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MARITIME LOGISTICS DEVELOPMENT STRATEGIES AND PERFORMANCE MEASUREMENT: A CASE STUDY

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ABSTRACT

Maritime Logistics plays a key role in developing a strong global supply chain system. The framework development and performance measurement among the chain of the maritime logistics could help to develop overall logistics performance of a country. Moreover, the ease of international trade and inclination of investors to invest in a country mostly depends on the efficiency of maritime logistics. The study aims to explore the maritime logistics and development strategies and performance measurement metrics contextualizing the case study of Malaysia. The paper analyzed the existing literature and proposed a conceptual framework for maritime logistics strategies. Customs, infrastructure and logistics quality have been identified as the key drivers for maritime logistics in Malaysia. The study will help the policymakers and maritime researchers to develop the maritime performance metrics of their own countries.

Keywords: Maritime logistics, performance, measurement, Malaysia

Introduction

Maritime transportation plays an essential role in the world's economy, as around 90% of the global trade is carried out by sea (UNCTAD, 2019). In maritime industry, several key players from the suppliers, customers, ports, customs, to insurance companies and many others, participated in the system indifferent activities and functions. In order to ensure the efficient, effective, economical and sustainable maritime transportation environment, all of these players and their individual functions must be operated in an integrated and coordinated manner. This integration and coordination in maritime transportation environment can be labelled by the logistics activities. Logistics can be defined as a process of planning, implementing and managing the movement of goods or products from one point to another (Caliskan *et al.*, 2016). According to (Lee, Nam & Song, 2012), maritime transportation can

be seen as a central integrated component of the global logistics systems, which not only consist of transport-related services but also involving any other logistical services. By relying on the concept of integration, maritime logistics can be regarded as a systematic entity of the integration system, which emphasises efficient and effective flow of the entire logistics system (Lee & Song, 2010).

According to Photis M. Panayides and Song (2013), logistics is a part of the supply chain, which consist of (i) planning and implementation, (ii) controlling the efficiency and the effectiveness of the flow, and (iii) storage of goods, services and any other related information, starting from the point of origin to the customers. In order to improve the efficiency of the logistics system in a supply chain, there is a need to ensure that the right logistics strategy is in place and implemented effectively. This logistics strategy will act as a guiding principle or driving force in helping us coordinate plans and policies between different partners across the supply chain. In general, these strategies increase the performance of the supply chain, which in turn affect the management of the whole logistic system.

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At the national context in any country, the understanding of each component of the logistics performance can help improve the efficiency of the logistics system by investing in the right area.

It is crucial for us to measure the performance of the logistics, especially those aspects that are critical to the particular flow of the supply chain. These measures could help us visualise the state of the supply chain and make the right decisions for improvements. Therefore, this paper aims to establish the conceptual framework in developing maritime logistics strategies, including its performance measurement. This conceptual framework

then to be applied for Malaysia to assess the level of effectiveness of logistics. Finally, this paper will conclude all of the findings and way forward as an observation or result of the research.

Conceptual Framework

Maritime Logistics in the Whole Logistics System

In maritime logistics system, there are three important actors: (i) shipping, (ii) port/terminal operations, and (iii) freight forwarding (Nam & Song, 2011). Each actor in this system has its roles or functions which are inter-related with other functions in the firm's supply chain.

Table 1: Main function and supporting activities of maritime logistics (Lee *et al.*, 2012)

| | Shipping | Port/Terminal operation | Freight forwarding |
|---------------------------------------|--|--|--|
| Main function | Moving cargo between ports | 1. Shipping reception | |
| | | 2. Loading/unloading cargo | Booking vessels and preparing for requisite documents for ocean carriage and trade on behalf of shippers |
| | | 3. Stevedoring | |
| | | 4. Connecting to inland transportation | |
| Supporting logistic activities | 5. Documentation relating to sea trade | 8. Warehousing | 14. Inventory management |
| | 6. Container tracking and information flow | 9. Offering distribution centre | 15. Packaging |
| | 7. Providing intermodal service | 10. Testing | 16. Warehousing |
| | | 11. Assembly | |
| | | 12. Repairing | |
| | | 13. Inland connections | |
| | | | |

As we see in Table 1 above, the maritime logistics system is a concept that covers a broad scope or philosophy. Both main functions and supporting activities comprise a comprehensive list of logistics activities, which involve integration, coordination, value-added customer services, lower costs, higher flexibility, reduced response time and higher quality (Caliskan *et al.*, 2016).

