A REVIEW ON DEVELOPMENT CHALLENGES FOR AN INLAND PORT AT MALAYSIA-THAILAND BORDER

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Abstract. An inland port helps enhance the global supply chain or process it by attaching value to raw goods, serving a higher quality of operation, and serving as a procurement path for the commodities required to reduce overall shipping costs. Inland ports can eliminate or reduce the uncertainty related to customs and border delays and become JIT, enabling fast and efficient production. However, the inland port development has several problems that will be affected their operations in the future. The objective of this study was to review the challenges to the development of an inland port at Malaysia Thailand border (Bukit Kayu Hitam (BKH)). A few challenges BKH will be facing in developing inland ports are lacking of transport infrastructure and operational activities, information sharing between crucial stakeholders (players), competition between other ports, and high cost labor and non-automatic cargo inspection. A systematic Literature Review (SLR) combine with bibliometric analysis approach being adopted to review the challenges facing other ports and inland ports worldwide. Total 100 articles related to the topic from 2004 and 2021 were selected and reviewed. Bibliometric analysis was used to determine the quantity of literature, the number of writers, and the number of related themes. Literatures were reviewed and evaluated using VOSviewer software by creating, visualizing, and analyzing the inputs. The findings had supported the challenges that affected the development of an inland port at BKH. Recommendations to develop the inland port at BKH were discussed for the stakeholders and other parties.

Keywords: *challenges, development, inland ports, Bukit Kayu Hitam (BKH), Systematic Literature Review (SLR)*

Introduction

Intermodal terminals in the hinterland have gained various titles over the years. One of them is Inland Clearance Depot (ICD), a concept that emphasises offering customs clearance at an inland site. Similarly, the word “dry port” has been in usage for decades now. It has also been used interchangeably with ICD and to differentiate an ICD in a landlocked country from a country with its seaports (Monios, 2011). While Rose et al. (2009) cited that an inland port is an inland intermodal terminal directly linked to seaport(s) by high volume transport means, consumers may depart or pick up their standardized units as though they were direct to a port. According to Jeevan et al. (2015), an inland port is an inland environment of cargo-handling facilities that allows many functions to perform, such as aggregation and delivery, temporary storage, customs clearance, and connecting transport modes.

The closest border town to the Malaysian to Thailand is Bukit Kayu Hitam, Kedah. It marks the end of Malaysia's longest path, the North-South Expressway (Malaysia Federal Route1), which runs from Johor Bahru in the south to the border at Bukit Kayu Hitam in the north. The expressway directly links Phetkasem Road in Thailand

(Thailand Route 4). As cited by Najimudin et al. (2020), Bukit Kayu Hitam, a Malaysia-Thailand border city, aspires to become one of the North Peninsular's newly industrialized economic zones. Rapid infrastructure construction has sparked economic and social development in this country. Therefore, the prospects for economic properties in Bukit Kayu Hitam, which include a diverse range of commercial, residential, manufacturing, and public areas, are anticipated to be plentiful once the construction is complete. This economic zone would include warehouses, shopping malls, homes, restaurants, entertainment centres, educational facilities, and modern Immigration, Customs, Quarantine and Security facilities (ICQS).

Thailand shares borders with four countries: Myanmar, Laos, Cambodia, and Malaysia. Lord and Tangtrongjita (2016) stated that, compared to other customs houses in Thailand, Sadao Customs House has the highest trade value due to the highway infrastructure linking central Thailand to Malaysian port cities. As a result, the number of trucks crossing the border at Sadao Customs House is growing year after year, causing border congestion. In addition, according to Othman et al. (2016), the customs clearance procedure at the border may cause delays and increase congestion on the roads. This delay issue has a detrimental influence on customs operations, resulting in different processes and needless overhead expenses, impacting the sector's efficiency based on cost-effectiveness. Therefore, the study's general objective is to review the challenges of development inland port at Bukit Kayu Hitam. The specific objectives are: (1) to review the effect of transport infrastructure and operations on inland port development at Bukit Kayu Hitam; (2) to review the effect of sharing information between crucial players on the development inland port at Bukit Kayu Hitam; (3) to review the effect of competition with seaport and inland terminals on inland port development at Bukit Kayu Hitam; and (4) to review the effect of high-cost labour and non-automatic cargo inspection on the development of an inland port at Bukit Kayu Hitam.

