C M S   R E S E A R C H   U P D A T E S

NOVEMBER 2012

RESEARCH HIGHLIGHT 1: SINGAPORE TIME CHARTER PARTY FORM (TRACK LEADER: PROF BERNARD TAN; RESEARCHERS: TICY VELUVELLEL THOMAS & REMANI CHINCHU BALAJI)

INTRODUCTION

Following the successful launch and overwhelming response to the Singapore Ship Sale Form, the Centre for Maritime Studies (CMS) was commissioned by the Singapore Maritime Foundation (SMF) to draft the Singapore Time Charter Party Form (STCP Form). The proposal to draft a new charter party form was in response to the demands from the Singapore and Asian maritime community to have a charter party form that addresses and incorporates crucial changes and developments that have occurred in the chartering business over the years.

DEVELOPMENTS OF THE SINGAPORE TIME CHARTER PARTY FORM

In furtherance of this vision, CMS research staff Ms. Ticy Thomas and Ms. Chinchu Balaji undertook an exhaustive study to examine the existing time charter party forms and to explore current and pertinent issues faced during chartering of vessels, which are not effectively covered by the existing time charter party forms, with ample guidance from the Singapore Time Charter Party Drafting Committee, comprising of stalwarts from the maritime industry.

The STCP Form is in the process of being finalized, with private consultations being carried out with various maritime industry powerhouses for further inputs and comments to have in place a new charter party form, which is aligned with the changing times.

PUBLIC CONSULTATION

The first public consultation of the STCP Form was organised by the SMF on 12 July 2012 at the Marina Mandarin Hotel, during which the Form garnered positive responses and essential inputs from the maritime industry players.

OBJECTIVE

The purpose of this study is to estimate the capacity of a container port. The port capacity can be represented by the port throughput achieved by the combination of the handling activities of different types of resources. This study examines ways to improve the productivity of existing container ports through the reconsideration of the resource requirement and operation strategies.

METHODOLOGY

Three types of resources in a container port are assumed. These resource types are, namely: Quay Cranes (QCs); Transporters; and Yard Cranes (YCs). The numbers of resources are also provided. The port capacity is basically determined by the ways that these resources are utilized and the number of respective resources.
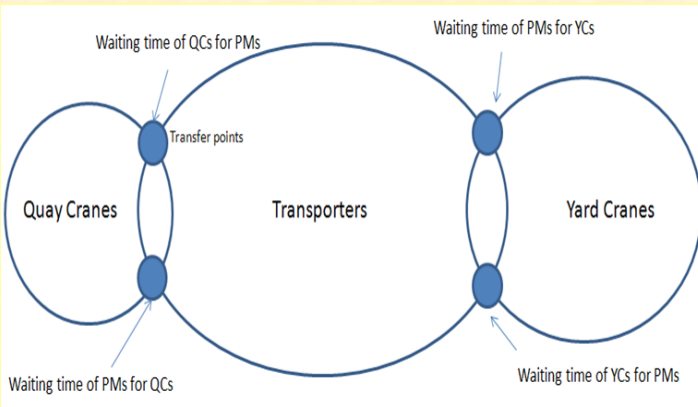
CONTAINER FLOWS

The container flows by resources can be modeled as a closed-loop queuing network consisting of single server nodes and delay nodes. QCs and YCs are modeled as single servers, and transportation activity of transporters between a QC and a YC is modeled as a delay node.

