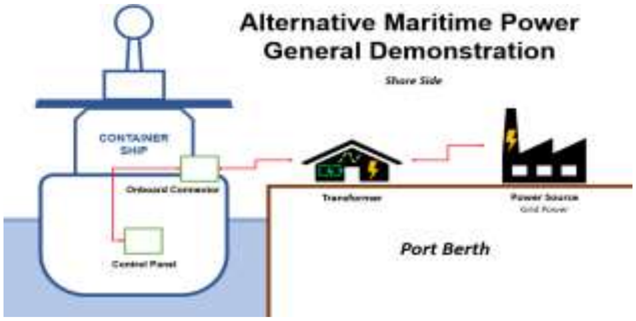

Fig. 1. Alternative Maritime Power System

Cold ironing infrastructure requires marine terminals be equipped with extra electrical capacity, conduits, and ‘plug’ technology. This allows vessels to accept power cables from the port berth. Larger container ships require over 1,500 kilowatts (kW) of power; however, depending on the varying sizes of modern containerships and refrigerated cargo power port and ship requirements can change drastically [5]. The total amount of power required for a system such as this would vary at each port due to differences in time a ship spends at a berth, the number of ships that hotel at that port, and the types of vessels that it services.

One likely reason that AMP systems have not yet been widely adopted is the sizable initial investment required by both ports and shipping companies. Today, a state-of-the-art, cold ironing equipped port costs vastly more than a conventional terminal without shoreside AMP [6]. Analysts from AECOM estimate that the costs of implementing an AMP system in California would likely be around $1.5 million per-berth. From a port’s perspective, the biggest benefit of implementing an AMP system is the positive environmental impact due to reduced emissions. Ports would also likely receive long-term economic benefits from the selling of electricity to shipping companies and could benefit from boosts in public perception and funding as a result of green initiatives such as Alternative Maritime Power.

ii) *Small Modular Nuclear Reactors:* Emergent technological advancements in the energy sector have the potential to be implemented cost effectively within the next twenty years, potentially overtaking existing renewable methods as the most popular form of sustainable energy generation. Small Modular Reactors (SMR’s), or any nuclear reactor operating at a scale of under 300 MWe, are at the forefront of government research into sustainable, risk resilient energy systems [7]. Compared to large nuclear reactors producing over 4 GWe, SMR's offer the notable advantage of lower upfront capital costs, independence from the power grid, extremely low operational risk and reduced maintenance cost. Currently, the smallest modular reactor design has a capacity of 11MWe, which would meet double the annual energy usage of the Port when used at 97% capacity 365 days a year [7].

As with any FOAK design, the present economic feasibility is hindered by increased research and development costs compared to more mature, existing nuclear plant designs. Cost reduction of implementation feasibility of SMR's is expected to take place over the coming decade through modularization of manufacturing, increased learning rate per doubling of production volume, co-siting of initial FOAK SMR's, and design simplification of individual components among other advancements [8].

The importance of SMR's to maritime ports is supported by their ability to immediately adapt power output to changes in energy demand, unmatched risk resilience to disturbances in grid-based power supply, modularity allowing factory-based components to be ordered and replaced as necessary, islanding to allow extra energy production to be sold back to the grid, fuel security in allowing nuclear fission products to be stored on site, and underground construction protecting components from being damaged in a climatic catastrophe or physical attack [9].

B. *Alternative Port Financing – Green Bonds*

Green Bonds are a type of bond issued for the purpose of raising money for climate and environmental projects [10]. They were first issued by the world bank in 2009 and have since reached $521 billion in cumulative global issuances [11]. By giving investors tax benefits and the ability to balance financial returns with environmental benefits, Green Bonds lower the cost of capital for issuers. Green Bonds can also improve the reputation of the issuer, diversify the issuer's investor base, and lead to improved internal operations due to the required reporting and transparency [12].

Green Bonds only differ from regular bonds in how they are labeled in the market. In order to earn the green label, issuers must meet the Green Bond Principles (GBP) as defined by the World Bank: (1) *Use of Proceeds* - projects should provide clear environmental benefits that will be assessed and quantified by the issuer; (2) *Process for Project Evaluation* and Selection - issuer should clearly communicate the sustainability objectives, the category of eligible green projects, and the criteria by which the project was selected; (3) *Management of Proceeds* - the proceeds from issuance shall be set aside only for green projects; (4) *Reporting* - issuer should make and keep up to date information as to the use of the proceeds and material developments of the project [12].

