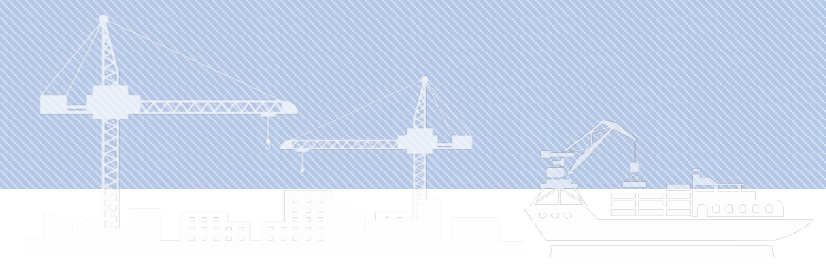


# Enhancing Port Competitiveness Using AI

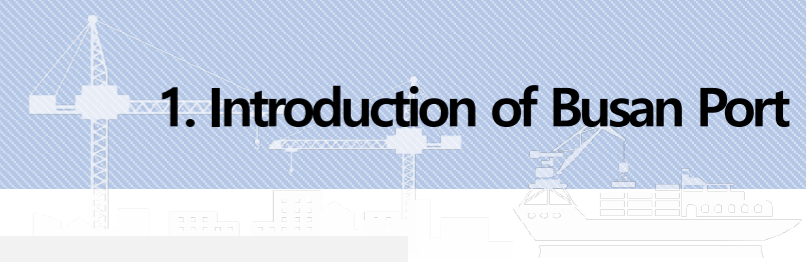
Busan Port Authority





- 1. Introduction of Busan Port**
- 2. Roles and Characteristics of Ports**
- 3. Key Issues in Ports and the Need for AI**
- 4. AI Use Cases in the Port Industry**
- 5. Next Steps**

