Chapter 12
The Implication of the Container Floating Terminal on the Efficiency of Port Klang's Terminal Operations and Domestic Freight Forwarding Industry

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Abstract Orders for mega vessels with a capacity of more than 20,000 TEUs have bolstered the sector since 2014. Despite the fact that these mega vessels serve to reduce sea transportation costs and increase global trade, they, on the other hand, also need some port infrastructure and container handling equipment adjustments. This will likely produce higher peaks in port container traffic, which will have far-reaching consequences. A number of seaport and terminal industry players have taken the initiative to establish a floating terminal to cater for the demand, since the development of seaport terminals to meet the call of mega vessels has become such a pressing issue for the sector. The container floating terminal (CFT) is a floating infrastructure that has been developed with facilities to transport containers from larger container ships or load other cargoes on a short-stay platform and then transport them to smaller ships for shipment to end-users. Thus, the purpose of this research is to look into the impact of the CFT on the efficiency of Port Klang's terminal operations and the local freight forwarding business. Using a questionnaire survey that was distributed among Port Klang's employees and local freight forwarding companies, this study found that there is a relationship between the development of the CFT and the improvement of Port Klang's terminal operations efficiency and the local freight forwarding industry.

Keywords Mega vessels · Container floating terminal (CFT) · Port efficiency · Freight forwarding industry

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12.1 Introduction

Ships have grown bigger in recent years, which has attracted the public's attention. The industry is transitioning to a new era of mega vessels, with the most recent attention on the HMM Algeciras, the world's largest container vessel. The season for megaship announcements appears to have begun, with various shipping lines declaring orders for even larger ships almost every two weeks, creating a mathematical sequence that has left everyone guessing when and who will possess the next megaship. Mega vessels are not a new phenomenon in the container shipping sector. The search for economies of scale, as well as the global trade mechanism including non-bulk cargo, has driven motivations for shipping companies to purchase mega container ships, which have risen in size at a rapid pace over the past decade. Furthermore, one of the causes driving most shipping alliances to focus on offering the most efficient yet low-cost maritime logistics services is the tremendous improvement in trade between Europe and Asia.

Mega-ships have established such a large peak in terms of ports and hinterland transit. This type of behaviour is not new, but it is never been witnessed on such a huge scale before. It is fair to say that most ports struggle to deal with these surges, especially when they arise suddenly, such as due to a shipping line's lack of dependability. Larger vessels are being deployed, needing more complex and automated handling procedures, yet fewer ports are being visited at the same time, resulting in increased competition among hub ports. Ports have long struggled to adjust to the massive container ships that container lines have been deploying in recent years [1]. On the other hand, the port terminal's facilities must change. Unless the port interface is updated, an ultra-large container ship (ULCS) is not particularly useful. Large container ships demand large container port terminals that can handle cargo and adhere to port traffic laws.

The mega-ships put a lot of pressure on ports. The annual rate of transport costs associated with mega-ships could be around US$0.4 billion, with roughly a third of the additional costs related to equipment, a third to dredging, and a third to the cost of port infrastructure and port hinterland [2]. Mega-ships, in addition to requiring massive investments, cause increased congestion and intensify competition between ports. A higher cargo density paired with fewer vessels results in higher peak hours for massive numbers of containers, placing a significant burden on ports. Ports require more cranes, as well as more highly qualified workers to operate them efficiently, more yard space, and the capacity to deliver containers inland using more trucks, railcars and barges. Parties participating in terminal operations would have to cooperate more closely together to avoid long turnaround times, congestion and expensive demurrage and detention charges.

Handling all vessels, cargo, and now the varied sizes of mega vessels from all over the world generates such a "stress point" for each government to deliver the greatest version of the port of call to its clients. Providing customers with a fully functional port will almost certainly prompt port developers to seek for a solution. This is where the container floating terminal concept is being established. Because

of the available water depth, the development of this floating or offshore terminal inside the port area would aid in the settlement of these challenges, as this facility would be more adapted to receive and handle large vessels.

12.2 Aim

There are very limited studies that are focused specifically on the implementation of the CFT. The majority of the studies currently discussed the impact of mega vessels on the seaport industry. There are numerous studies that focused on solutions for port industries to deal with demand issues by expanding their seaports. However, there is little discussion of the CFT as one of the solutions. Therefore, the aim of this study is to see into the implication of the CFT on the efficiency of Port Klang's terminal operations and the domestic freight forwarding industry that is currently supporting the logistics operations in Port Klang.