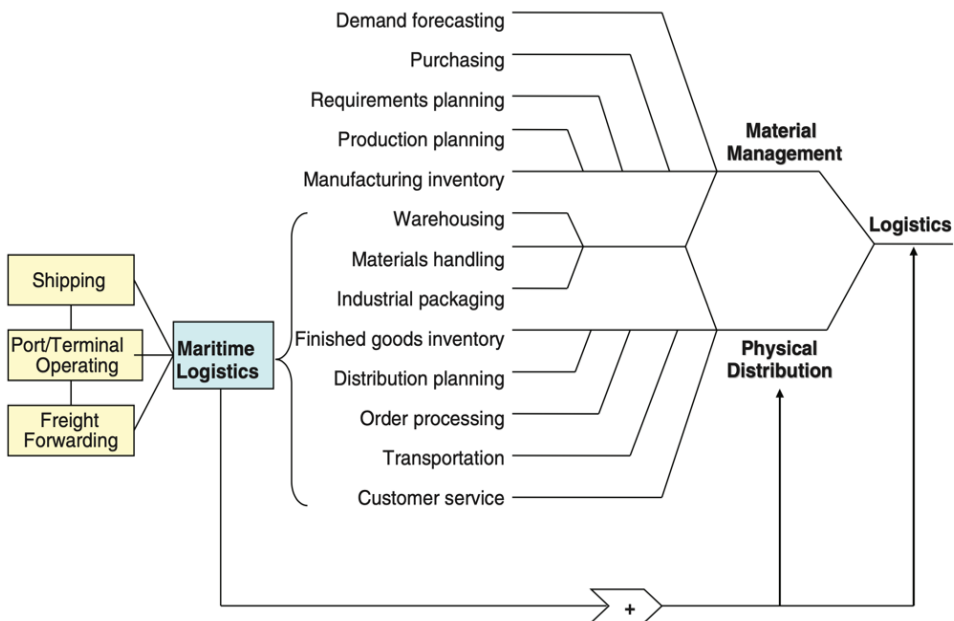


Figure 1: Maritime logistics in the whole logistics system (Lee *et al.*, 2012, extended from Coyle *et al.*)

There are two main pillars in a whole logistics chain, which are; (i) material management, and (ii) physical distribution. Figure 1 above shows how maritime logistics interact with other activities in a whole logistics chain as the major part in physical distribution (Lee *et al.*, 2012). Each maritime player in the system are interlinked to each other, meaning that their roles and functions are directly or indirectly affected by other players. Therefore, to improve operational efficiency and service effectiveness, it is crucial to develop maritime logistic strategies, together with their performance measurement. With the right strategies and performance measurement, continuous implementation will increase the quality of maritime logistics in particular, and quality of the entire logistics system in general.

As mentioned earlier, measuring the performance of maritime logistics is crucial to ensure the service level or delivery is to customer's satisfaction. Customers in

the global market now expect high-quality products or services at lower cost and in shorter time. Maritime logistics, as a part of the logistics chain, are involved in physical distribution. These activities may include materials handling, storage and warehousing, transportation, and distribution centre. The major function of maritime logistics can be characterised as 'bridging the gap between producer and customer'.

From a maritime perspective, logistics organise the movement of goods through a wide range of network activities, not only at the local scale but also at a global and regional scale. Therefore, instead of only being a private endeavour, logistics has become a public policy concern. Referring to the paper prepared for the International Transport Forum (ITF) Roundtable Meeting (ITF, 2016) at the OECD, the performance of maritime logistics can be described by six criteria; (i) transport intensity,

(ii) modal split, (iii) market diversity (iv) operational efficiency, (v) service quality, and (vi) environmental impact. These six criteria are the main areas in developing the measurement framework for the performance of maritime logistics strategies, particularly in freight performance metrics. All of these criteria are also being used to design related public policy for the government. By understanding and setting

up effective strategies for the logistics performance, the government can improve efficiency and make the right investments in transport infrastructure. A range of factors was also considered in developing maritime strategies, including productivity and quality of service. Figure 2 shows the main areas or criteria influencing policymakers.