# History of Busan Port



## 1. Introduction of Busan Port



### RENAISSANCE (2005~)

### PROSPERING (1970~2005)

### GROWING (1940~1970)

### BEGINNING (1876~1940)



- Busan International Port opened in 1876



- General cargo piers developed in 1944

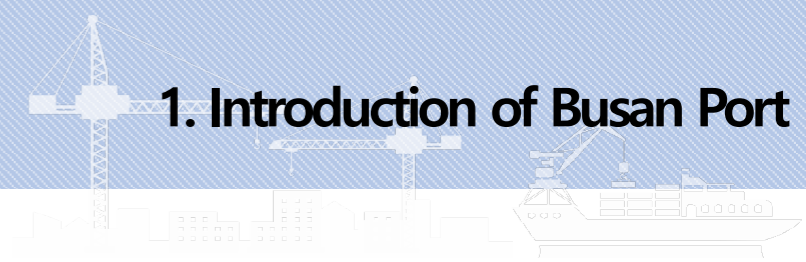


- "Jasungdae", the first dedicated container terminal opened in 1978

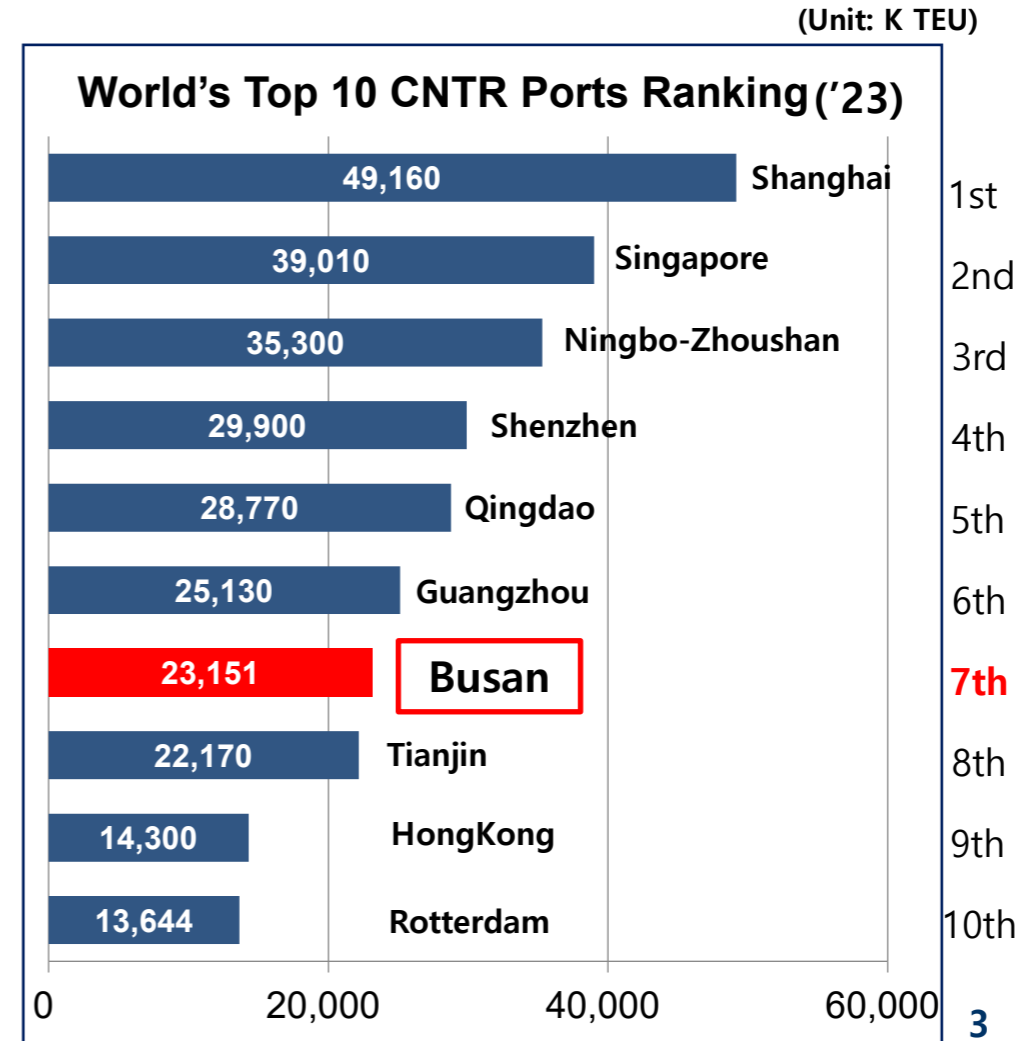
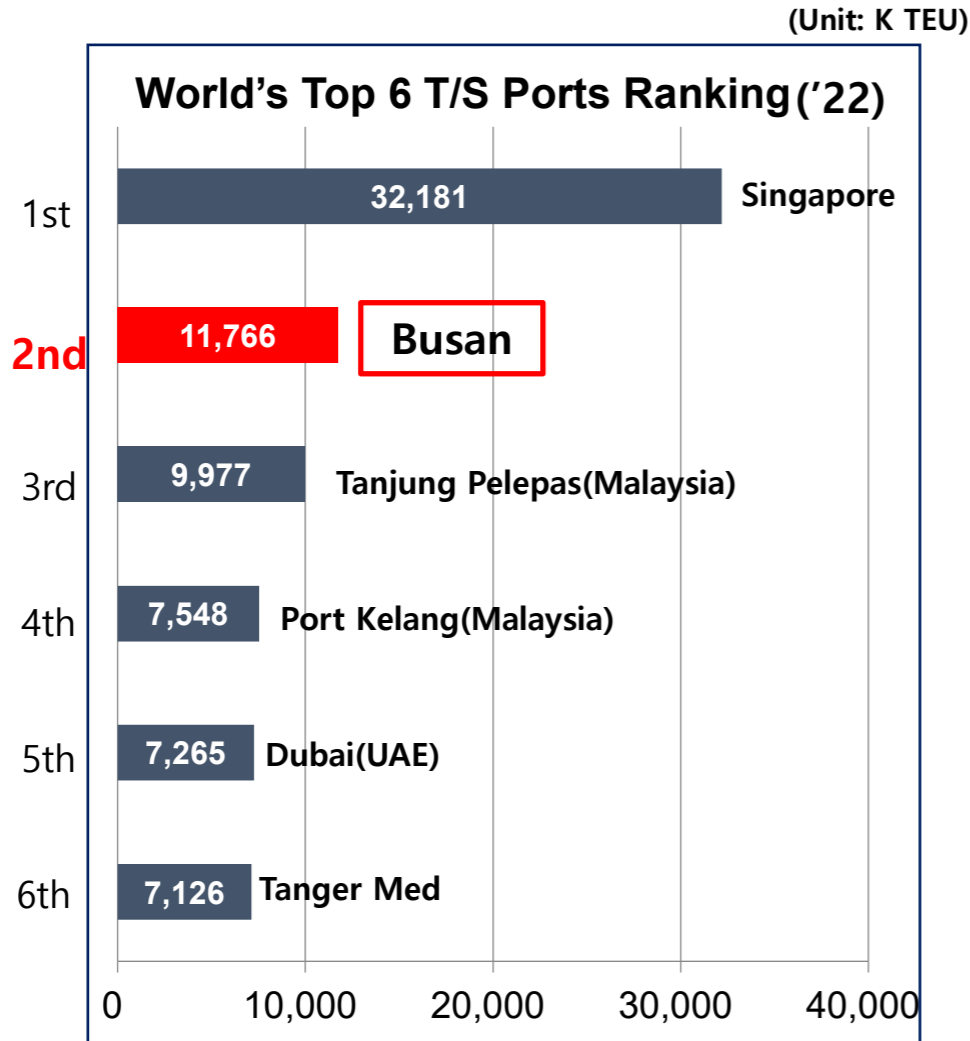


- Busan New Port opened in 2006
- Busan Northport Redevelopment Project started in 2008

