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An Analytic Hierarchy Process-based Survey to Investigate the Impact of Terminals' Service Attributes on Attracting Shipping Lines



INTRODUCTION

Introduction

- Shipping is the lifeblood of the world economy.
- About 80% of world trade volume transported through sea, which makes ports and their hinterlands vital for global trade.



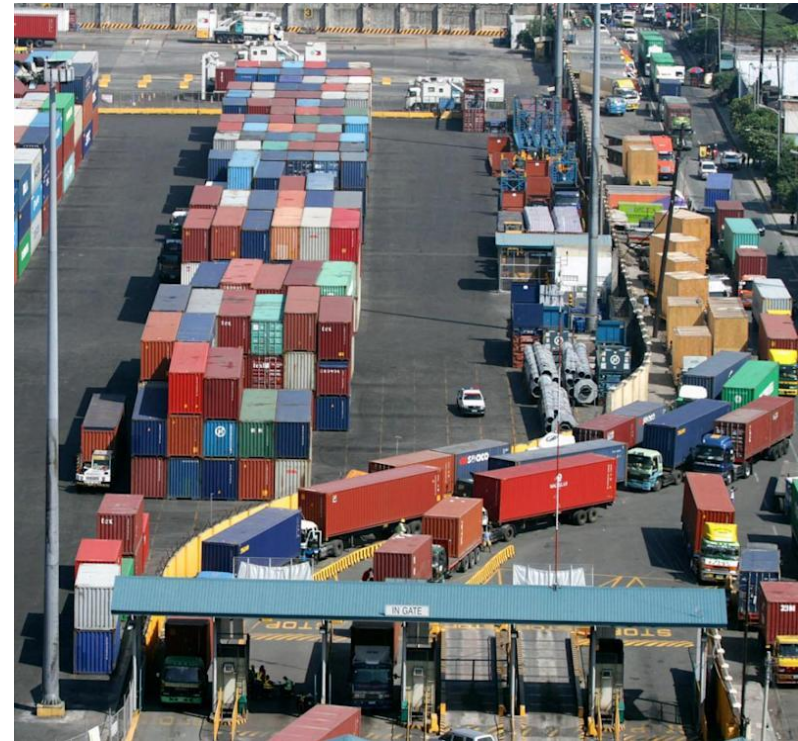
Introduction

- Decision-makers worldwide tend to believe that **supply-driven policies** through investing in mega infrastructure projects result in attracting more shipping lines to their ports.



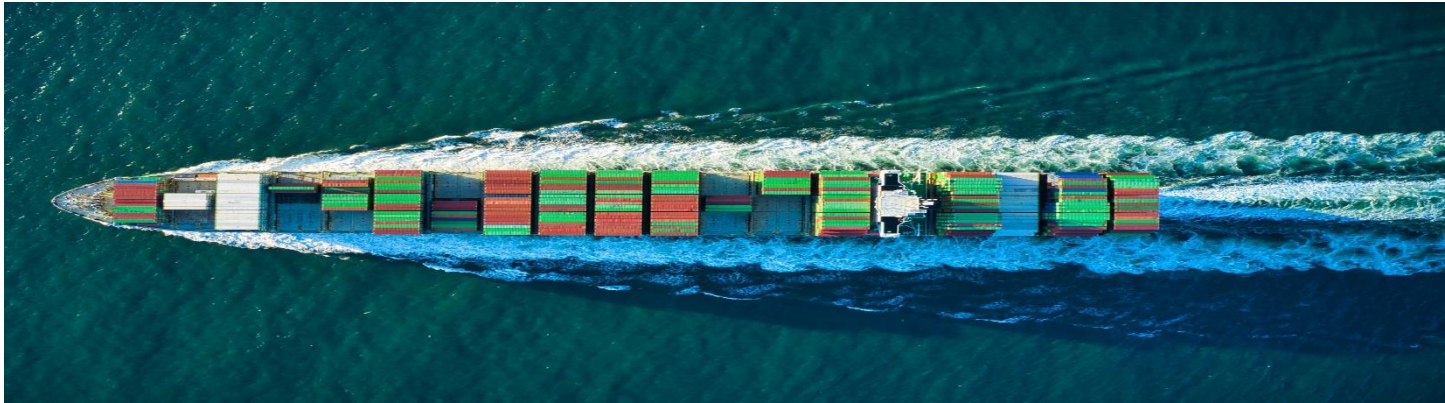
Introduction

- The development of transport infrastructure can lead sometimes to system imbalances when such infrastructure investments do not pay back efficiently the costs that are spent on them.



