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## An Empirical Study on the Current Feeder Shipping Network Patterns among Malaysian Feeder Service Providers

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### ABSTRACT

Route network patterns have been investigated globally by many researchers, with the majority of studies only focussing on the liner shipping industry for long-distance services, and with less attention paid to the feeder services industry. The feeder services industry is important to enhance the economic sustainability and viability of feeder service providers and trade partners. The primary objectives of this paper were to study the focal economy points of feeder services in Malaysia and to demonstrate the type of network patterns practised by Malaysian feeder service providers. Accordingly, an empirical study was conducted through the cooperation of eight Malaysian feeder service providers via face-to-face interviews and port visits to understand the patterns of each shipping route deployed. Moreover, to demonstrate the network patterns of each feeder service provider, a route network model was designed. The main finding from this study found that Port Klang was the primary feeder hub port and focal economy point in Malaysia due to the highest number of feeder vessels entering the port. Furthermore, the type of route patterns applied by Malaysian feeder service providers were determined and categorised based on three models: 75 % (basic model), 17.5 % (butterfly model), and 7.5 % (chain model) collected data consisting of 40 service routes. This paper will assist future and existing feeder service providers in their planning and execution of the optimal service routes regarding their efficiency in servicing existing and future customers and promoting strategic and tactical allocation of shipping services to specific ports.

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### 1. Introduction

The feeder services industry in Malaysia is an extremely important service area, if not a vital asset, for the transportation of containers within

the Asian region, and globally. In Malaysia, feeder services are divided into two main categories: coastal and foreign going feeder services. It is

crucial for Malaysia to remain actively involved in the feeder services industry to enhance the current maritime environment and to boost profitability. Accordingly, an efficient shipping service industry in Malaysia, with significant linkages between ports will enhance the sustainability and development of the feeder services industry in the country. However, this raises several questions, which form the basis of the objectives set out for this study, which must be answered before this can occur:

- i) What is the primary objective and economic focal point of the feeder service industry in Malaysia?
- ii) What feeder companies in Malaysia commonly use shipping route patterns and linkages between ports?

The purpose of this study is to answer these two questions, based on literature research and through conducting interviews and collecting data from respective parties in this industry:

- i) To study the local economy and the rationale for feeder services in Malaysia; and
- ii) To demonstrate the type of route network patterns currently implemented by Malaysian feeder service providers by designing and utilising a route network model.

An empirical study was carried incorporating interview sessions conducted with eight feeder service operators located in Malaysia. The scope is, therefore, focussed on Malaysian feeder service companies. Furthermore, only an overview of existing route services based on the data collected from feeder service companies is presented, and not an in-depth study. Furthermore, this paper presents the authors' interpretation of the current feeder route networks based on the data in examining the current development of feeder service networks in commonly used by Malaysian feeder shipping providers in delivering shipping services to customers.

## 2. Literature Review

The Malaysian Government has recognised the feeder services industry as one of the primary service sectors able to contribute towards the countries national economic development agenda. As evidenced in the 11<sup>th</sup> Malaysia Plan (2016 - 2020), "Malaysia is in the progress of building an integrated needs-based transport system for enhancing connectivity across transport modes and regions, as well as expanding port capacity, access and operations" (Economic Planning Unit, 2015). Therefore, the feeder services industry is one of the key focus areas to enhance the competitiveness and attractiveness of Malaysian ports (Khalid, 2007). Accordingly, excellent feeder service networks are encouraged to achieve economies of scale, investment opportunities and higher foreign trade container transportation efficiencies (Chang et al. 2008), especially within the Malaysian context.

A study by Karsten et al. (2015) stated that feeder services are usually operated within a specific market segment to serve the main (larger) ports and the group of smaller feeder ports. The services involve cargo distribution of maritime containers and coordinating traffic (Jadrijević and Tomašević, 2011). A feeder network covers a smaller geographical region compared to a global shipping network and tends to have fewer ports which can be changed more frequently (Wang and Liu, 2014). Ports that many feeder operators are reliant upon are characterised by several factors such as the size of the mother vessel, the cargo amount for each spoke

port, the distance of the spoke port, distribution costs, time of the port's availability, cargo handling and onboarding costs (Jadrijević and Tomašević, 2011). Also, the formation of a shipping network design is developed at both the strategic level and the tactical level considering such criteria as port rotations, ship deployment, frequency and scheduling (Agarwal and Ergun, 2008).

In the shipping industry, wide-ranging service patterns are classified as triangle services, pendulum services, butterfly services, conveyor belt services and other forms of varying complexities. These are mixed with simple end-to-end services and adapted for both main haul and relay services to create a network best fitting a carrier's requirements (Notteboom, 2004; 2006). There is an enormous level of diversity amongst the various practices and types of liner services (also known as routeing network pattern), applying similar concepts, although under various names.

Due to the rapid development of the container shipping industry, the structure surrounding container ship routeing has become more sophisticated and technology enabled. A variety of approaches have been adopted to develop the most economical shipping route patterns for container transport to gain optimum profit, although the profit, of course, is impacted if the loaded containers are empty (Chen and Yang, 2011). In reference to several examples, Ducruet and Notteboom (2012) categorised route patterns into end-to-end services, line bundling services and transshipment operations, all connected to form extensive shipping networks. Meanwhile, Wilmsmeier and Notteboom (2011) described several variants of ship routeing patterns such as hub-and-spoke, relay, and direct services, including point to point and line bundling services.

In a separate study, Rodrigue et al. (2013) categorised three shipping network patterns known as port to port, pendulum, and around the world. Port to port is an applied concept where cargo is loaded in one port and discharged in one to three other ports. The pendulum pattern is referred to as a regular path existing between a sequence of ports where the maritime shipping line seeks to optimise the vessel's usage by choosing only to service those ports having essential trade relations. The around the world, pattern is a service that involves a limited number of ports per continent where a series of transshipment hubs of regional cargo are inter-connected (Rodrigue et al., 2013).

A variety of approaches to design the optimal route in shipping have been adopted with the intention to reduce overall operational costs. However, the issues around shipping route patterns ended up attracting significant attention by shipping service providers aiming to maximise their profits via their own individual container transport plans and routeing strategies (Chen and Yang, 2011). Furthermore, limited studies regarding regional feeder containership service networks also led to difficulty in designing practical shipping line networks (Polat et al., 2014). This issue will continue to remain unresolved given the role of ports, and their evolution continues, coupled with studies on new routeing models and parameters. Therefore, this issue highlights a significant gap in current modelling to optimise container shipping routes and transportation planning. A new method to assess ship routeing patterns, especially for feeder shipping services in Malaysia, needs to be conducted by analysing existing shipping routeing networks before developing other alternatives. Accordingly, this will help to optimise current shipping routes and transport planning and scheduling.

As mentioned earlier, this paper examines the present development of feeder route service networks for Malaysian feeder service providers deployed within Malaysian domestic maritime waters, the Intra-Asia

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