CLOSED-LOOP FLOW MODEL
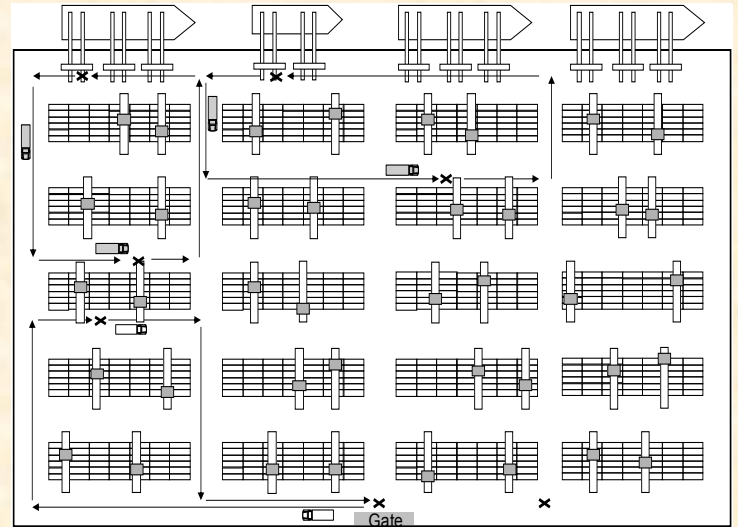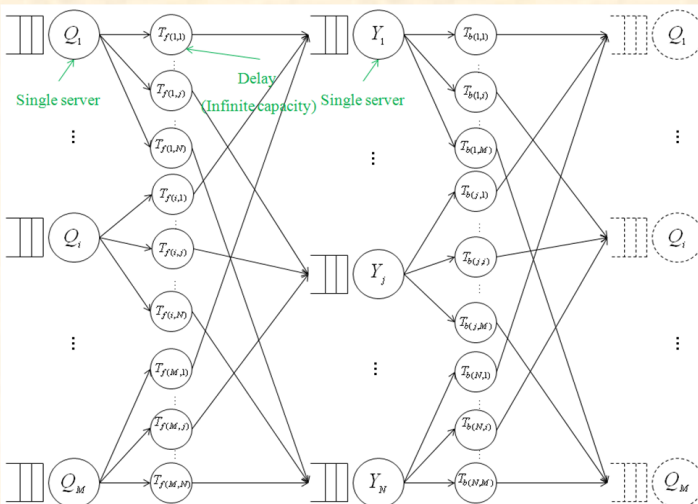
SUB-NETWORK FORMATION

The nodes for delaying the arrivals of transporters are approximated as a single aggregate delay node. Each sub-network is represented by a single server node and a delay node; and the number of sub-network is equal to the summation of the numbers of QCs and YCs.

Therefore, each sub-network being modeled as a closed network with finite population consisting of a single server node and a delay node.
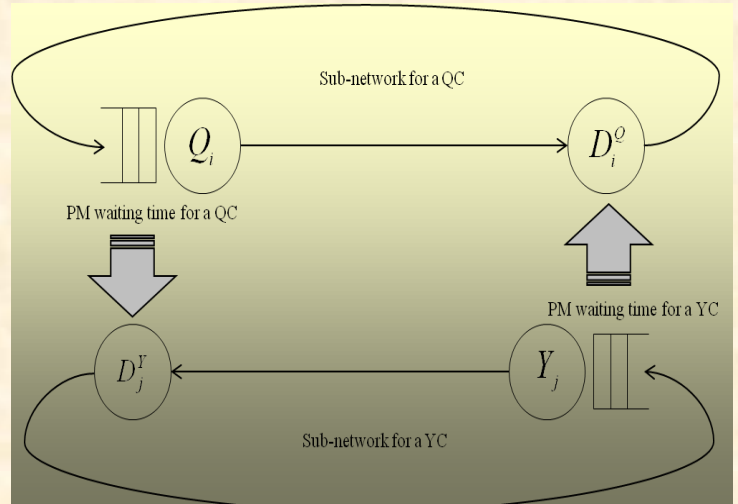
RESEARCH HIGHLIGHT 2: ANALYSIS ON CONTAINER PORT CAPACITY (TRACK LEADER: A/PROF LEE LOO HAY, A/PROF CHEW EK PENG; RESEARCHER: DR LEE BYUNG KWON)