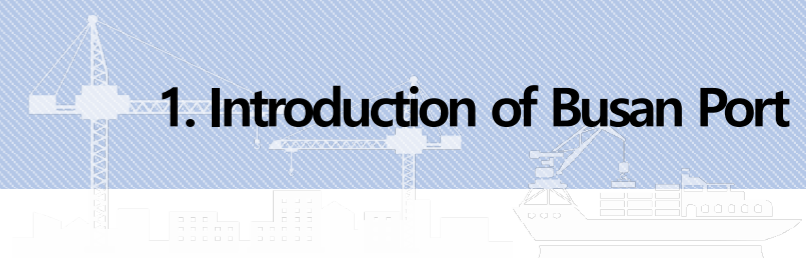
# Overview of Busan Port



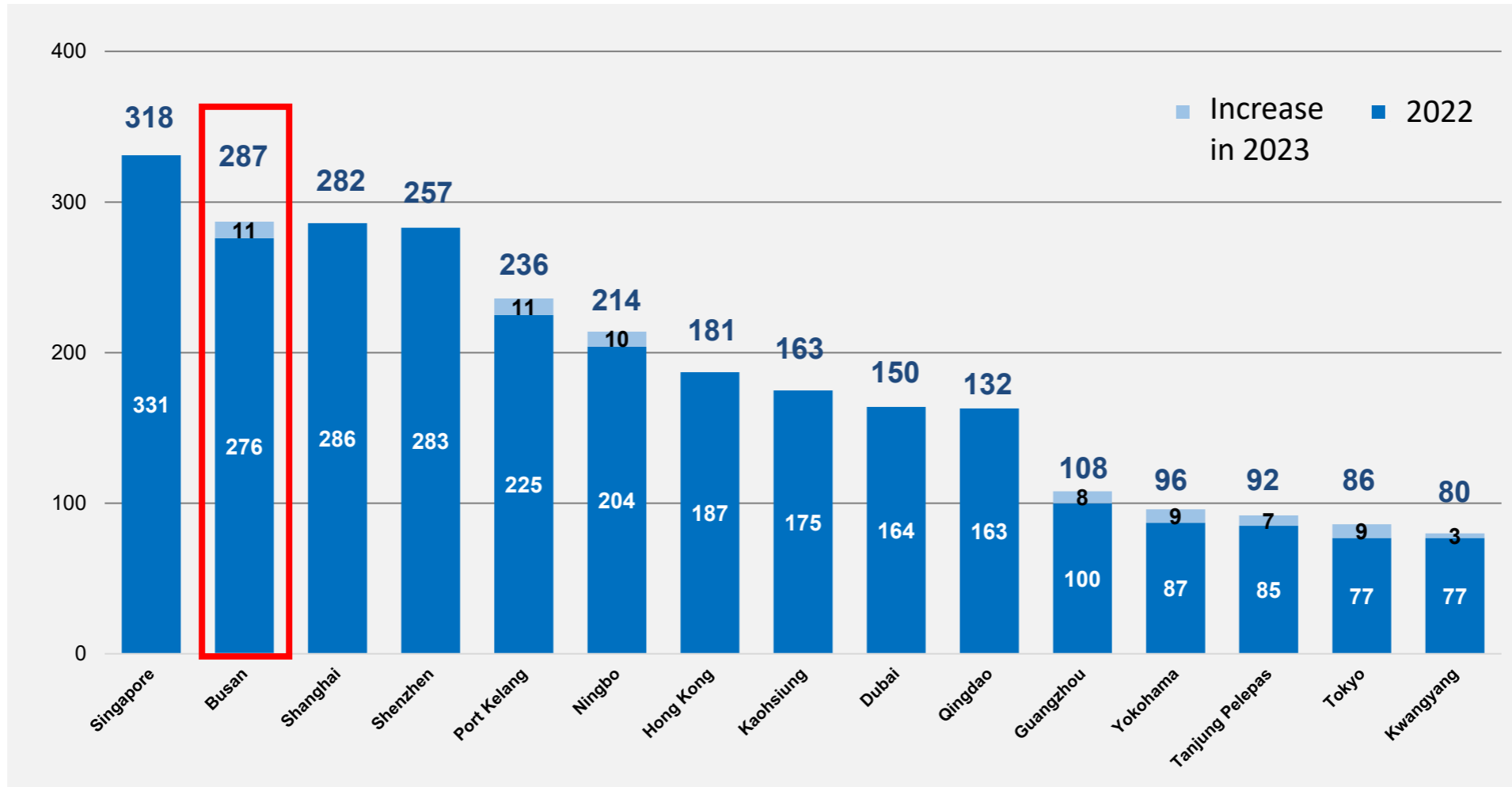
✓ The 2nd busiest T/S Port and 7th busiest Port in the world