Introduction

- It is important to understand the behavior of shippers and the preferences of liners, which opens the way to ask the question:



What are the important factors that attract liners to a specific port/terminal?

Introduction

- To contribute to this research question, an AHP-based survey was designed and used to gather information on:
 - Stakeholders' (e.g. shipping lines, cargo owners, and terminal operators) **opinions** and **service attributes** (e.g. adequacy of port facilities, port dues, and turnaround time), using **online questionnaires** and **in-person interviews**.



Google Forms

Introduction

- The questionnaires were distributed among a representative sample of the national container companies operating under the supervision of the Holding Company for Maritime and Land Transport (HCMLT).



شركة دمياط لتداول الحاويات
و البضائع





RESEARCH METHODOLOGY

Research Methodology

- Analytic Hierarchy Process (AHP) is a structured technique for organizing and analyzing complex decisions based on mathematics and psychology;
- It divides different choices into groups and manages them into hierarchies;
- The AHP method is used to convert experts, researchers, and scholars' personal opinions into objective measures.

Research Methodology

To apply the AHP method, six steps were followed:

1. Decide a list of factors and sub-factors from literature reviews and expert opinion sessions;
2. Draw the hierarchical structure by deciding the main factors and sub-factors;
3. Establish the pairwise comparison;
4. Create comparison matrices;
5. Calculate the consistency ratio for both matrices;
6. Find the weights for each variable and decide which variables have higher priority.

Research Methodology

1. Establishing a list of factors

- A comprehensive literature review was conducted through various research papers and studies;
- Expert's opinion sessions were conducted through multiple meetings with different port users.

Research Methodology

1. Establishing a list of factors

- The selected factors/sub-factors took into consideration the World Port Sustainability Program (WPSP) which attains the United Nations sustainable development goals through six themes.



	Digitalization
	Infrastructure
	Health Safety and Security
	Environmental care
	Community building
	Climate and Energy

Research Methodology

1. *Establishing a list of factors*

- Each theme has a representative factor in this study to measure the acceptance of the Egyptian market to these factors and to direct decision-makers to which theme they must give a priority to start a sustainability project and invest in this topic.



Digitalization



Infrastructure



**Health Safety
and Security**



**Environmental
care**



**Community
building**



**Climate and
Energy**

Research Methodology

1. Establishing a list of factors

- The list of factors reached nine main factors and 36 sub-factors, which have undergone another round of elimination to reach the final list of **6** main factors and **19** sub-factors.

2. Draw the hierarchical structure:



Research Methodology

3. *Establishing the pairwise comparisons:*

- The scale used in the AHP method is a nominal nine-point scale starting with “Equal importance,” which is represented by the number 1, and ending with “Extreme importance,” which is represented by the number 9.

Evaluation Scale	Definition
1	Equal Important
2	Weak or slight
3	Moderate importance
4	Moderate plus
5	Strong importance
6	Strong plus
7	Very strong
8	Very, very strong
9	Extreme Importance

Research Methodology

3. Establishing the pairwise comparisons:

- The next table represents a sample for the comparison tables representing a pairwise comparison between factors.

ID	Factor	AHP SCALE																	Factor
1.	Factor 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Factor 2
2.	Factor 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Factor 3
3.	Factor 1	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Factor 4
4.	Factor 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Factor 3
5.	Factor 2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Factor 4
6.	Factor 3	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Factor 4

Research Methodology

3. Establishing the pairwise comparisons:

- Data was collected using online questionnaires and in-person interviews;
- There were multiple forms for the questionnaire :online google form, editable PDF form and paper form were used rarely to minimize paper waste;
- All forms were available in both languages Arabic and English.

Question 1: Which of the following factors is important than the other in attracting you to choose a port/container terminal of call?



Port Infrastructure



Cost/Port Charges

Clear selection

Based on your previous choice, please indicate the level of importance of your chosen factor relative to the unchosen one using the following 9-point Likert scale. *

1 2 3 4 5 6 7 8 9

Equal Importance Extreme Importance

Research Methodology

- **Pilot Survey Experiment**
- Before launching the final version of the survey, a pilot survey was applied over a group of researchers and experts;
- Outcomes of this pilot test, were helpful to collect opinions and recommendations to update the survey.