SENSITIVITY ANALYSIS
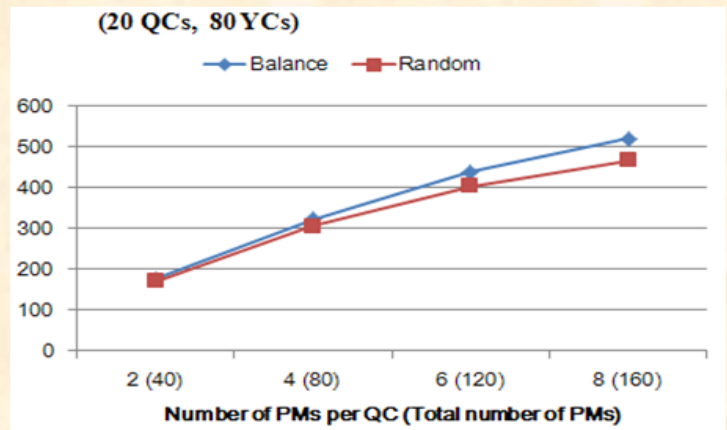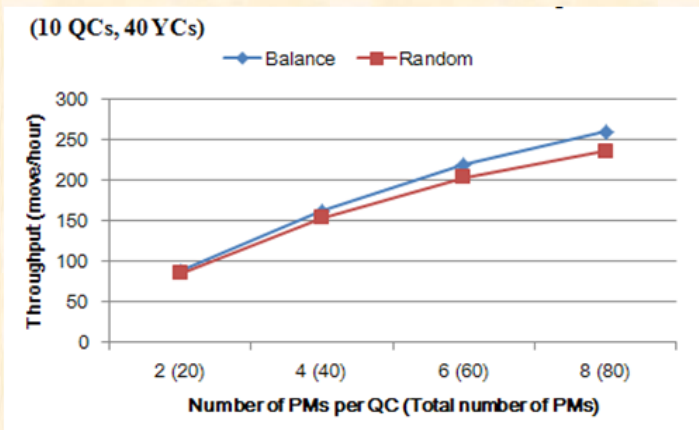
CONCLUSIONS

The following conclusions are drawn from the study:

- The balance strategy outperforms the random strategy and a smaller number of resources would be required under the balance strategy.
- It is found that the balance strategy helps to reduce the number of resources for a given level of the throughput.
- The port layout that promotes the efficient flow of Prime Movers can possibly improve the port capacity in terms of the throughput.
- It is also possible that the proposed model helps to predict the port throughput and determine the number of resources needed in a port.

RESEARCH HIGHLIGHT 3: NEXT GENERATION CONTAINER PORT (TRACK LEADER: A/PROF LEE LOO HAY, A/PROF CHEW EK PENG; RESEARCHER: DR LEE BYUNG KWON)

CHALLENGES

To seek revolutionary concepts in the planning, design, and operations of the next generation of container ports, that will achieve a quantum leap in efficiency and productivity to support future shipping in an economically and environmentally sustainable manner.