# Busan Port's T/S Competitiveness



## ✓ Competitiveness of Busan Port – Port Connectivity



# Busan Port's T/S Competitiveness



## ✓ Competitiveness of Busan Port – Weather Condition



Perfect Weather Conditions  
Minimal Typhoon Impact  
and Sea Fog



For on Time Delivery for  
the carrier's customers



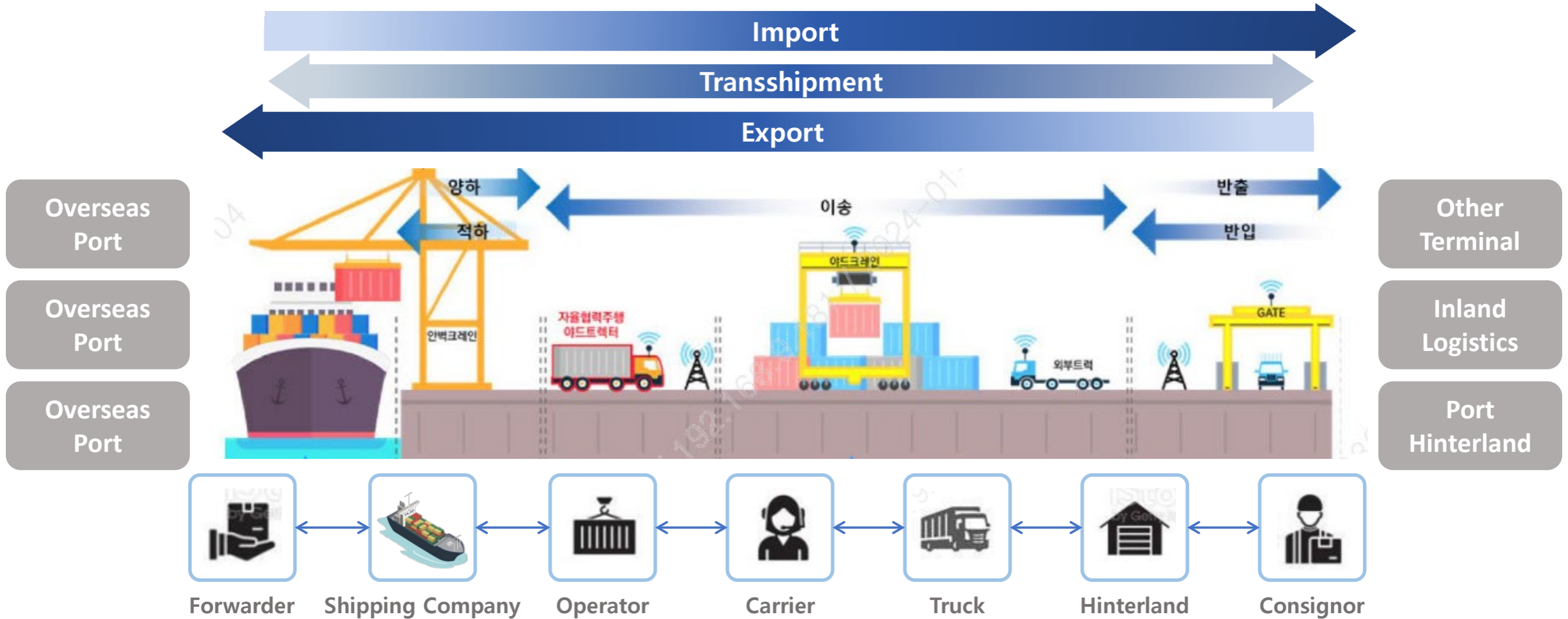
Best Transshipment Port

Busan  
Port

Major carriers use Busan for their China-origin US-bound T/S cargo during particularly foggy season.



- ✓ Ports serve as gateways for import and export, supporting the logistics activities of various stakeholders by distributing cargo, providing temporary storage, and transporting to final destinations.



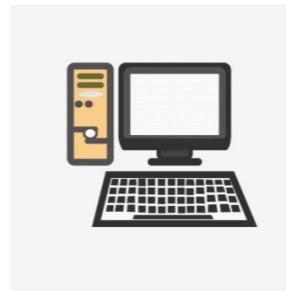
- ✓ Ports are an infrastructure-centric industry that requires large-scale investments and has a high dependency on systems



**Large-scale investment, infrastructure**



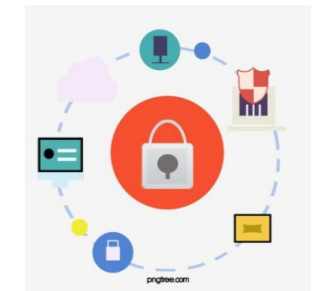
**Advanced equipment**



**Information System**



**Extensive network**



**Customs clearance and security**

- ✓ The port currently faces challenges such as global supply chain uncertainties, environmental regulations, and digital transformation.

### Increasing Uncertainty

#### Global economic and political instability

- Trade wars, economic sanctions, political conflicts
- Reorganization of shipping alliances and alternative routes

#### Global supply chain disruptions, increased unpredictability.

- Supply chain instability
- Difficulty in forecasting and planning
- Increase in logistics costs

### Global Environmental Regulations

#### Strengthening of environmental regulations

- Growing global demand for environmental protection
- Strict environmental regulations introduced by IMO and national governments

#### Increase in operating costs

- Increased costs for introducing eco-friendly equipment
- Installation and operating costs for emission reduction equipment

### Transition to Smart Ports

#### Demand for Smart Port Transformation

- Port Automation
- Data Integration and Connectivity
- Expansion of Port System Connectivity

#### AI Utilization Challenges in Smart Ports

- AI-based Facility Operation Automation
- Port Operation Forecasting and Optimization
- Port Security and Safety Management

- ✓ **Need for AI Utilization in Data Analysis and Forecasting, Port Operation Optimization, Environmental and Safety Security Management**

### 1 Data Analysis and Forecasting

Using AI to predict cargo volume variability and plan operations, helping to reduce uncertainty caused by international instability.

- Cargo Flow Analysis and Forecasting
- Ship Location and Arrival/Departure Time Prediction
- Developing Port Development and Operational Strategies through Data Analysis

### 2 Port Operation Optimization

Real-time monitoring of port operations optimizes resource allocation, improving operational efficiency.

- Berth and Yard Schedule Optimization
- Optimization of Automated Terminal Cranes and Autonomous Vehicles
- Port Data Integration for Overall Supply Chain Optimization

### 3 Environmental and Safety Security Management

Optimizing port operations reduces energy use and carbon emissions, while AI-based maintenance ensures efficient facility upkeep

- Real-time Monitoring of Energy Usage and Carbon Emissions
- AI-based Predictive Maintenance Considering Equipment Operation Status
- AI-powered Safety and Security Monitoring and Response Systems

### •Ports of LA and Long Beach Utilize AI for Ship Tracking and Navigation

#### 1 Vessel Traffic Service (VTS)

AI and advanced technologies manage safe and efficient vessel movement. They contribute to real-time location tracking, traffic congestion relief, and enhanced port safety.

#### 2 Precision Navigation

AI-based precision navigation systems support the safe approach and movement of large tankers in ports. They monitor vessel position and routes in real-time to provide optimal paths.

#### 3 Improved Operational Efficiency

The introduction of AI technology has significantly enhanced overall port operational efficiency and greatly aids in preventing safety incidents.



- ✓ **Port of Rotterdam Enhances Predictive Capabilities with Digital Twins and Implements AI Technologies for Maintenance**



### Digital Twin

Port of Rotterdam has adopted AI-driven digital twin technology to create digital replicas of all port assets. This technology optimizes port operations through real-time data analysis and predictive modeling.

### Predictive Maintenance

The AI-based predictive maintenance system forecasts the failure points of port machinery and equipment, allowing for preemptive action. This reduces unnecessary downtime and enhances operational efficiency.

### ✓ Port of Singapore Utilizes AI for Cargo Allocation and Processing Order, as Autonomous Vessel Operations



#### **AI-based Cargo Management System**

The Port of Singapore has implemented an AI-powered cargo management system to optimize cargo loading and unloading processes. This system uses AI algorithms to determine the optimal cargo placement and processing sequence, maximizing operational efficiency.

