BREAKBULK AMERICAS

Smart Ports: The Advantages of Artificial Intelligence

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Abstract

Lack of artificial intelligence has dampened the true potential of maximizing the outputs of port industries. In this research, students will showcase the benefits of using AI to evolve areas of delayed operations through congestion, accidents that put personnel and equipment at risk, and operational planning inefficiencies. Furthermore, this research aims to not only inform but also help spread this innovated technology into other realms of the supply chain industry by providing real world examples of how this is clearly for the better. AI holds significant potential and can serve an important role in advancement for the future.
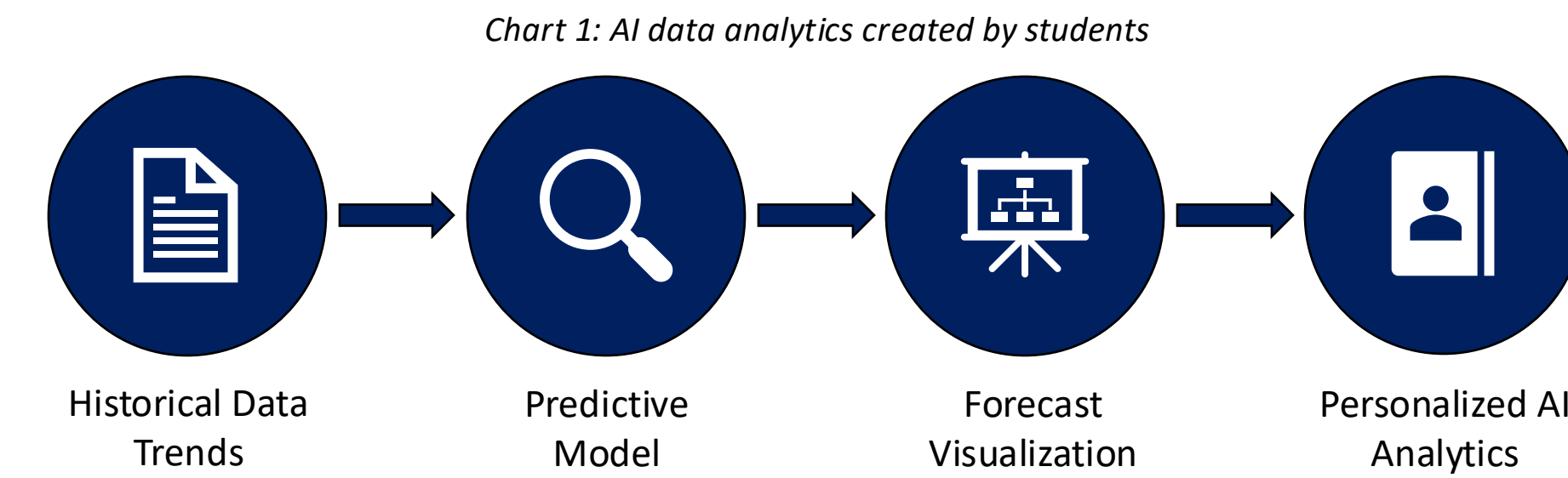
Methodology