KEY PERFORMANCE INDICATORS
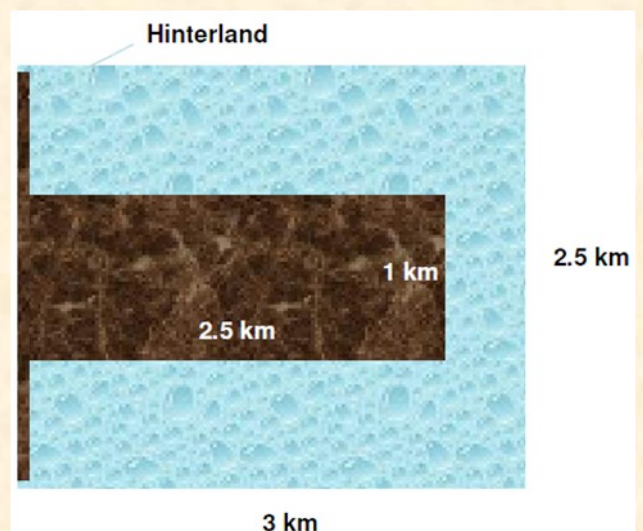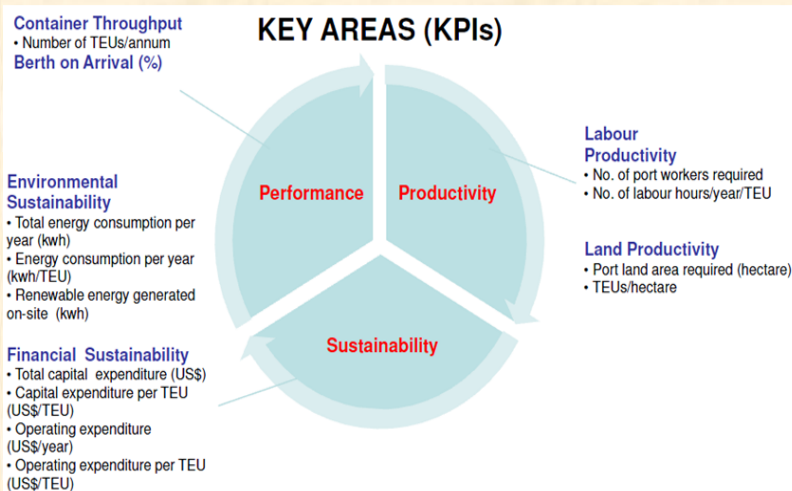
RESEARCH ACHIEVEMENT

IAME Best Paper Award, awarded by the International Association of Maritime Economists, at the IAME Conference Taipei, 6-8 September 2012, for the following Conference paper:

An Exploratory Study on the Effect of Trade Data Aggregation on International Freight Mode Choice, by A/Prof Anthony Chin, Dr Yang Dong and Dr Ong Ghim Ping Raymond.

Abstract:

Planners tend to use various rules of thumb to judge if a certain commodity is to be carried by a certain transportation mode. One such rule of thumb is the use of commodity value-weight ratio as a means to estimate the amount of commodities transported by a given mode. Alternatively, discrete choice model may be employed using available macroscopic commodity trade information. Using international commodity flows between continents, discrete choice models can be developed to compare the modal split between air and sea transport. However, given different aggregation level of data, the data collecting work can be remarkably huge and the analyses require considerable amount of resource, time and cost especially when multiple origin-destinations are taken into consideration over time. One issue that planners face is whether or not the estimated parameters are transferable spatially (among regions) or temporally (over time). This study therefore aims to explore the potential impact of trade data aggregation (international trade ODs, trade classification levels, periods and commodity types) on commodity mode choices derived from discrete choice models.

PUBLISHED TECHNICAL PAPERS (WITH ABSTRACTS ATTACHED)

1. Suyi Li, Qiang Meng, and Xiaobo Qu, (2012), An Overview of Maritime Waterway Quantitative Risk Assessment Models, Risk Analysis, 32:3, 496-512.

Abstract:

The safe navigation of ships, especially in narrow shipping waterways, is of the utmost concern to researchers as well as maritime authorities. Many researchers and practitioners have conducted studies on risk assessment for maritime transportation and have proposed risk reduction/control measures accordingly. This article provides a detailed review and assessment of various quantitative risk assessment models for maritime waterways. Eighty-seven academic papers and/or project reports are summarized and discussed. The review then proceeds to analyze the frequency and consequence estimation models separately. It should be pointed out that we further summarize the advantages and disadvantages of frequency estimation models and provide recommendations for their application. From the overview, we find that the quantification of the impact of human error is of great importance and should be considered in future studies. Possible solutions are also proposed in the discussions.