DATA ANALYSIS AND RESULTS

Data Analysis and Results

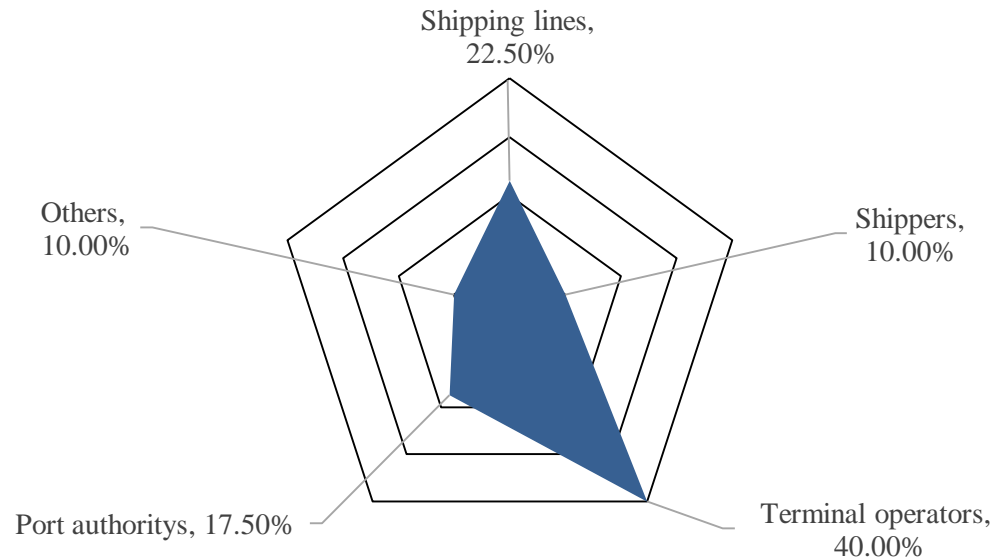
Sample size:

- The surveys were distributed and sent to 50 respondents;
- Each survey was analyzed and tested individually.

Data Analysis and Results

Sample size:

- Only 45 responses were received back, and after the analysis stage, five responses were incomplete and inconsistent, so these answers were eliminated. Final sample size is 40 responses divided as follow.

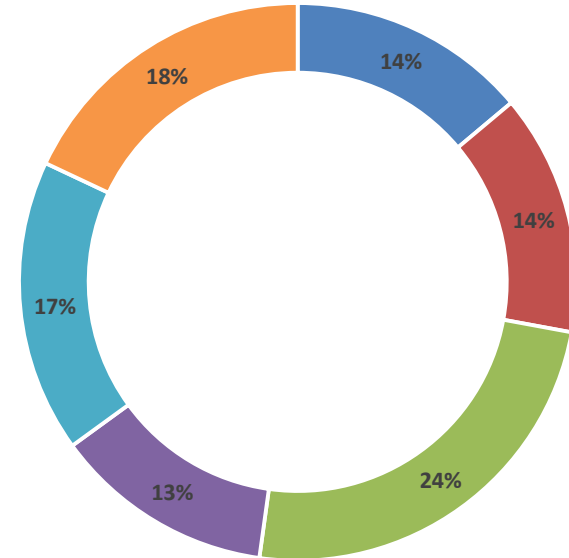


Data Analysis and Results

Relative weight of main factors for the 40 respondent

Port Characteristics	Priority	Rank
Port Infrastructure	14%	5
Cost/Port Charges	14%	4
Port Efficiency	24%	1
Connectivity	13%	6
Information Technology	17%	3
Safety and Security	18%	2