#### **Autonomous Vessels**

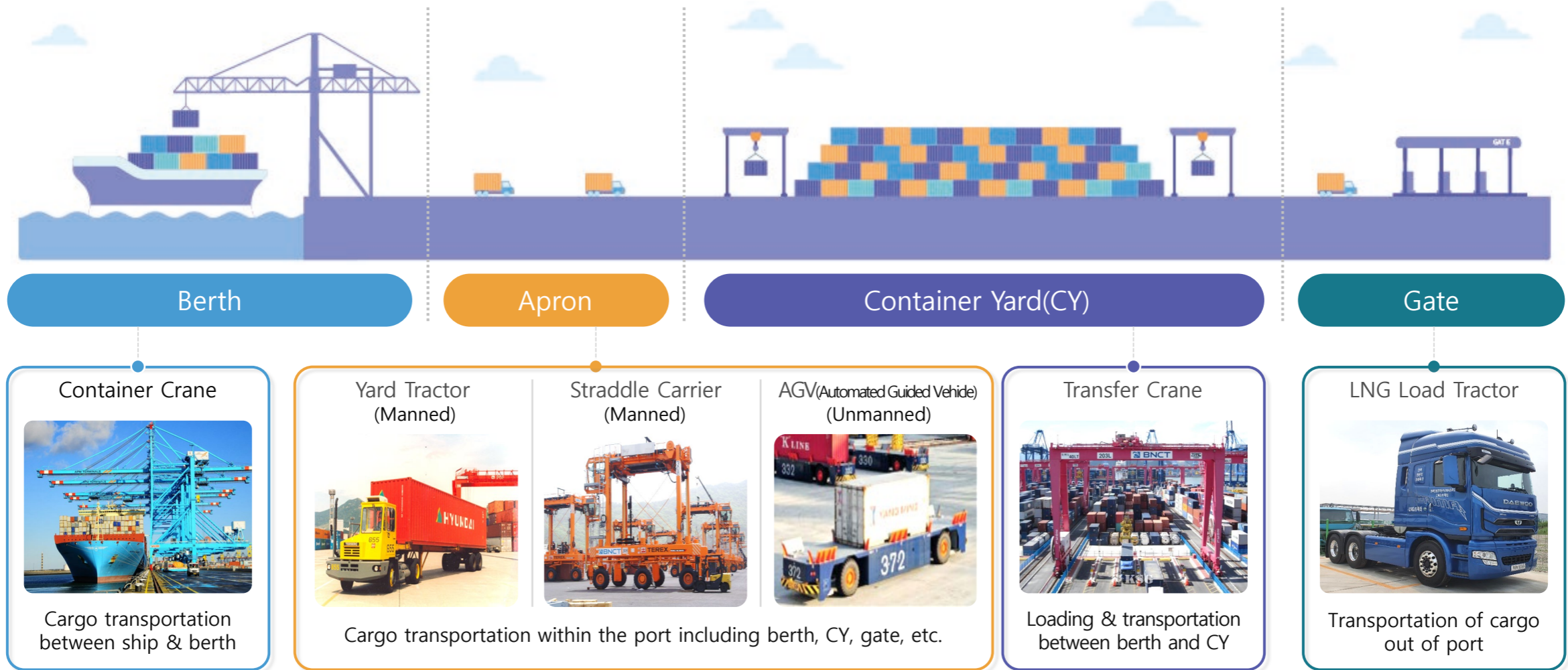
The Port of Singapore is testing autonomous vessel technology, using AI to enable ships to plan their own routes and navigate safely within the port. This helps reduce human error and enhances port safety.

#### **Smart Port Initiative**

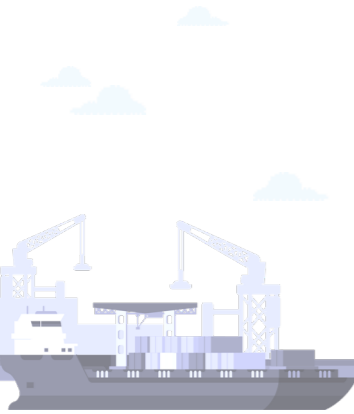

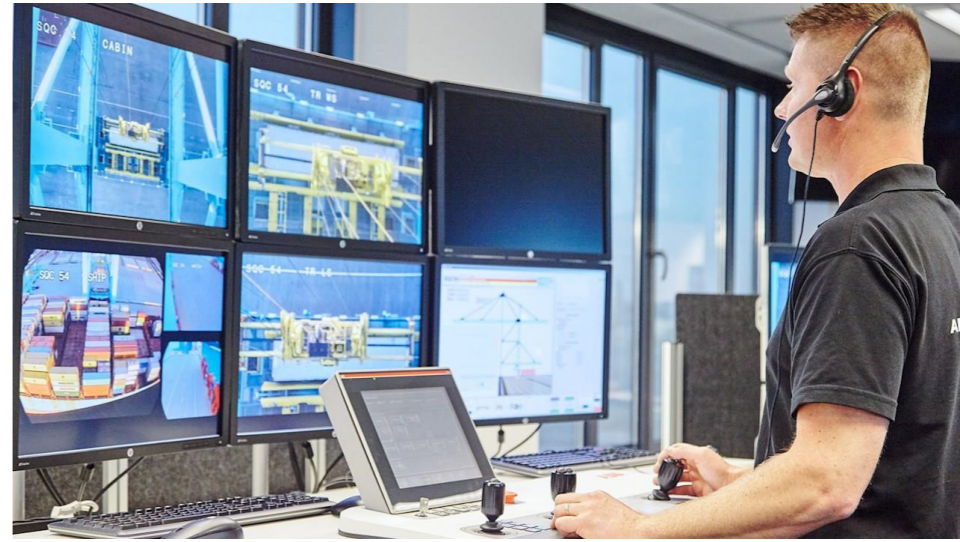
Singapore is advancing the digitalization and automation of its entire port operations through an AI-driven Smart Port initiative, thereby strengthening its global competitiveness.