Literature review

Challenges effecting the development of inland port

The challenges affecting inland port operations covered in this section gathered from existing literature on inland port operations globally. Four primary factors affect inland port operations and their related sub-factors: infrastructure and operation, information sharing between crucial players, competition among other ports, and other challenges.

Infrastructure and operation

Accessibility and connection of an inland port are limited by transportation infrastructure barriers, limiting its ability to support port activities. According to Fechner (2012), decentralized container distribution through inland ports without good transport networks results in losses for the container seaport's attractiveness. It so tends to drive seaports to execute the inland transformation. According to Zainuddin et al. (2019a), the infrastructure required to facilitate transloading in inland ports. Lack of infrastructure quality for transport limits inland ports in connection with manufacturers or seaports. Polyzos and Tsiotas (2020) demonstrated that increased freight services increased trade, followed by increased labour supply and technology diffusion. Port competitiveness influenced by port service quality, logistical expenses, regional linkages, hinterland condition, and port accessibility. Scaramelli (2010) stated that the

competitive position is affected by a mix of infrastructure quality, hinterland accessibility, and productivity.

Mandalay inland port in Myanmar, for example, the country has the lowest internal transportation connectivity in Asia, and these linkages create significant challenges to its inland port operations (Black et al., 2013). Anor et al. (2012) indicated that the road network system is one of the most significant infrastructures in every country since it allows people and commodities to move freely. A road network system exhibits road hierarchy, connection, accessibility, linkages, and mobility. This system significantly affects the transportation business and is a significant component in the logistics industry. As a result, the port city's network system needs important development (Anor and Ahmad, 2010). On the other side, the road network system also impacts the expansion of port cities, based on the functions of efficient land use and road network integration. For example, Zainuddin et al. (2019b) cited large freight numbers transported to and from significant seaports via the road system. However, over-use of road infrastructure in this region has significantly degraded road conditions.

Poor road infrastructure, a lack of interchangeable roads, and narrow roadways are the primary causes of highway traffic congestion. For instance, in Africa, the Dar es Salaam seaport is connected to the hinterlands through a road network. The efficacy of the connections, on the other hand, should be enhanced. Road infrastructures heavily utilized, resulting in increased traffic congestion and road accidents near ports (Mwendapole and Jin, 2020).

Information sharing between crucial players

The rapid digitization of society impacts port operators. In the context of a port, such as cargo containers, vehicles, cranes, and workers, assets such as cargo containers, trucks, cranes, and personnel are increasingly equipped with digital devices (Jager and Lin, 2016). Wireless technologies (Wi-Fi, RFID) and associated management software link the devices to management systems through the Internet (e.g. EPCIS and various dashboard management systems). Information systems receive, deliver, analyze, and utilize data to guarantee the efficiency and effectiveness of an organization's operations. These information systems have grown in importance in logistics services, and they provide a crucial instrument for lowering costs and successfully serving customers via improved customization of the service given.

Along with sufficient facilities and infrastructure at ports, IT systems play a crucial part in processing information about cargo from origin to destination (Sitorus et al., 2016). Ports must get adequate and reliable data from other players in the container freight network to ensure that movement is effective and efficient. According to Heilig et al. (2017), the efficiency and safety of related freight movements are heavily reliant on information exchanges. The lack of information integration significantly impacts information sharing between inland ports and other container freight distribution chain players. At the moment, there is no central point of information for container port users. For example, Port Klang Authority (PKA) has developed its own electronic supply chain system known as Port Klang Net (PKN). However, it only connects PKA to other port operators (i.e. West Port and North Port). Another example is Tanzania's Isaka inland port, which had substantial delays in customs procedures for border-crossing cargo inspections, resulting in high trade expenditures and low competitiveness.

