**NUS-RightShip Hackathon Problem Statement**

**‘Just-In-Time Arrival’ and Emission Reduction at Singapore Ports**

**Background:**

Port congestion is a pressing challenge in global maritime logistics, significantly impacting operational efficiency and environmental sustainability. Vessels frequently encounter inefficiencies that lead to excessive waiting times. Vessels experience extended waiting times to dock at their assigned berths and this disrupts cargo operations and increase turnaround times for ships. In such scenarios, vessels often spend excessive periods in anchorage areas before moving to their berths, exacerbating the delays and inefficiencies in port operations.

In addition to that, extended port stays lead to increased costs for shipping companies. This includes not only demurrage fees, which are charges for delays, but also heightened labor costs and potential penalties for schedule deviations. Additionally, inefficiencies in cargo handling and vessel scheduling place adds strain on port resources and labor, further driving up costs.

The environmental impact of port congestion is also notable. Vessels idling in port or anchorage areas consume more fuel, which results in higher emissions. This idle fuel consumption often surpasses what would be used if vessels could dock and complete their operations more quickly. Furthermore, the increased need for tugboats and additional port machinery to manage congested traffic further exacerbates fuel consumption and emissions. This increase in emissions adversely affects the air quality in and around the port area. Ports situated near densely populated regions contribute significantly to local air pollution, which impacts public health and poses challenges to environmental sustainability.

**Objective:**

The primary objective is to propose innovative solutions that minimize emissions and optimize port operations by conducting a Just In Time Arrival analysis. Your challenge is to develop strategies that reduce waiting times, which consequently enhance port efficiency and lower carbon emissions.

You are strongly encouraged to consider the following into your solution:

1. How much time do vessels spend waiting before berthing?
2. At what speed should the vessel be travelling to be able to arrive at the port in time to reduce waiting for berthing?

**Area of Focus:**

The focus will be on the waters surrounding Singapore, targeting insights and solutions specific to this critical maritime area.

**Data Sources:**

* AIS data of vessels in Singapore waters from June-July 24, including vessel characteristics and engine specifications
* Port polygons
* Port call data
* Methodology to derive Just-In-Time Arrivals
* Supplementary tables relating to emission factors
* Accompanying data dictionaries

**Deliverables:**

* A case paper for emission reductions, including the methodology and assumptions behind the JIT calculations
  + Cover page + a half-page abstract (max 200 words) + max 4 pages with double spacing, Times New Roman font size 12.
* Results
  + The results should be submitted in an Excel file with the below headers. Please use the template provided.

**NOTE: Do not make any changes to the header names in the provided template.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Header Name** | **Data Type** | **Units** | **Definition** |
| 1 | team\_name | String | - | Name of submitting team |
| 2 | anc\_before\_jit | Float | Tonnes | CO2 emissions by vessels in anchorage before JIT is applied for the month of July |
| 3 | anc\_after\_jit | Float | Tonnes | CO2 emissions by vessels in anchorage after JIT is applied for the month of July |
| 4 | anc\_savings\_after\_jit | Float | Tonnes | CO2 emissions savings in the anchorage  after JIT is applied for the month of July |
| 5 | avg\_time\_before\_jit | Float | Hours | Average time spent by vessels in anchorage before JIT is applied for the month of July |
| 6 | avg\_time\_after\_jit | Float | Hours | Average time spent by vessels in anchorage after JIT is applied for the month of July |
| 7 | transit\_before\_jit | Float | Tonnes | CO2 emissions prior to vessels entry into the port boundary before JIT is applied |
| 8 | transit\_after\_jit | Float | Tonnes | CO2 emissions prior to vessels entry into the port boundary after JIT is applied |
| 9 | transit\_savings\_after\_jit | Float | Tonnes | CO2 emissions savings at transit after JIT is applied |

The deliverables are to be submitted via link by **Saturday, 18th January 2024, 9AM**.

**Judging Criteria:**

The participating teams will be judged based on the following criteria:

* Accuracy in the calculations
* Creativity and innovation in the approach to solving the problem
* Clarity and effectiveness of the presentation, including visualisations

NOTE: Judges’ decisions are final

**Conclusion:**

Addressing port congestion is essential for improving operational efficiency and environmental sustainability in maritime logistics. Prolonged waiting times disrupt cargo operations, increase costs, and contribute to higher fuel consumption and emissions. To tackle these issues, the primary goal is to develop innovative Just-In-Time (JIT) Arrival strategies that reduce waiting times and optimize vessel speeds for timely arrival, enhancing efficiency and sustainability.