Main Criterion weights

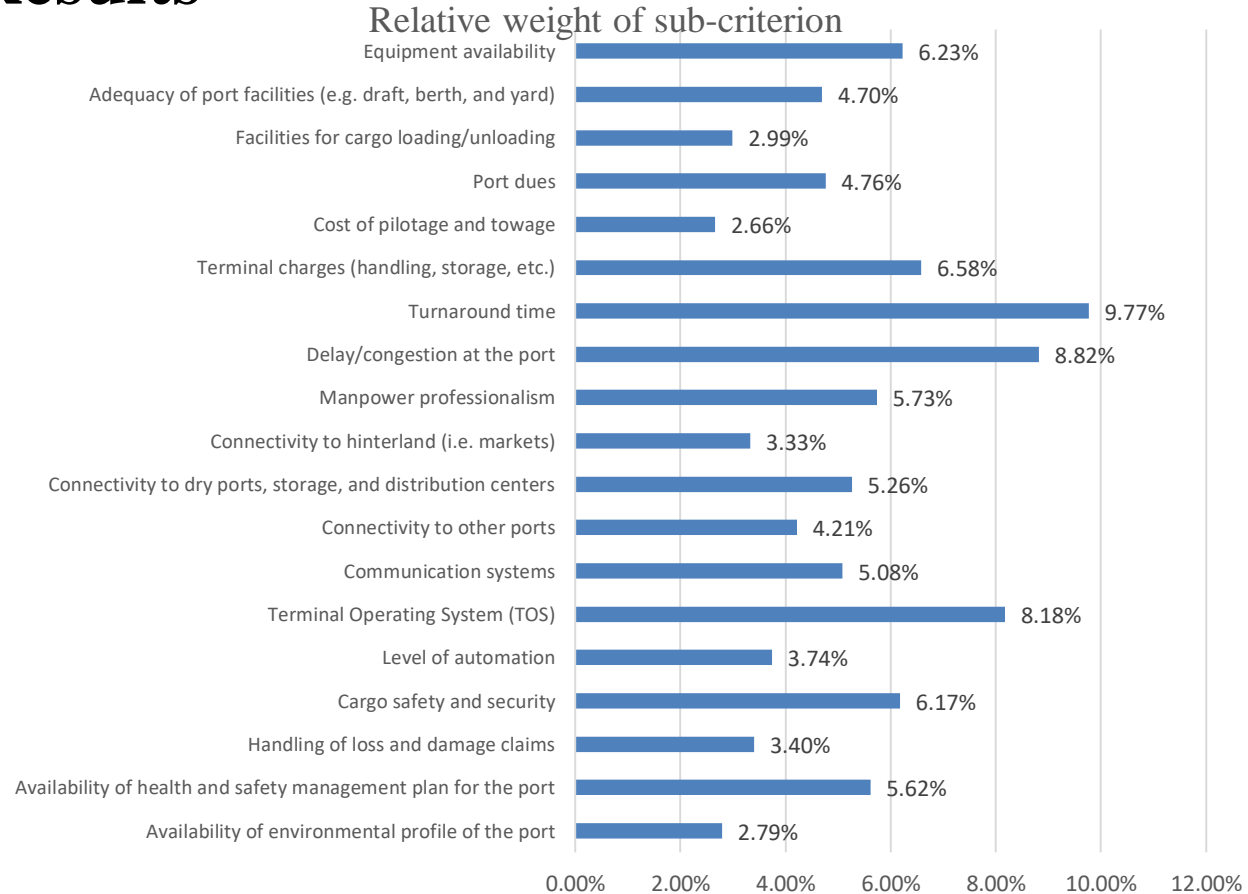


- Port Infrastructure
- Cost/Port Charges
- Port Efficiency
- Connectivity
- Information Technology
- Safety and Security

Data Analysis and Results

Relative weight of sub-criteria for the 40 respondent

- “Turnaround time” came first in the arrangement with almost 10%, followed by connectivity to other ports and communication systems;
- While factors like “port dues” and “Adequacy of port facilities” came last in the arrangement.