- ✓ Busan Port opened a fully automated terminal in April 2024, utilizing AI for the operation of unmanned cranes, AGVs, and other equipment.

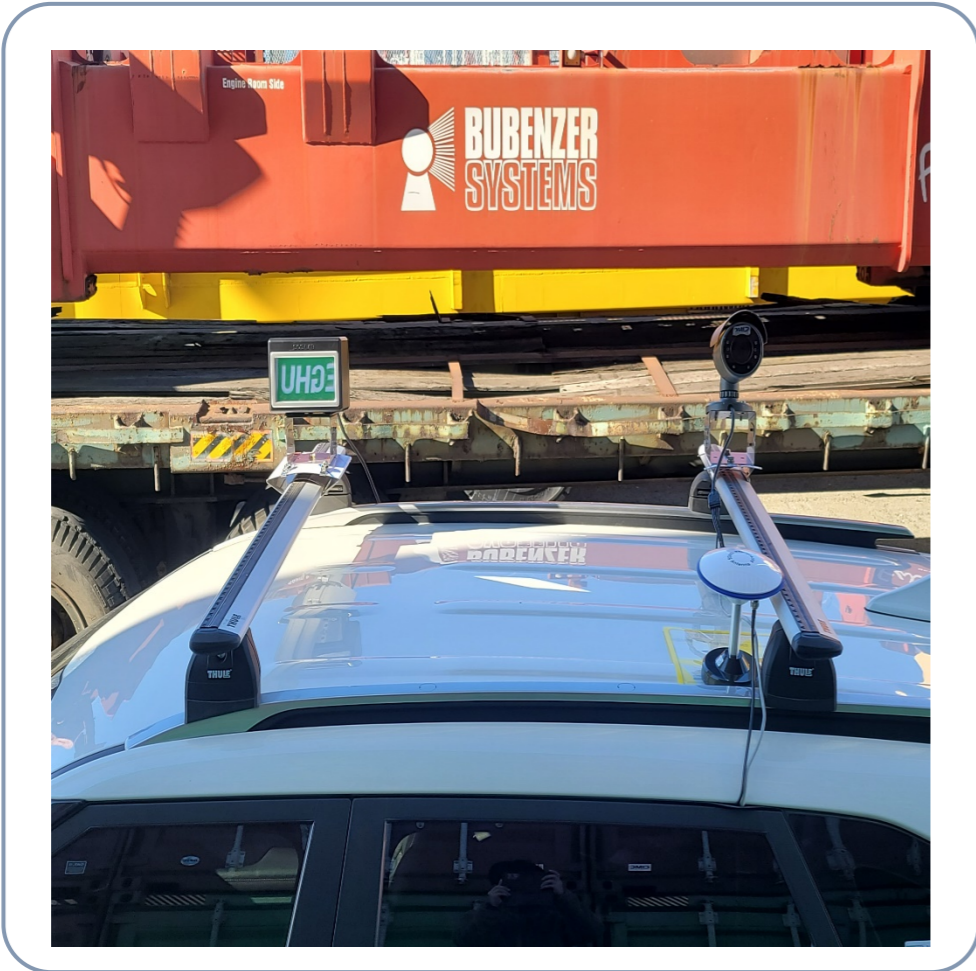




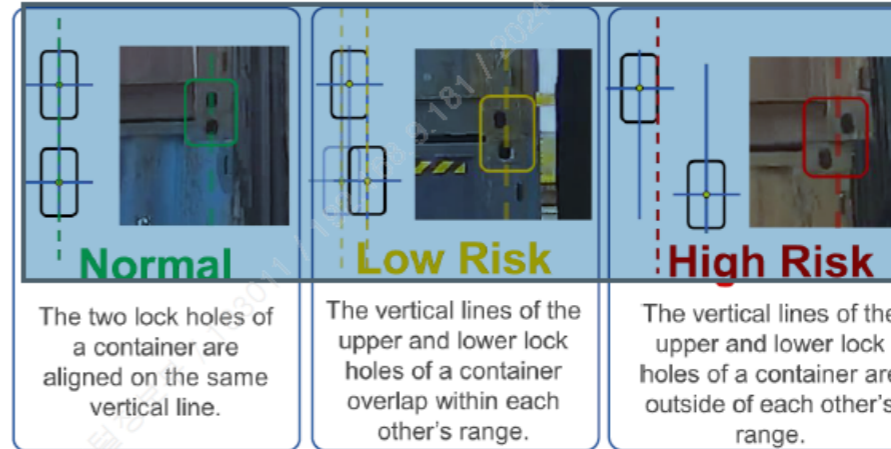
| Category  | Existing CNTR Terminal  | Fully Automated CNTR Terminal   |
|---|---|---|
|  |   |    |
| Operation   | by man<br>(container crane, yard tractor, etc.)   | remote or automatic   |
| Working Environment   | <ul style="list-style-type: none"> <li>✓ Vibration &amp; noise, exhaust gases and sunlight</li> <li>✓ Keeping eyes on the downside</li> <li>✓ by skilled workers, resulting in differences in productivity</li> </ul> | <ul style="list-style-type: none"> <li>✓ Quite and comfortable office work</li> <li>✓ Can become proficient quickly</li> <li>✓ Efficient movement by using 3D scanner and camera</li> </ul> |