2. Qiang Meng and Xiaobo Qu, (2012), The economic importance of the Straits of Malacca and Singapore: An extreme-scenario analysis, in Transportation Research Part C: Emerging Technologies, 48:1, 258-265.

Abstract:

This paper proposes a decision tree model to estimate the loss to global economy on the hypothesis of an extreme scenario of blockade of the Straits of Malacca and Singapore. The insurance surcharges, inventory costs and the time values of cargoes, and Time Charter Equivalent rate are used to estimate the psychological loss, the loss to industries, and the loss to carriers, respectively. Interestingly, there is a pseudo-paradoxical phenomenon with respect to the loss to carriers. An illustrative example is also provided to explain the "Malacca Paradox".

PUBLISHED TECHNICAL PAPERS (WITH ABSTRACTS ATTACHED)

3. Qiang Meng, Shuaian Wang, (2012), Liner ship fleet deployment with week-dependent container shipment demand, European Journal of Operational Research, 222:2, 241-252

Abstract:

This paper addresses a practical liner ship fleet deployment problem with week-dependent container shipment demand and transit time constraint, namely, maximum allowable transit time in container routing between a pair of ports. It first uses the space–time network approach to generate practical container routes subject to the transit time constraints. This paper proceeds to formulate the fleet deployment problem based on the practical container routes generated. In view of the intractability of the formulation, two relaxation models providing lower bounds are built: one requires known container shipment demand at the fleet deployment stage, and the other assumes constant container shipment demand over the planning horizon. An efficient global optimization algorithm is subsequently proposed. Extensive numerical experiments on the shipping data of a global liner shipping company demonstrate the applicability of the proposed model and algorithm.

4. Shuaian Wang, Qiang Meng, (2012), Liner ship fleet deployment with container transship-ment operations, in Transportation Research Part E: Logistics and Transportation Review. 48:2, 470-484.

Abstract:

This paper proposes a liner ship fleet deployment (LSFD) problem with container transshipment operations. The proposed problem is formulated as a mixed-integer linear programming model which allows container transshipment operations at any port, any number of times, without explicitly defining the container transshipment variables. Experiments on the Asia–Europe–Oceania shipping network of a global liner shipping company show that more than one third (17–22 ports) of the total of 46 ports have transshipment throughputs. Computational studies based on randomly generated large-scale shipping networks demonstrate that the proposed model can be solved efficiently by CPLEX.

5. Zhuo Sun, Jianfeng Zheng, and Hongtao Hu, (2012), Finding Community Structure in Spatial Maritime Shipping Networks, International Journal of Modern Physics C, 23:6

Abstract:

This study explores the community structure in spatial maritime shipping networks. As compared with air transportation networks and urban road networks, ports in spatial maritime shipping networks have smaller connections due to the physical confinement. A new divisive algorithm is proposed for detecting community structure in spatial maritime shipping networks. At each iteration for modularity optimization, the length of each edge is successively updated, instead of edge removal used in the conventional divisive method. Finally, numerical experiments based on the global maritime shipping network are carried out to account for the properties of community structure in spatial maritime shipping networks.

PUBLISHED TECHNICAL PAPERS (WITH ABSTRACTS ATTACHED)

6. Wang, S and Q Meng, (2012), Liner Ship Route Schedule Design with Sea Contingency Time and Port Time Uncertainty, Transportation Research Part B-Methodological, 46:5, 615-633

Abstract:

This paper deals with a tactical-level liner ship route schedule design problem which aims to determine the arrival time of a ship at each port call on a ship route and the sailing speed function on each voyage leg by taking into account time uncertainties at sea and at port. It first derives the optimality condition for the sailing speed function with sea contingency and subsequently demonstrates the convexity of the bunker consumption function. A mixed-integer non-linear stochastic programming model is developed for the proposed liner ship route schedule design problem by minimizing the ship cost and expected bunker cost while maintaining a required transit time service level. In view of the special structure of the model, an exact cutting-plane based solution algorithm is proposed. Numerical experiments on real data provided by a global liner shipping company demonstrate that the proposed algorithm can efficiently solve real-case problems.