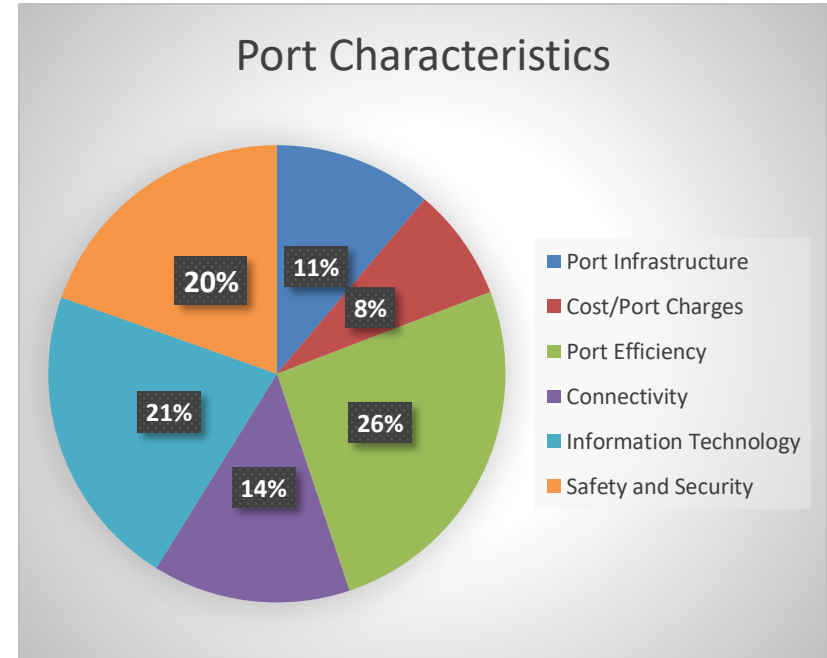
DATA ANALYSIS OF DIFFERENT GROUPS

- The study put a higher importance on creating a comparison between **Decision-makers** (port authorities and terminal operators), and **Port users** (shippers, shipping lines, and others (researchers, scholars, and other partners deal with shipping and port services));
- To discover the gap between those teams if it exists;
- Different perspectives helps in avoiding any bias in results to one side over the other side.

DATA ANALYSIS OF DIFFERENT GROUPS

Shipping lines

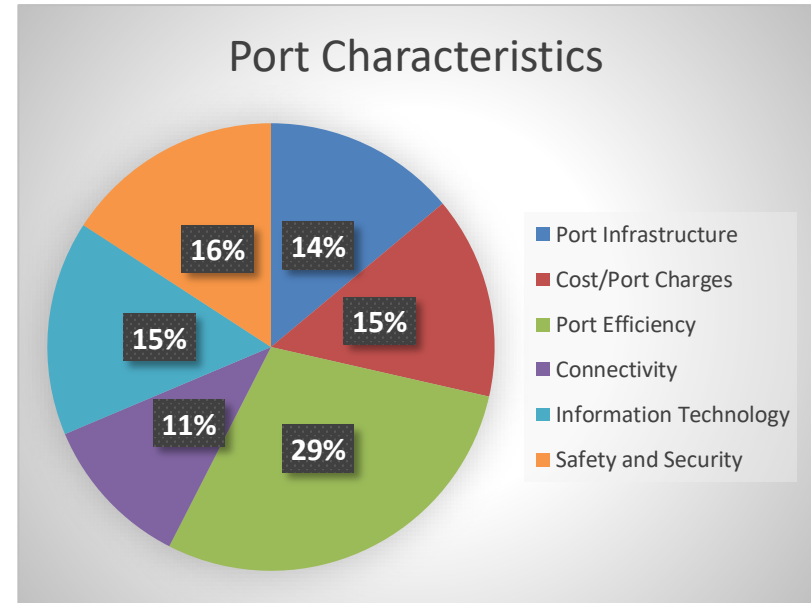
Port Characteristics	Priority	Rank
Port Infrastructure	11.2%	5
Cost/Port Charges	8.0%	6
Port Efficiency	25.7%	1
Connectivity	14.0%	4
Information Technology	21.6%	2
Safety and Security	19.6%	3



DATA ANALYSIS OF DIFFERENT GROUPS

Port authority's

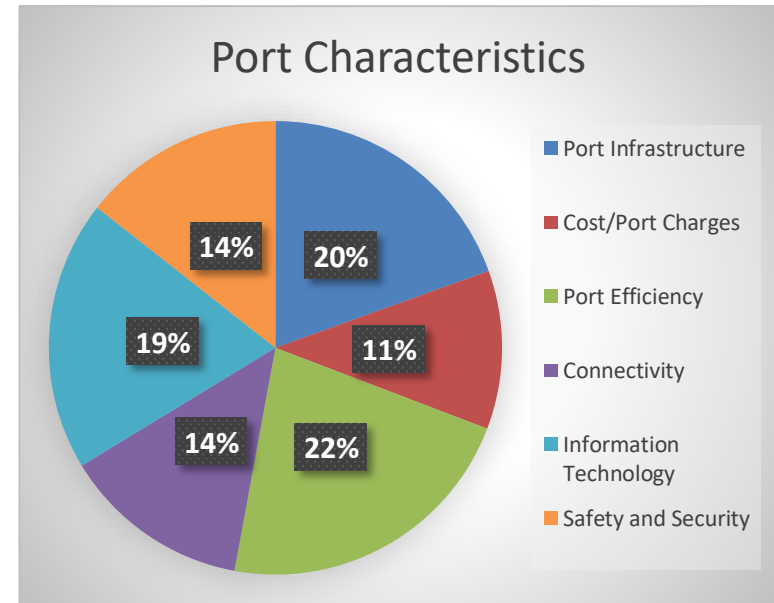
Port Characteristics	Priority	Rank
Port Infrastructure	13.9%	5
Cost/Port Charges	14.6%	4
Port Efficiency	28.9%	1
Connectivity	11.1%	6
Information Technology	15.5%	3
Safety and Security	15.8%	2