With the first step of the research, we started by understanding what AI means and its benefits. The UH library database was used to search for peer-reviewed academic journal articles that explained essential theories and broader perspectives. Additionally, Google search was used for supplementary information such as recent news and articles from reliable websites. Multiple studies on the Tianjin and Haiphong Port were used to relate the topic to practical application. To this end, other individual and nonacademic websites provided insights to crucial information. Without these resources, the project would have lacked an actual dimension because accurate and reliable information were brought together.
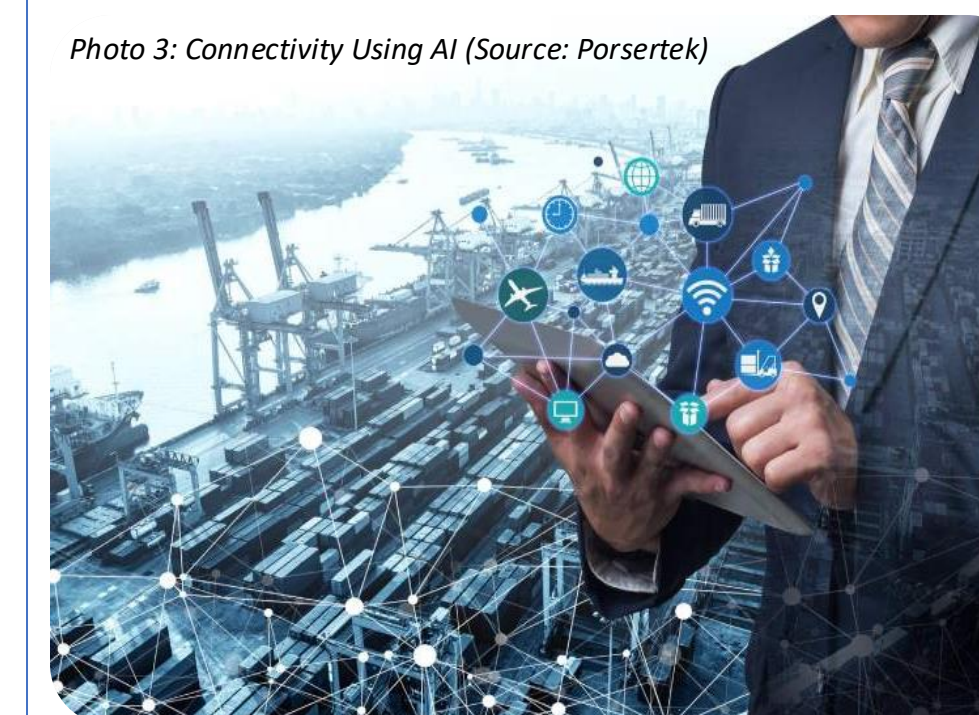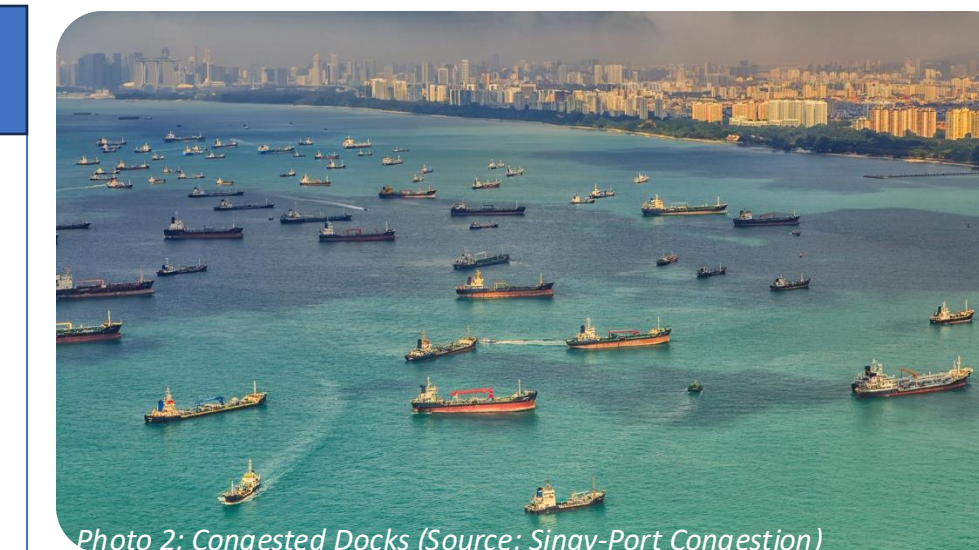