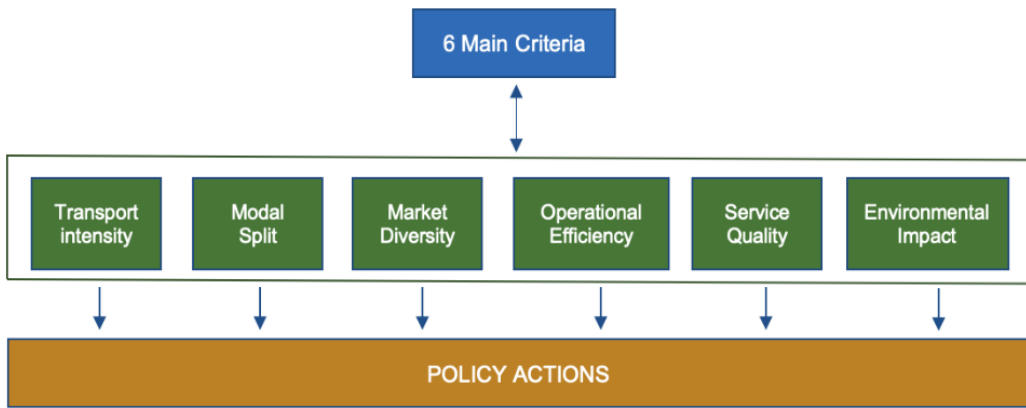


Figure 2: Strategies areas for policy actions

(Source: Author, information extracted from ITF Roundtables Report No. 158, 2016)

In developing maritime logistics strategies, the desired outcomes have to be clear. Benchmarking indicators such as the Logistics Performance Index (LPI) can be used to develop strategies. According to a World Bank report, the six indicators in determining the LPI are (i) Customs, (ii) Infrastructure, (iii) International shipment, (iv), Logistics quality, (v) Timeliness, and (vi) Tracking and tracing.

Key Performance Indicators (KPI) or metrics are also used to measure the performance of the maritime logistics. Each indicator will be labelled with KPI, to help the government track, observe and optimise the whole logistics processes in an efficient way. KPI is qualitative information, which can help policymakers assess the

performance of the country’s supply chain, including to find the gaps that require more attention. This KPI may include total transit time, cost per tonne-km, port dwell time, and user perception. From the perspective of maritime logistics, all players or actors in the supply chain can be considered a ‘customer’. Therefore, in order to increase performance, the overall demands of these customers should be taken into consideration. According to Lai *et. al.* (2002) efficiency in the logistics transport system can be categorised into two: (i) efficiency-related, and (ii) effectiveness-related. Since maritime logistics is a part of the transport logistics, these two parts can be used to develop a conceptual framework for assessing the performance of maritime logistics.

Table 2: Measurement of efficiency and effectiveness in transport logistics.

| Supply chain process | Measurement criteria | Performance indicators |
|--|--------------------------------|--|
| Efficiency-related (internal facing) | Cost | <ul style="list-style-type: none"> ● Total logistics management costs ● Productivity |
| | Assets | <ul style="list-style-type: none"> ● Return processing cost ● Cash-to-cash cycle time ● Inventory days of supply ● Asset turns |
| Effectiveness-related (customer facing) | Reliability | <ul style="list-style-type: none"> ● Delivery performance ● Order fulfilment performance |
| | Flexibility and responsiveness | <ul style="list-style-type: none"> ● Perfect order fulfilment ● Response time ● Production flexibility |

(Source: Lai *et al.*, 2002)

Building on Figure 2 above, Figure 3 below shows a conceptual framework for developing the strategies for maritime logistics by using the LPI. The development of strategies is based on the performance measurement findings, gaps analysis, KPI, and performance indicators (for both internal and customer-facing).