DATA ANALYSIS OF DIFFERENT GROUPS

Terminal operators

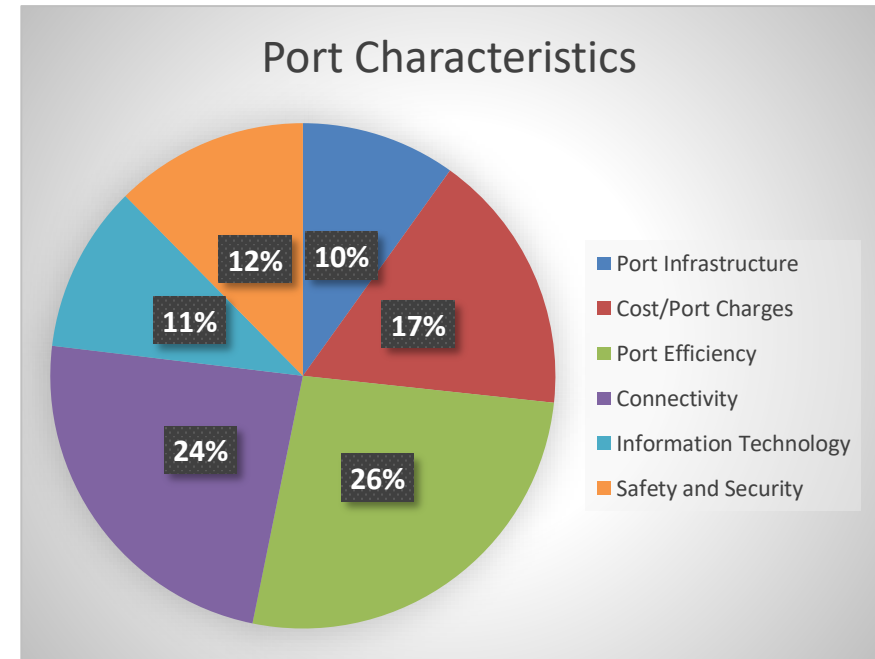
Port Characteristics	Priority	Rank
Port Infrastructure	19.5%	2
Cost/Port Charges	11.3%	6
Port Efficiency	22.1%	1
Connectivity	13.4%	5
Information Technology	19.3%	3
Safety and Security	14.4%	4