Photo 1: Tianjin Port (Source: Port Technology)
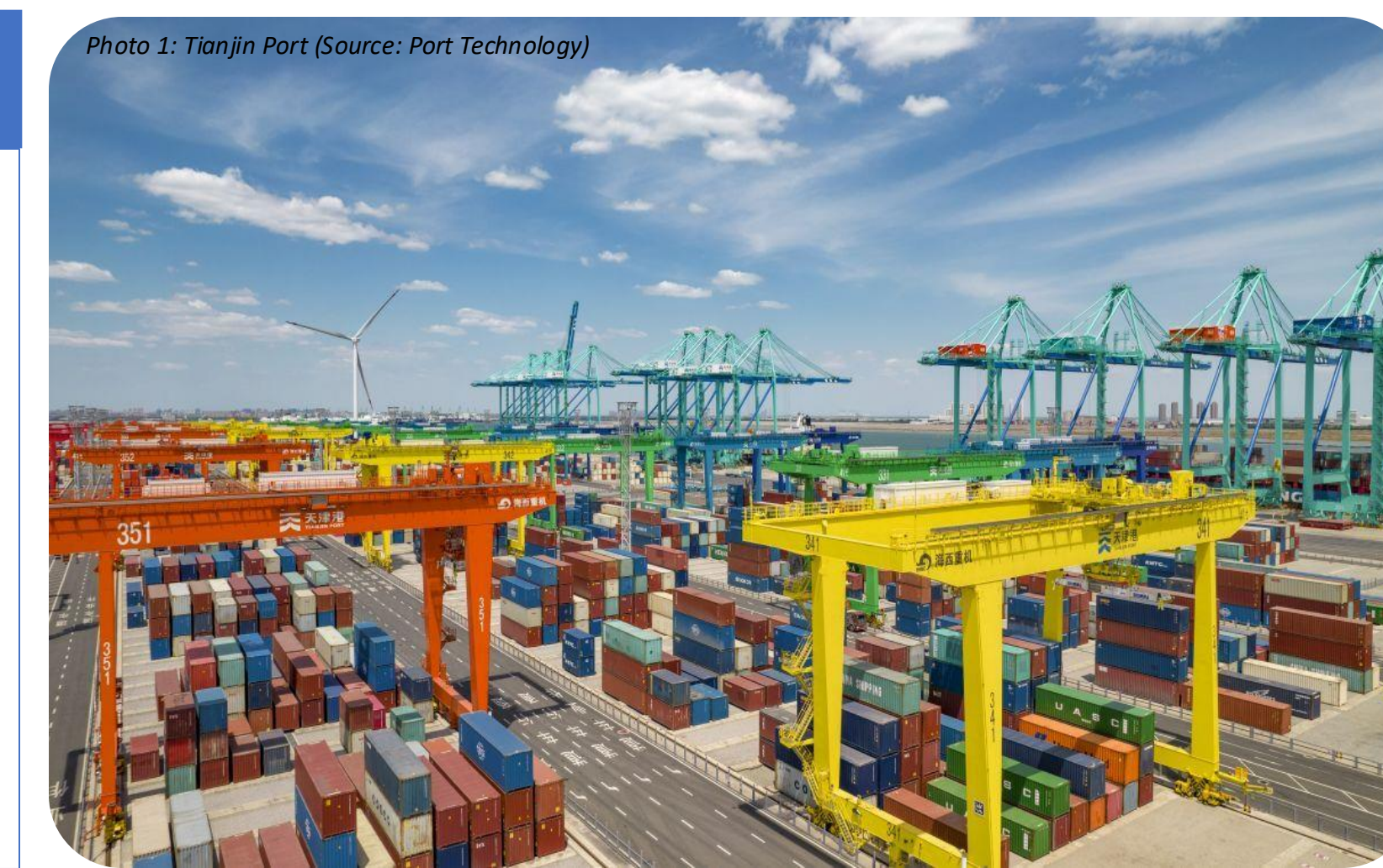
Smart Ports