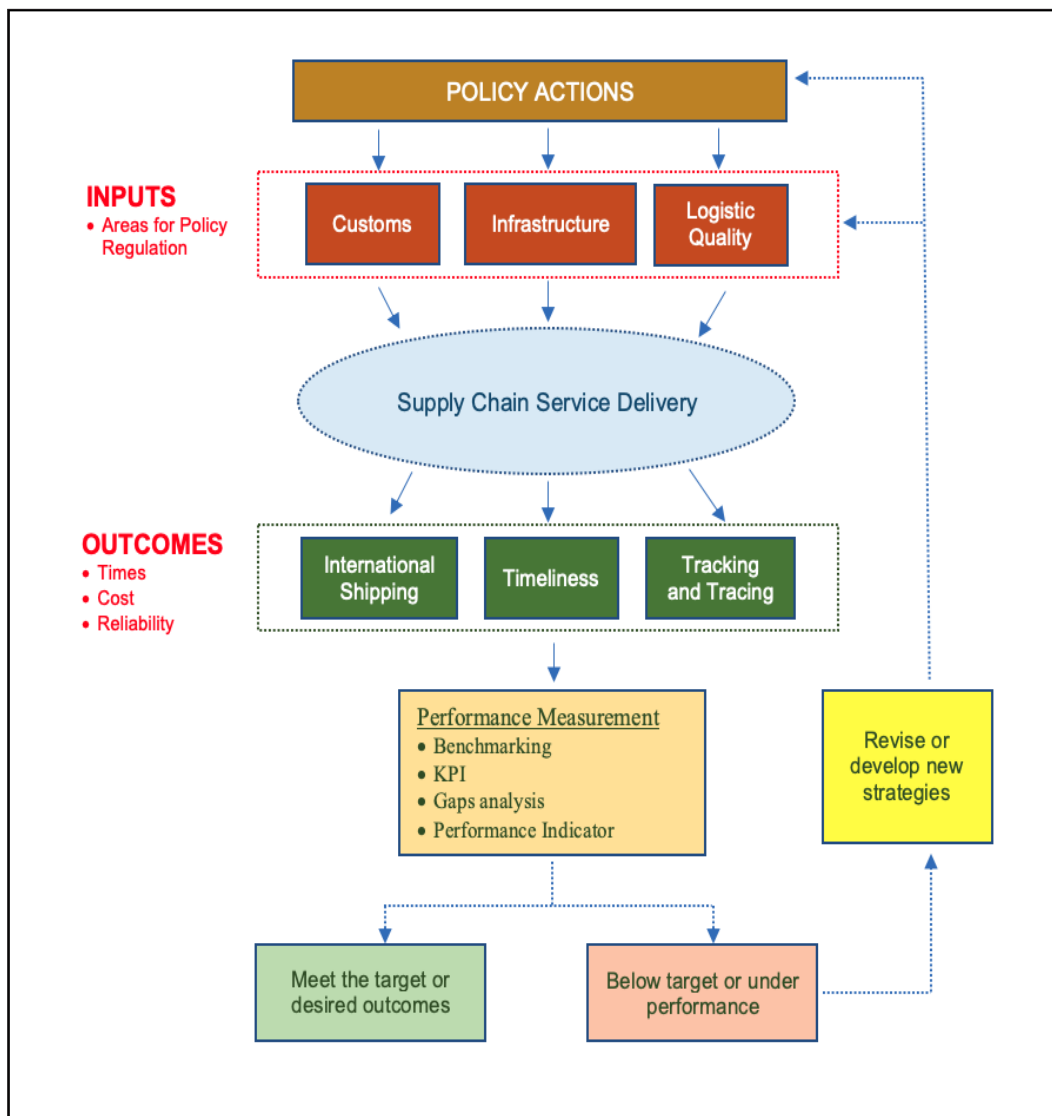


Figure 3: A conceptual framework for developing maritime logistics strategies (Drawn by the Author, based on information from ITF Report, 2016)

Several key elements or components in the logistics chain must be carefully assessed when revising or developing maritime logistics strategies. At this stage, the performance indicators will tell us what elements or components should we focus on to improve the performance or service effectiveness. For example, the level of efficiency of the ports since they are systematic element of multimodal logistics supply chain and coordinating nodes between different components in maritime logistics. In this area, strategies must be designed to ensure a port has its optimum capacity in coordinating materials and information flows, operating with reasonable costs and also be reliable in cargo handling.

Related Issues and Limitations

As we know, by using LPI and its components, we manage to benchmark the performance by comparing data with other countries' logistics and trade facilitation. These performance indicators can also be used to assess the effectiveness of specific policies, quantifying the desired outcomes and measuring the overall progress. However, in order to assess the effectiveness of a particular policy related to maritime logistics, each policy must have its indicator. Hence, a highly effective indicator must be developed in order to get sufficient information and guidance, and to avoid misunderstanding or misinterpretation. According to the ITF (2016), the quality and availability of the data also became a problem in producing ideal indicators. When these indicators were used to benchmark performance internationally, the key industry trends and characteristics must be taken into account as well, to avoid or minimise any risks of misrepresentation.

Other than that, the performance indicators in the LPI should be used for a particular country only to compare their performance over time, instead to use them for comparing the performance with other countries. The difference in geographical location, economic development and composition of trade may cause the comparison to be inaccurate and misleading. In assessing the performance and defining the indicators in maritime logistics, participation or cooperation among all players in the supply chain is crucial. Participation needs to be broad by involving both the private and public sector.