### ✓ Container Alignment Status Monitoring

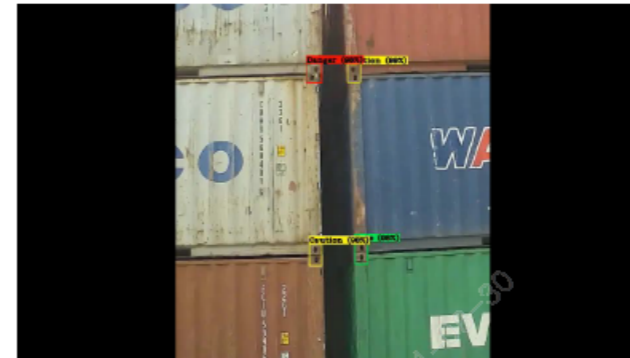
Collecting data by Intelligent CCTVs and lidar sensors



Classifying the stacking conditions as 'Normal', 'Low Risk', 'High Risk' by using AI

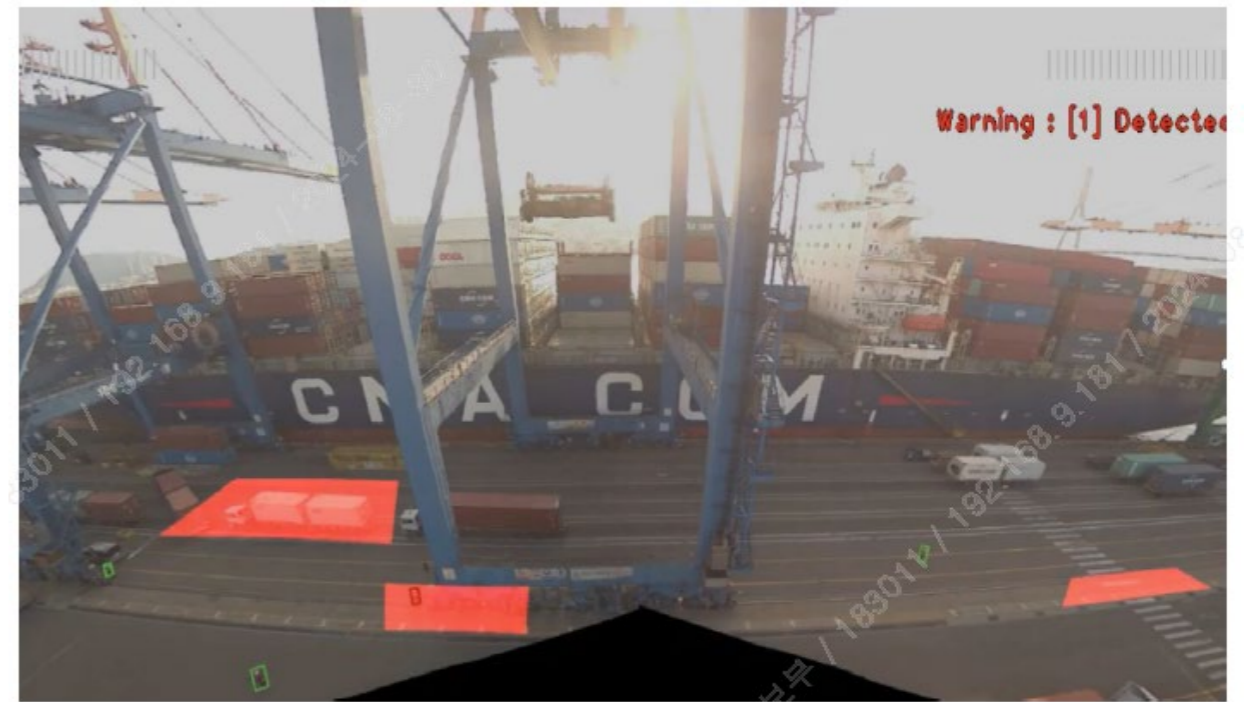
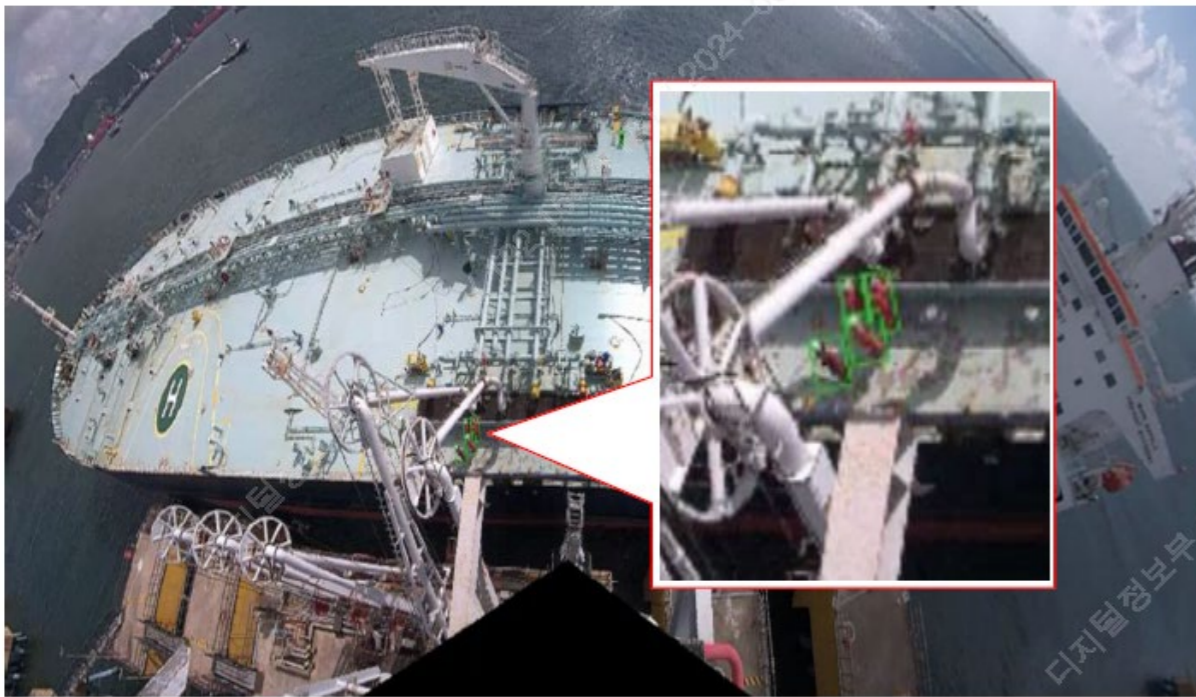