7. Xinjia Jiang, Ek Peng Chew, Loo Hay Lee, Kok Choon Tan, (2012), Flexible space-sharing strategy for storage yard management in a transshipment hub port, OR Spectrum.

Abstract:

In this paper, a storage yard planning problem is studied for a transshipment port with limited space and high-throughput level. Generally, the consignment strategy is used in the yard for a transshipment port, where containers to the same destination vessel are stored together. This is to facilitate faster loading process as it reduces reshuffles as well as long distance movements of yard cranes. However, the consignment strategy is known to be inefficient in space utilization since each storage location must be dedicated to a particular vessel. To improve the space utilization while retaining the advantage of consignment, a new approach named the "flexible space-sharing strategy" is proposed. The idea is that the container space can be shared by two different vessels as long as their containers do not occupy the space at the same time. This strategy allows the same storage location to be reserved for two vessels. The amount of space will only be allocated to a specific vessel on the arrival of corresponding containers. By controlling where to stack the containers in the storage locations, the containers to each vessel are not mixed and the consignment feature can be preserved. This strategy is first formulated as a mixed integer program (MIP). As the MIP model has a block diagonal structure, we develop a search algorithm which combines MIP and heuristics to find the solution. The numerical experiments show that the "flexible space-sharing strategy" can handle much more containers within the same storage space compared with the "non-sharing strategy".

8. Shuaian Wang, Qiang Meng (2012), Robust schedule design for liner shipping services, Transportation Research Part E: Logistics and Transportation Review, 48:6, 1093-1106

Abstract:

This paper examines the design of liner ship route schedules that can hedge against the uncertainties in port operations, which include the uncertain wait time due to port congestion and uncertain container handling time. The designed schedule is robust in that uncertainties in port operations and schedule recovery by fast steaming are captured endogenously. This problem is formulated as a mixed-integer nonlinear stochastic programming model. A solution algorithm which incorporates a sample average approximation method, linearization techniques, and a decomposition scheme, is proposed. Extensive numerical experiments demonstrate that the algorithm obtains near-optimal solutions with the stochastic optimality gap less 1.5% within reasonable time.

CMS RESEARCH SEMINARS

1. Global Liner Shipping Network Design, by Researcher Dr Liu Zhiyuan (Track Leader: A/Prof Meng Qiang)

Seminar Abstract:

This study presents a holistic analysis and useful software for the network design problem of intermodal liner shipping system. The existing methods for liner shipping network design are mainly dealing with port-to-port demand. However, a large portion of the customers of a liner shipping company are located in the inland part. Thus, it is necessary to cope with the inland origin-destination (OD) pairs, where the transport mode-change from inland transportation to maritime shipping is involved. This study first proposes a solution method for the conversion of inland OD demand to port-to-port demand. Then, a framework for global intermodal liner shipping network design is presented. By virtue of the software tool designed, the proposed methodology is applied to a large-scale global shipping network example.

2. Brief Introduction of Major Ports in China, by Researcher Ms Yang Lingxiao (Track Leader: Prof Fwa)

Seminar Abstract:

This presentation gives a brief introduction of major ports in China. Because the regions of East Asian and Southeast Asian now have the strongest economic and trade growth in the world, and also a major centre of gravity of global sea freight activities, ports there should gain some attention. Besides, proportion of major ports in China is large, so we will learn something about these ports' current status today. These major ports include Dalian, Tianjin and Qingdao in north China, and Shanghai, Ningbo, Xiamen, Guangzhou, Shenzhen and Hong Kong in south China. Their location as well as geographical and economic significance will be introduced.