12.3 Literature Review

12.3.1 Port Efficiency

A port is a facility that connects maritime and hinterland transportation while also providing warehouses and other value-added services that attract both industrial players and investors [3]. Port output is the performance of any single part of the operation that occurred at the terminal. It could be calculated according to the total time taken to handle the cargo, quality of the performance and capacity to cope with any problem that occurs in the terminal's handling area [3]. Additionally, Rahman et al. stated that port efficiency and output could be measured according to their service performance consisting of the transit period and also the amount of tonnages handled by ship on a regular basis when maintaining the port's asset efficiency and financial results [4]. In this regard, both papers have touched on and addressed port efficiency issues as it is a very significant part that has led to a global economy and international trade's productivity and growth.

Jeevan and Roso said that the seaports are currently competing in terms of the vessels size, which has resulted in an extraordinary operational constraint as well as diseconomies for the seaport [5]. Both of the next papers written by [6] and [7] also mentioned that, seaports are currently facing with great pressure especially in expanding their infrastructure to accommodate the current larger size of the merchant fleet. Ismail et al. stated that in addition to reducing port efficiency, the present huge vessels are affecting numerous sectors of the transportation chain, particularly the multimodal transportation system connecting seaports with the hinterlands [6]. On the other hand, Jeevan et al. stated that despite offering significant benefits to traders

and the environment, the introduction of mega vessels has significant implications for seaports, imposing new conditions on seaports, affecting land-side operations, and putting a strain on the entire container logistics chain [8]. Baik also stated that ports spend a lot of money improving their facilities and vying for vessel calls, but it is difficult to handle such demand spikes [1].

In comparison, the study by Rahman et al. is much more relatable with this study as the finding of this paper has shown that the port efficiency could be achieved through the instalments of a complete port infrastructures, logistics superstructures and also great packages of the value-added services [4]. As for the studies by [5–8], the researcher could understand more on the impact of the current picture of the enlargement of the vessel size that has given a big impact towards the performance of the seaports.

12.3.2 Floating Terminal

A floating container storage terminal (FCST) is recognised as a floating facility, which is located near the main terminal on the open sea [9]. Apart from being the most effective and efficient solution for the containerisation industry, this offshore terminal was first developed to cope with the problems arise from oil and gas industry. In 2001, El Paso had been tasked to build a new vessel based on available technology for the Gulf Gateway [10]. Due to this development, the players in the port and terminal industry had come out with an idea to build up an offshore terminal as a backup to the expansion of the inland terminal. The study by Maletic et al. stated that the installation of this floating infrastructure can definitely help in increasing the efficiency of the onshore port performances as it could contribute in reducing the turnover time for both containers and vessels [9]. Meanwhile, Giranza and Bergmann listed out that from their study, it is found out that the investment on floating terminal is more profitable as compared to the onshore terminal [11]. Next, Songhurst (2017) argued that the floating facility is such a bless to the industry as this floating mega structure offers such a lower development cost, faster and flexible schedule and also reusable asset feature [10]. The preceding studies showed how fast the floating terminal industry has grown due to the total investment of the floating infrastructures was much lower than investment for onshore terminals.

On the other hand, the paper written by Souravlias et al. stated that the other benefits offered by this floating terminal is as per followed: (1) it could serve as a disaster relief hub, particularly in coastal areas where land access is difficult or time-consuming, and (2) it would be beneficial not only for port purposes but also for offshore energy production, aqua farming and possibly as a future living location.

As overall, all the papers did provide with the same useful information as regards with the installation of the floating terminal but the most relatable are the papers written by Maletic et al. and Souravlias et al. as both of the papers definitely focused on all the criteria of the floating terminal. The weakness of all the papers selected is on the methodology part as none of the methods used is relevant to be used for this study.

12.3.3 Domestic Freight Development

Arip et al. stated that an international freight transport terminal is defined as the main or hub facility where all the services including the transportation, logistics and goods distribution either for the national or international trade are being connected [12]. As the number of TEUs continues to increase especially in Port Klang, where the container volume has increased to 10.9 million TEUs in 2014 compared to 496,326 TEUs in 1990 [8], the development and expansion of the seaport area is becoming a crucial issue for the players involved in the industry. From primary data collected, Arip et al. discovered that the physical aspects of the freight transport terminal are the most important factor in determining the goods distribution system performance of the intermodal freight transport terminal in Malaysia. This factor is followed by both the core-on site activities and core-on site service elements [12]. The study also discovered that Malaysia was still left behind in the development of the intermodal freight transport terminal [12].

A study by Nasir et al. that covers on the local intermodal transportation services in Malaysia found that there were three major problems when using these intermodal transportation services. The problems included operational efficiency, management and cost. Apart from the problems, it is also stated that the operational efficiency is made up of the total transit time and reliability, the inland terminal operations and also dry port operations [13]. The development of the ports could be such a benefit facility towards the stakeholders as it will help in reducing the waiting time for ships, increasing the efficiency in the supply chain as well as decreasing in the total freight cost [8]. It is also found that the connectivity between the seaport and the hinterland infrastructures including the dry port is very crucial to help providing more numbers of trade volume. Next, [13] stated in their study that the main challenges to overcome in order to increase the usage of intermodal in Malaysia are the efficiency, management issues as well as the cost factors.