- Labeling to classify the alignment status based on three criteria for constructing a dataset of collected data



### ✓ Abnormal Behavior Identification and Reporting Technology

- Preventing safety incidents at the terminals using an AI-based monitoring system
- Detecting unusual behaviors of workers and machinery in apron area
- When workers or machinery enter the 'Red Zone' an alarm sounds as warning

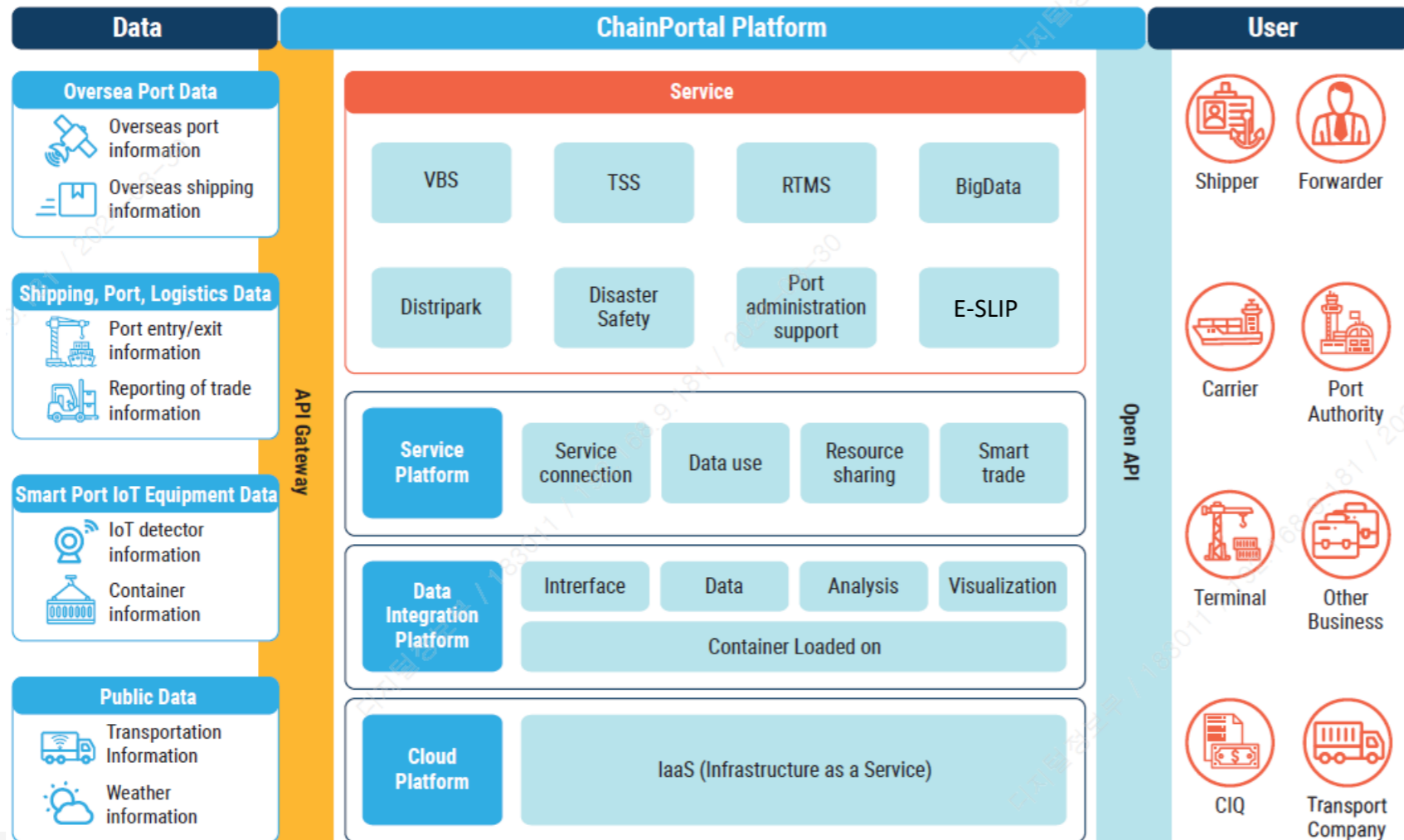


# AI Implementation Plans for Busan Port

## 5. Future Plans

- ✓ Busan Port plans to apply AI to its Port Community System (PCS), known as Chain-Portal, to enhance the overall operational efficiency of the port.

Describes the service architecture of Chain Portal platform



### ▪ Busan Port Chain-Portal System

- Over 17,000 users are utilizing
- Real-time operational data integration has been completed
- VBS, TSS, IIS, E-SLIP Services

### ▪ Future plans for AI application to enhance the system

- Optimization of planning processes
- Improvement in prediction accuracy
- Monitoring of operational status and detection of anomalies

- ✓ Busan Port is implementing a digital twin across the entire port to enhance operational visualization and optimization through AI application.
  - The digital twin for one terminal is complete, and operational effectiveness has been verified through simulations.
  - There are plans to expand the digital twin to cover the entire Busan Port in the future.
  - The application of the digital twin and AI will be used to optimize port operation.