3. Graph Visualization, by Researcher Dr Jiang Kaifeng (Track Leader: A/Prof Stephane Bressan)

Seminar Abstract:

Graph visualization is an area of mathematics and computer science combining methods from geometric graph theory and information visualization to derive 2-D or 3-D layout of graphs arising from applications such as social network analysis, data clustering, cartography, and bioinformatics. In this talk, I will first introduce the problem and give a review of mathematical models and algorithms available in the literature for graph drawing. Then I will introduce a semi-definite programming (SDP) approach for graph visualization problems and present some numerical results for some large scale graph problems.

4. Global Trade Flow Forecasting by Econometric Model, by Researcher Ms Maggie Sou Weng Sut (Track Leader: Dr Raymond Ong)

Seminar Abstract:

Nowadays, trade among countries or regions becomes an important economic activities in the world and contributes a lot in the maritime industry. Water transportation is the major transportation system in long distance. Therefore, in the planner's level, no matter government or port authority, there will be a need to forecast the future trade amount in order to establish corresponding trade policy or implement related facilities. In this context, an economic model – GTAP model is used for such prediction. GTAP model is a Computable General Equilibrium (CGE) model which takes both microeconomic and macroeconomic behaviors into account. In this study, the limitations and improvement of the GTAP will be discussed.

CMS RESEARCH SEMINARS

5. Bluetooth MAC Detection Technology for Traffic Data Collection, by Researcher Ms Lakshmi Rajasekhar (Track Leader: Dr Raymond Ong)

Seminar Abstract:

Bluetooth technology is familiar to most of us as the 'wireless technology' in our laptops, mobile phones and other electronic devices capable of sharing videos, photos, and other information between two connected devices wirelessly. Recently, Bluetooth Median Access Control (MAC) ID detection method has been proven to be an effective technique for real-time traffic monitoring. Also, its continuous data collection capability by sampling the actual traffic makes it feasible for permanent installation in the road with minimal cost and better data, both qualitatively and quantitatively. In this talk, I will give an introduction to Bluetooth traffic data collection, its advantages & disadvantages, basic Bluetooth data collection unit, Bluetooth field data collection and deployment, and Bluetooth traffic data validation using GPS Floating Car study.

6. Forecasting Seasonal Container Throughput Volumes at International Container Ports, by Researcher Dr Farhan Javed (Track Leader: Dr Raymond Ong)

Seminar Abstract:

Seasonal container throughput forecasts at ports are immensely important to logistics companies, shipping lines, port authorities and shipyards. Such forecasts allow shipping lines and port operators to formulate appropriate short-to-medium strategies in order to maintain competitiveness. The aim of this seminar is to explore the use of SARIMA models in forecasting container throughput at the container ports, while taking into consideration seasonal variations. Through the use of various performance metrics, the effectiveness of the developed SARIMA models for the container ports is evaluated. The forecasted throughput can be used to draw qualitative insights, thereby allowing shipping and port operators to make better tactical and operational decisions.

7. Whaling: Its Impact and Regulatory Framework, by Researcher Ms Remani Chinchu Balaji (Track Leader: Prof Bernard Tan)

Seminar Abstract:

Whaling is the hunting of whales for human purposes. Its earliest forms date to at least 3000 BC. Whales had once roamed the oceans of the world in peace and plenitude helping to maintain the delicate balance of life that once thrived in the ocean. However, the commercial whaling industry started turning the oceans of the world into deserted wastelands. Whales are increasingly becoming extinct which forced the international community to take steps to protect them and this resulted in the formation of regulatory framework like the International Whaling Conventions (IWC) that seek to curtail the disappearance of whales across the globe. The modest purpose of this paper is to study the impact whaling has on the environment and the effectiveness of the regulatory framework that is in existence today to regulate and curb whaling practices.

CONTACT DETAILS

Centre for Maritime Studies
National University of Singapore
12 Prince George's Park

Singapore 118411

Tel: + (65) 6516 8669

Fax: + (65) 6775 6762

Email: cmssec@nus.edu.sg