Conceptual Framework Application – Malaysia's Case

The maritime industry has always played an important role in Malaysia as a nation surrounded by the sea. Starting with the Third Malaysia Plan in 1976, Malaysia seemed to be committed to coping with the current trends in international trade by building up seaports infrastructure, and several shipping lines were initiated as well. Besides increasing investment in logistics-related activities, important strategies have been in place, especially on the development of multimodal transportation system that includes the enhancement of inter-modal transportation capability, and logistics facilities.

According to a report on LPI by the ITF or World Bank in 2016 and 2018, the quality of trade and transport-related infrastructure in Malaysia was reported at 3.45 (1=low, 5=high), then dropped to 3.22 in 2018. Figure 4 below shows Malaysia's LPI and Scorecard from 2007 - 2018.

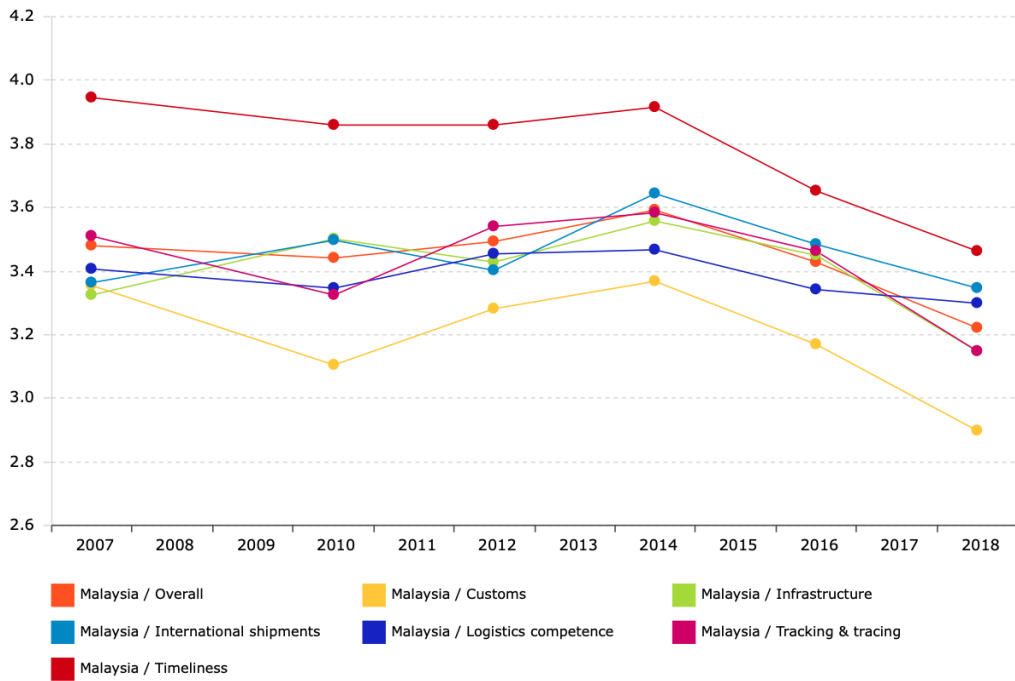


Figure 4: Malaysia LPI Scorecard from 2007 – 2018

(Source: ITF Report, 2018)

Based on the conceptual framework, six key dimensions were used to measure the performance. For the Malaysia case, in 2018, the score is as follows:

Table 3: Malaysia LPI Scorecard Table from 2007 – 2018

| No. | Key Dimension / Indicators | Score |
|-----|---|-------|
| 1 | Efficiency of the clearance process (speed, simplicity and predictability of formalities by border control agencies, including customs) | 2.90 |
| 2 | Quality of trade and transport-related infrastructure (ports, railroads, roads, information technology) | 3.15 |
| 3 | Ease of arranging competitively priced shipments | 3.35 |
| 4 | Competence and quality of logistics services (transport operators, customs brokers) | 3.30 |
| 5 | Ability to track and trace consignments | 3.15 |
| 6 | Timeliness of shipments in reaching the destination within the scheduled or expected delivery time | 3.46 |

(Source: ITF Report, 2018)

Outputs from the above performance indicators analysis were used by policymakers as the basis for their decision to increase the attractiveness of Malaysia as a business location. As highlighted in the conceptual framework in the previous chapter, the policy action will be focused on six main areas; (i) transport intensity, (ii) modal split, (iii) market diversity, (iv) operational efficiency, (v) service quality,

and (vi) environmental impact. For the case of Malaysia, information on the strategies and policies from the Ministry of International Trade and Industry (MITI) will be referred in applying this conceptual framework.