A study by Chudasama found that the development of an economy and the development of a port are inextricably linked [14]. This was reinforced by the finding that, whilst, on the one hand, economic growth necessitates port development as part of infrastructure development, and on the other hand, port development facilitates import–export and draws industries to its hinterland, resulting in forward and backward linkages with the rest of the economy. The paper came to a key conclusion, specifically, that economic growth in the hinterland economy would have an effect on cargo traffic at ports making them more competitive [14].

In summary, the three research papers at [8, 12, 13] discussed in the preceding paragraphs are relevant to this research as they were focusing on the development of the freight transportation and the domestic freight terminal in Malaysia. They also discussed in detail on how the pattern of the local freight terminal could affect the business of the local seaports. The methodology used by some of the writers, which is the qualitative method can also be considered as one of the methods for this and subsequent research.

12.4 Methodology

12.4.1 Participants

In this study, the questionnaire was distributed online using a Google Form. The online questionnaire was completed by 55 respondents using the purposive sampling method. Employees of the terminals in Port Klang and representatives from selected freight forwarding companies that operate in the area around the port make up the population of this study. From the total respondents, male accounted for 57.1% of the respondents, while female respondents accounted for 42.9%. More than half of the respondents, i.e. 65.45% or 36 people, are aware of the existence of the CFT, while the remaining 34.55% had never heard of it. According to the data gathered, 100% of respondents agreed that the construction to modernise the port is important in order to handle a variety of difficulties that most seaports face. The majority of those working in the port and adjacent sectors agreed that the creation of this future structure might contribute to in resolving the issues of draught constraint and land for horizontal expansion.

12.4.2 Measure

All the data collected via the online questionnaire was then being analysed using the Pearson coefficient analysis. The Pearson coefficient, r, is a sort of correlation coefficient that represents the relationship between two variables on the same interval or ratio scale.

Table 12.1 Correlation analysis between Port Klang's terminal operations efficiency and the development of CFT

Correlations			
		Port Klang's efficiency	Container floating terminal
Port Klang's efficiency	Pearson correlation	1	0.853**
	Sig. (2-tailed)		0.000
	N	55	55
Container floating terminal	Pearson correlation	0.853**	1
	Sig. (2-tailed)	0.000	
	N	55	55

**Correlation is significant at the 0.01 level (2-tailed)

12.5 Results and Discussion

12.5.1 Correlation Analysis Between Port Klang's Terminal Operations Efficiency and the Development of CFT

Table 12.1 indicates a Pearson's coefficient of correlation of $r = 0.853$, indicating a strong positive linear relationship between Port Klang's terminal operations efficiency and CFT development.

12.5.2 Correlation Analysis Between Freight Forwarding Industry and the Development of CFT

Table 12.2 reveals a strong positive linear relationship between the freight forwarding industry and the development of the CFT, with a Pearson's coefficient of correlation of $r = 1.000$.

12.5.3 Implication of CFT on Port Klang's Terminal Operations Efficiency

The building of the CFT has been determined to have an impact on Port Klang's terminal operations efficiency, according to Pearson's coefficient of correlation, $r = 0.853$. This finding is in line with the previous study's findings, which said that port efficiency is achieved by combining the right mix of port infrastructure, logistics superstructure and related value-added services [3]. In this study, the researcher

Table 12.2 Correlation analysis between freight forwarding industry and the development of CFT

Correlations			
		Freight forwarding industry	Container floating terminal
Freight forwarding industry	Pearson correlation	1	1.000**
	Sig. (2-tailed)		0.000
	N	55	55
Container floating terminal	Pearson correlation	1.000**	1
	Sig. (2-tailed)	0.000	
	N	55	55

**Correlation is significant at the 0.01 level (2-tailed)

discovered a number of essential aspects that help to enhance the efficiency of ports and terminals. According to the data analysed, one of the most important factors for seaports to maintain their efficiency is vessel turnaround time, which can be achieved through good port and terminal infrastructure. According to a research at [1], one of the major challenges facing most seaports is the increase in demand for turnaround time, as the trend of giant container ships has produced new levels of congestion and activities that have hurt the efficiency of most seaports.

On the other hand, the flexibility to expand capacity to meet the current trend of container vessel expansion is the most important attribute for Port Klang to improve its efficiency level. According to the study, the CFT is one of the futuristic alternatives for coping with the container market's growth and the development of mega-sized vessels. This is supported by [15], which says that globalisation has led in a rise in vessel size, necessitating the expansion of seaport container handling capacity. In order to solve the issue of port growth and extension, the study suggests the building and development of a floating terminal, particularly in the case of land limitation. The creation of this CFT could help improve cargo handling, encourage strong competitiveness for seaports and increase the number of TEUs and mega vessel calls which could have a positive impact on Port Klang's terminal operations efficiency in this scenario. The arrival of mega vessels brings such significant effects for the majority of seaports around the world. Therefore, in order to stay competitive, ports must spend a large amount of money to improve their facilities and capacity. As a result, when it comes to the relationship between the development of the CFT and the efficiency of Port Klang's terminal operations, this research shows that the development of this futuristic structure has a significant impact on Port Klang's terminal operations efficiency.