In a fast-paced globalized economic world that we live in, technological innovation has modernized the way we implement and conduct the movement of goods and services in the supply chain and logistics industry. However, automated equipment in ports is growing, but still relatively rare. Less than 5% of over 1,300 container terminals around the world have some degree of automation of handling equipment (Davidson, 2024). The reason AI is relatively rare is the fact that ports and shipping companies are characterized by high levels of invested capital, with most assets in the yards having long operational lifespans (Hadland, 2024). Unless AI is retrofitted to assets already in use, the majority will wait for the lifespan to run out.
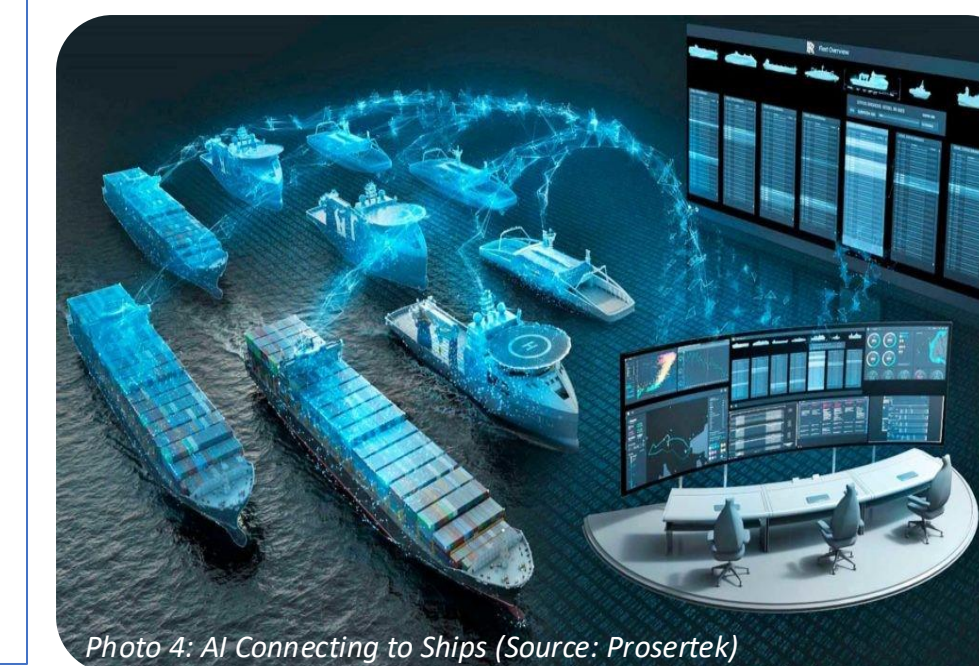

Chart 1: AI data analytics created by students

Historical Data Trends → Predictive Model → Forecast Visualization → Personalized AI Analytics

Tianjin Port

- China's Tianjin port ranked among the top 10 largest ports in the world and became the first intelligent zero carbon terminal. While trading with over 800 ports in 200 different countries and handling over 20 million container per year (Arnold, 2023).
- Smart terminals being able to run multiple scenarios considering clearance and pick up times based on who the receiver is increase efficiency of a single crane by +40% while reducing cost of labor by 60% (Xinhua, 2024).

Photo 2: Congested Docks (Source: Sinay-Port Congestion)

Photo 3: Connectivity Using AI (Source: Porsertek)

↑ Efficiency up +40%

↓ Cost of labor down 60%

Chart 2: Port Workers created by students. Information from (Xinhua, 2024).
■ Tianjin port workers
■ Traditional port workers

Terminal operates with just 200 workers compared to a traditional one without AI implemented

- Over 70 driverless vehicles make up one of the largest AI controlled fleets in the world. These electric powered vehicles make routing decisions and avoid obstacles based on data from sensors around the yards while controlling their own charging schedules (Arnold, 2023).
  - 0 injuries since introduced.
- Developers produced a system called "Huawei Cloud OptVerse AI Solver" which automatically intakes data and analyses trillions of combinations for operational planning. This system alone accelerates planning from 24 hours to just 10 minutes (Huawei Cloud Computing Tech. Co., 2024).

Photo 4: AI Connecting to Ships (Source: Prosertek)

Without AI	With AI
Congestion	In a case study of Haiphong Port located in Vietnam, the use of AI plays an important role in dealing with congestion and turnaround times. Data is collected and then AI can quickly process the data, make better estimates on accuracy of vessel arrival and departure times and provide more frequent and accurate forecasting compared to the traditional manual process. In turn, this improves efficiency and optimizes resources (Dinh, Nguyen, Pham, 2024).
Accidents	The most important things to keep safe in this field of work are the personnel, equipment and vessels. All commercial ports rely on maritime pilots to navigate, and AI is a tool that supports their decision-making processes by being able to factor in multiple and changing variables such as weather to enhance safety.

Conclusion

The implementation of AI has the potential to revolutionize port and shipping operations by optimizing time management. Through this, waiting times have been reduced while alleviating congestion throughout the port. The increased uptake of AI tools and technologies will support ongoing and incremental gains in efficiency and safety standards while mitigating workplace injuries. Studies drawn from Tianjin and Haiphong Port have shown and proven through the years the many advantages this tool provides. In the coming years operational lifetimes of assets will diminish, and ports will have a very important question to ask themselves, why would we not use AI?

References

Photo 5: Smart Port (Source: Huaweicloud)

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