According to the MITI, in promoting the development of the logistics industry (focusing on maritime logistics) in Malaysia, the government has set six strategic thrusts as shown in Table 4 below:

Table 4: Malaysia Strategic Thrust in Maritime Logistics

| No. | Strategies |
|-----|---|
| 1 | Creating an efficient, competitive logistics industry |
| 2 | Developing particular transport modes to operate in a competitive international environment |
| 3 | Improving the capacity of the industry to enhance its participation in the global supply chains |
| 4 | Intensifying the application of new information and communication technology |
| 5 | Ensuring an adequate supply of competent workforce |
| 6 | Strengthening institutional support |

(Source: MITI, 2018)

The policy to increase the performance of the maritime logistics in Malaysia was developed based on the above strategies, and each strategy has its measures and indicators. With a specified target, the responsible actors or players will be given their KPI to monitor progress and overall achievement. These players can be the Customs Department, Ports, Department of IT, and Transportation Department. As far as maritime logistics is concerned, the three main inputs to improve the supply chain service delivery are (i) Customs, (ii) Infrastructure, and (iii) Logistics Quality.

Key Areas for Further Development – Malaysia's Case

When we talk about the national logistics performance in Malaysia, there is a study conducted by Shan Lu *et al.*, (2012) to find the level of satisfaction, but from the manufacturing industry perspective. However, this figure can also be used to assess the overall performance of logistics in general, since the manufacturing industry is a sector from 'material management' (refer to Figure 1), as part of a whole logistics system. The result of the study is shown in Table 5.

Table 5: Perception of the National Logistics performance in Malaysia

| Items | Mean ¹ | S.D. ² |
|---------------------|-------------------|-------------------|
| Connectivity | 3.43 | 0.696 |
| Efficiency | 3.41 | 0.765 |
| Competitiveness | 3.31 | 0.938 |
| Quality | 3.28 | 0.598 |
| Safety and Security | 3.25 | 0.679 |
| Cost | 3.01 | 0.741 |
| Sustainability | 2.96 | 0.697 |

Note : 1. Mean scores obtained from a Likert scale ranging from 1 (much worse) to 5 (much better).
 2. S.D. = standard deviation.

(Source: Shan Lu *et. al.*, 2012)

Apart from the conceptual framework, the above components can also be used in developing strategies in maritime logistics. However, some other factors also should be put as an indicator in assessing the overall performance of logistics. To increase the level of satisfaction among the players, the government also have to look into other factors such as inland transport linkage (unbalance development across the country), as well as the eradication of corruption in Malaysia. These factors can be the barriers to achieving the desired target of particular policies when it comes to the implementation stage. As the recommended improvement for the conceptual framework, these both factors should be part of the performance measurement criteria related to the efficiency and effectiveness in the supply chain process (internal and customer-facing).

The conceptual framework in developing maritime strategies is crucial to the government to improve its performance in maritime logistics. If the government is using only a method not covering all aspects, the strategies or measurement taken may not bring any improvement. For example, the strategies may only cater to domestic logistics (micro-logistics level), rather than the global logistics level. This situation may

prevent the government from seeing the bigger picture of the logistics, comparing their performance with other countries and even having difficulty in identifying the core problem or bottlenecks.

Conclusion and Recommendation

The LPI, which was developed by the World Bank, is widely used by countries for benchmarking and making a comparison (Dang & Yeo, 2018). The conceptual framework to develop the maritime logistics strategies in this paper also shows how policymakers use six core indicators in LPI to formulate policies and measures to improve national logistics performance. However, in LPI, all indicators are regarded as equally important. At the same time, in logistics, we need to measure many other fields or aspects that may not be included in the LPI. Therefore, the multi-criterion decision-analysis method should be used in developing the conceptual framework, rather than focusing on one method only.

As we know, LPI was developed as a tool to measure the performance of national logistics for the countries. However, all of the six components of the LPI (customs, infrastructure, competence, shipments, tracking, timeliness) were developed based on the perception of the selected

respondents only. Furthermore, each conceptual framework is location- or country-based. Therefore, particular countries will still have to look at other 'national' factors or variants to evaluate their logistics performance. By doing this, the evaluation will be more accurate, and a deeper understanding of the overall performance level of their logistics service, especially on maritime logistics, can be achieved.

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