12.5.4 Implication of CFT on Local Freight Forwarding Industry

According to the findings, the development of the CFT has a direct impact on the local freight forwarding industry. As noted in the previous study, the CFT has a strong positive linear association ($r = 1.000$) with the domestic freight forwarding industry. This relationship may also be supported by [14], in which the author stated that the interaction between the port and the hinterland, which includes freight forwarding and other logistics components, is generated by the port's better-operating facilities. The development of this CFT, according to the findings of this study, will have an impact on Port Klang's productivity, resulting in a smooth supply chain and hinterland link. According to the survey findings, 71.4% of respondents agree with the statement that in order to respond to contemporary industrial changes, seaports must engage with their inland connectivity to boost their flexibility as espoused by [5], particularly in terms of seaport infrastructures. The effectiveness of the seaport, as well as the supply chain from the hinterland, will suffer if this is not been sufficiently addressed.

On the other hand, the construction of this CFT, based on the findings, will increase the present use of domestic freight forwarding services. This is verified by a research published by [14], in which the author states that the operational efficiency of the services is linked to the time and reliability of the services, which is linked to the operation at the seaports. As a result of the good development and infrastructure, particularly in dealing with the present trend of giant vessels, the time for cargo handling could be managed effectively, affecting the smooth flow of the freight forwarding business as well as increasing the usage for the services.

As a consequence, in terms of the relationship between the growth of the CFT and the domestic freight forwarding sector, this study demonstrates that the development of the seaport can have a favourable impact on the performance of the local freight forwarding services industry.

12.6 Research Implications

12.6.1 Implication for Academia and Future Research

As this research is exploratory and interpretive, it opens up numerous areas for future research, both in terms of theory development and concept validation. More research will be required and can be done in the future to further elaborate the findings of this study. To start with, based on the facts given above, the researcher discovered the possible impact of the CFT on the efficiency of Port Klang's terminal operations and the local freight forwarding industry. According to the data collected, the CFT's construction could help to improve vessel turnaround time as well as cargo handling efficiency, resulting in improved port performance. As a result, the supply route to the hinterland is becoming more efficient, helping freight forwarding enterprises in

the port area to perform much better. The focus of this study was on the general consequences of the CFT. Instead of focusing on generalisation as it appears to have done here, future studies may be expanded to learn more about this CFT. Finally, this research will add to our understanding of this infrastructure. Given how fresh this CFT is and how little attention it has received thus far, conducting additional research on this brand-new development may be a good idea for the future researchers.

12.6.2 Implication for Industry

The contribution of this study in the industry context is the formation of a perspective, particularly for those working in the port industry, on how the CFT could help in resolving various difficulties in the area. People might recognise the impact that this infrastructure could have on the port business based on the literature review that has been conducted. For example, according to [16] on Tunisian seaports' study, most of their seaports are experiencing expansion challenges, where the ability to increase the space was limited to less than 10 m. As a result, it is suggested that industry leaders devise a futuristic strategy to deal with such a situation. As a result, this study may lead industry players to explore developing a CFT as a defence against such issues. This study, as well as other subsequent studies that may develop from this idea, may have an impact on investors or organisations making decisions about how to build and operate a future-ready port.

12.7 Conclusion

According to the findings and the discussion previously stated, the development of the CFT had an impact on Port Klang's terminal operations efficiency and the domestic freight forwarding industry. When determining the port's level of efficiency, there are several crucial aspects to consider. These included reducing vessel turnaround times, increasing seaport capacity, enhancing cargo handling efficiency, increasing the amount of TEUs, and increasing the number of mega vessels calling at Port Klang. These crucial aspects can be achieved by solid long-term growth and technological advancement at the ports, which in this case is the CFT construction. The CFT's construction appears to provide a major impact on the local freight forwarding industry, which transports goods around Port Klang. As a way of dealing with the huge vessel trend, the factors indicated above, such as a smooth supply chain and freight forwarding connectivity, may be established with the good development of seaports. It is believed that the high level of efficiency at the seaport will contribute to the increased efficiency of the freight forwarding business and will also help to strengthen the demand for these services. All these could be achieved through a good development at the seaport and how fast development of the maritime logistics industry are effectively managed. In conclusion, this study will provide a better

understanding of the CFT and how it may be considered as one of the finest options for the seaport in dealing with the current challenge.

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