U.S. Green Bonds are verified Climate Bond Certified by Climate Bonds Initiative (CBI) an international nongovernmental, nonprofit organization dedicated to stimulating investment in projects and assets emphasizing environmental sustainability. No U.S. ports have issued Green Bonds, however, similar organizations such as the New York Metropolitan Transit Authority and Bay Area Rapid Transit (BART) have received the green label on their recent bond issuances [11]. The Japanese shipping company, NYK Line, raised around $90 million in Green Bonds in 2018 and received praise as the first major shipping company to utilize these securities [13].

A port should consider issuing Green Bonds in order to fund large investments into sustainability projects. These projects can include investments into LNG Bunkering, Alternative Maritime Power, Green Domestic Manufacturing, and related logistics innovations that cut down on emissions.

C. *Pandemic – COVID-19*

COVID-19 differs from other coronavirus illnesses that cause mild symptoms like the common cold [14]. This was first identified in Wuhan City, Hubei Province, China's wet markets in the Huanan Wholesale Seafood Market [14]. Due to a longer incubation period and delayed signs of symptoms, COVID-19 is highly contagious.

Many believe the initial societal shutdowns are a prelude to worse circumstances wherein the global markets might rebound from shortages. However, a key issue lies in the complete shutdown of most manufacturing facilities and not port operations. US News reports that POV volume losses in Feb, March, April will total ~44,000 import containers [15]. Container vessel calls at key Chinese ports are down more than 20% since January 20, 2020. It is too early to be certain of the impacts on POV, says CEO John Reinhart, but the Port is engaging with customers to better understand their operating posture [15].

Companies impacted by COVID-19 have been taking new actions to prevent industry wide impacts. An example industry that has been affected was Apple Inc., which has component manufacturing in Italy, Germany, Malaysia, and South Korea. Even car manufacturing in Germany and the United States has faced bottlenecks in shipments and inventory stocking due to recent layoffs [16]. Some current actions include transporting inventory to easily accessible ports, procuring inventory and raw material that are in short supply, and securing available air transportation supply and capacity [17]. At the moment, however, the most important supply chain task is US healthcare supply to reduce the load of coronavirus cases in hospitals before rebuilding global supply-chain infrastructure.

With regards to engineering solutions, the IEEE published an article outlining a global engineering response to pandemics and other infectious diseases. When managing such pandemics, specific capabilities are needed for preparedness, detection, characterization, response, and support to restore societal order [18]. Timely situational awareness has become an increasing concern for assessing technological impact on outbreaks. Data sharing between epidemiologists, care providers, patients, and the public is becoming increasingly difficult due to privacy concerns and lack of established criteria for data-sharing. There is a move towards using computational algorithms to recognize patterns and identify pathogens. For example, ProMed was an email reporting system developed in 1994 that actually helped detect the 2003 SARS outbreak. Given the presence of COVID-

19, engineering systems of pathogen detection is the first step in the process of infectious disease management, which can only improve through establishing engineering initiatives and building more computer architecture. From a port perspective, there have been other engineering actions in a responsive manner. As of March 27, two US Navy hospital ships were sent to ports in California and New York to ease the burden on hospitals during the crisis [19]. Each of these ships have 12 operating rooms, 1000 hospital beds, radiology services, medical lab, pharmacy, optometry lab, a CAT-scan, and two oxygen producing plants. This is evidence of engineering existing systems as a response to COVID-19 impacts on healthcare infrastructure. Moving forward, such engineering responses and developments are important in other phases of the process beyond detection, such as in response and preparedness phases.

March 2020 signaled one of the largest economic declines since October 2008.While there are policy objectives present to strengthen the macroeconomy, several SMEs (small-medium owned enterprises) are rapidly declining, a lost revenue stream for the port. For example, Long Beach has seen a 50-75% decline in business as its largest import partner, Shenzhen port in China, was largely impacted by COVID-19. These declines parallel other large domestic ports including POV. Ports are also concerned about declines in public and private grants received as the current priority is boosting and refinancing these businesses. However, POV, for example, is currently procuring 42% of its yearly spending on small, women-, and minority (SWaM) owned businesses when possible [20]. As a result, POV ensures the sustenance of these businesses through targeted contracts and spending.

Since COVID-19 is rapidly growing in the United States, this occurrence matches the findings from the analysis of scenarios as it is potentially a most disruptive scenario relative to other scenarios analyzed. Given the disruptiveness of COVID-19, there needs to be a focus on mitigating the financial and operational impacts of COVID-19 as it combines with diverse other scenarios.

V. RESULTS OF DEMONSTRATION

The normalized scores for disruption by each scenario are calculated and shown in Fig. 2 and Table IV. The scores for each scenario are out of a maximum 100. For POV, scenario s.04: Pandemic, is more disruptive than the other scenarios. The least disruptive scenario is scenario s.06: Alternative Financing.