DATA ANALYSIS OF DIFFERENT GROUPS

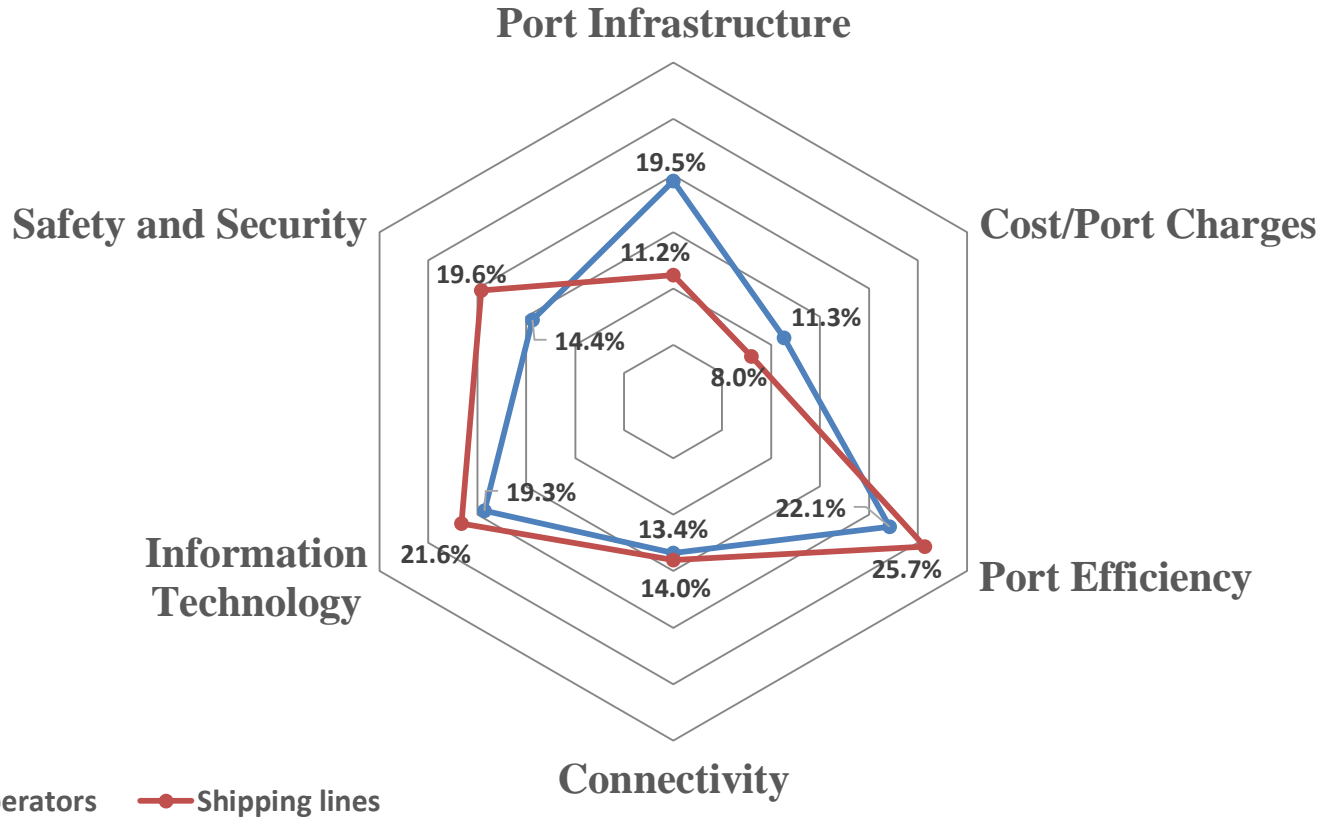
Shippers

Port Characteristics	Priority	Rank
Port Infrastructure	9.9%	6
Cost/Port Charges	16.8%	3
Port Efficiency	26.5%	1
Connectivity	23.7%	2
Information Technology	10.7%	5
Safety and Security	12.4%	4



DATA ANALYSIS OF DIFFERENT GROUPS

Comparing Shipping lines with port terminals





CONCLUSIONS & RECOMMENDATIONS

CONCLUSIONS

- It was believed that supply-driven policies and reduction of various cost elements will be the dominating factors.
- However, the aggregated results showed that “Port Efficiency” has the highest priority with 24%, which represents the time consumed in the port, and the congestion in the ports;
- The highest two factors in the sub-factors were “turnaround time” and “congestion at the port”.

CONCLUSIONS

- Decision-makers need to start thinking from a new perspective to find resilient solutions to congestion, using incentives and disincentives to attract shippers to ports that have lower traffic and to reduce the congestion in congested ports.
- The second main factor was safety and security, which indicates that port users, after the pandemic, started to think in a different way regarding the importance of health in the port community, and more automated ports with less human interference.

CONCLUSIONS

- In the comparison between decision-makers and port users, the data gave hope that the future of port planning may have a better improvement because the preferable factors for both teams were close to each other both teams gave the highest priority to “port efficiency” and “information technology”.
- Such results indicates that the future of the Egyptian port terminals will have higher trading rates, as long the decision-makers are aware of market preferable changes.

RECOMMENDATIONS

- Decision-makers have to focus on projects that support the following themes from the WPSP list: Digitalization and Health Safety and Security;
- To solve the issue of port congestion, there is a need for integrated communication system between the Egyptian ports to keep a balance in the trading rates for each port, by shifting trips to a less congested port.

RECOMMENDATIONS

- Provide training for sectors managers and workers regarding the new planning strategies like Agile and Lean management methodologies;
- Assess the existing condition of port facilities and port environment;
- Manage the available resources to have the optimum benefits from it,
- Set equipment maintenance plan to reduces idle hours,
- Set safety and security plan to avoid accidents, fatalities, wasted time and huge compensations.

Thank You