TABLE IV. NORMALIZED DISRUPTIVE RANKINGS OF SCENARIOS

Rank	***Scenario***
1	s.04 - Pandemic
2	s.07 - Population Changes
3	s.02 - Natural Disaster
4	s.05 - Increased Automation
5	s.03 - Green Technologies
6	s.01 - Funding Decrease
7	s.06 - Alternative Financing

TABLE V. RESILIENCE RANKING FOR INITIATIVES

Ranking	***Initiative***
1	x.26 CIMT-03 Craney Island Road-Rail Connector Right-of-Way Acquisition
2	x.20 NNMT-07 Adjacent Property Acquisition
3	x.29 CIMT-15 Craney Island Marine Terminal Phase 2 Construction
4	x.27 CIMT-15 Ship-to-Shore Crane Acquisition
5	x.24 RMT-10 Area B Expansion

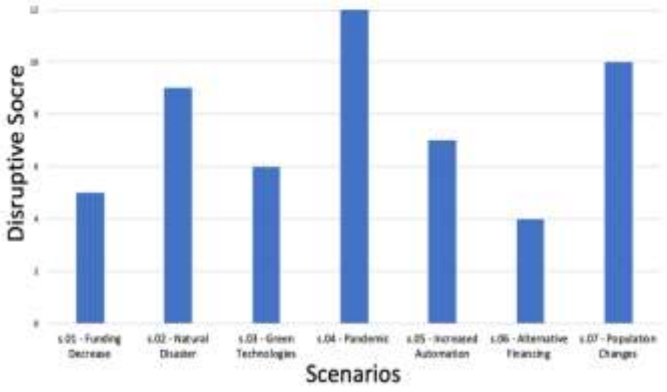

Fig. 2. Normalized disruptive scores for each scenario for the container port

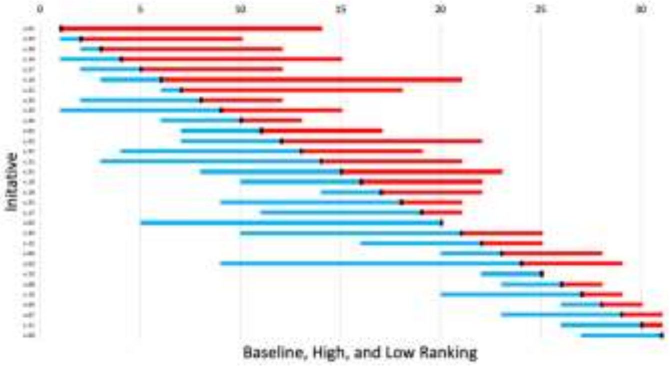

Fig. 3. Prioritization of Initiatives for the container port showing the baseline, high, and low ranks and normalized disruptive scores for each scenario

The demonstration also produced rankings of initiatives Fig. 3. The baseline rankings for each initiative are visualized by the black dots. Fig. 3 also demonstrates the high and low rankings for each initiative given a specific scenario. The blue bar shows an increase in prioritization of an initiative given a specific scenario, while the red bar shows a decrease in prioritization given a specific scenario. Specific initiatives are resilient if the set of scenarios their respective prioritization is the same. Table V shows the most resilient scenarios.

This section has described methods for identifying scenarios that most and least matter for enterprise risk management of the container port. It presented a scenario-based preference analysis applicable to many different domains. Other limitations to this methodology are the availability of data and amount of stakeholder engagement. This analysis required significant stakeholder engagement for criteria and initiative assessment and continued conversations throughout the lifetime of the model. Additionally, the assessment of criteria and initiatives by nature is somewhat subjective. The subjectivity of stakeholder opinions places limitations on how valid results might be due to stakeholder bias. While this could be considered a limitation, it also adds value to the model as it accounts for bias and reflects the aims and requirements of the interested parties.

VI. CONCLUSION

Table VI provides a summary of several scenarios and the associated proposed actions that can support enterprise resilience of the container port. Ongoing and future work should address these several proposals [21, 22, 23].

TABLE VI.

KEY FINDINGS FOR ENTERPRISE RESILIENCE OF A CONTAINER PORT TO EMERGENT AND FUTURE CONDITIONS

Select Scenarios	Proposals
Green Technologies	Utilizing AMP to provide hoteling vessels power in order to reduce emissions. SMR's will additionally help adapt power output to changes in energy demand and supply.
Alternative Financing – Green Bonds	Issuing Green Bonds to fund large-scale investment in sustainability projects, such as LNG Bunkering, AMP, domestic manufacturing, related logistics innovations.
Pandemic – COVID-19	Establishing mitigation plans and engineering practices to reduce the financial and operational impacts of COVID-19 and other similar pandemics.

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