Competition among other ports

Seaports and inland ports must complement one another, as they can improve seaport hinterland connectivity (Monios et al., 2016). As cited by Ng et al. (2013), the rivalry between seaports and inland ports has hampered these inland ports' success in their seaport network. To minimize rivalry from seaports, inland ports must diversify their operations or facilities to offer more value-added services to manufacturers. Brazilian inland ports, for example, have implemented new strategies to improve service to their clients, including suspending duty payments, expediting customs clearance, immediately unloading containers to avoid damage, maintaining a permanent presence of inspection agents, reducing the risk of cargo loss and damage, and allowing for partial cargo imports and exports based on business needs. The implementation of this newest regulation has improved the efficiency of container transportation to and from the harbour, thus decreasing competition from other seaports and increasing Brazilian seaport productivity (Galvão et al., 2013).

In addition to seaports, inland ports have faced competition from inland terminals. For instance, due to the length of time spent at Laem Chabang seaport and its distance from Bangkok seaport, the Lat Krabang inland container depot faced strong competition from Malaysia's Padang Besar Cargo Terminal (PBCT). PCBT facilities are essential for the transportation of perishable goods from southern Thailand to Penang Port (Jeevan et al., 2016). According to UNESCAP (2014), the distance between Lat Krabang's inland container depot and Malaysia's Penang Port is 490 kilometres, compared to 820 kilometres to Bangkok Port. Additionally, transit to Penang Port through PBCT took just three hours, compared to seven hours via the Lat Krabang interior container depot to the Laem Chabang seaport. Therefore, transportation prices were cut in half to prevent direct rivalry with the PBCT. In addition, daily double-track services, faster transfer times and the loading period into carriages were significant criteria providing the Lat Krabang Inland Container Depot with a competitive advantage (UNESCAP, 2014).

Other challenges

The other challenges to inland port development are high-cost labour and manual cargo inspection. A team was established there as an integrated unit to avoid incurring high workforce expenditures to solve this gap. This team brought together employees from several organizations, including seaports, logistic businesses, and transportation providers, to cut inland port operating expenses. Each employee was compensated by their employer, not by the inland port. Due to the fact that this team had a varied workforce under one roof, they achieved exceptional productivity (Roso et al., 2009). To serve seaports using this strategy, inland ports must be innovative, creative, and competitive. These may serve as an outstanding example of how all components of a container seaport system may work together to accomplish a shared objective.

Furthermore, cargo inspection is a crucial part of international trade. It is because cargo inspections can be used to prevent smuggling and evasion of customs duties. Cargo inspectors are also responsible for handling safety issues that may arise during the inspection. To understand what procedures should be followed by the inspectors, it is vital that they understand regulations and how cargo inspection works in general. As Qin (2010) stated, inland ports primarily provided the completion of facilities and services to their users. As proof, in Indonesia, the Cikarang inland port's issues were the time and expense associated with physical cargo inspections, which contributed to long-stay periods in the seaport (Jeevan et al., 2016).

Materials and Methods

This research used the qualitative approach method. Hammarberg et al. (2016) stated that the goal of qualitative research is multimethod, with an interpretative, naturalistic approach to its subject matter. In addition, qualitative research entails collecting various empirical materials, such as case studies, interviews, life experiences, and systematic literature reviews. We used the Systematic Literature Review (SLR) method to compile information on the challenge of developing the inland port at Bukit Kayu Hitam. Therefore, this study seeks to identify the challenges as stated in *Figure 1* of developing the inland port at Bukit Kayu Hitam. The application of each phase of the review process is detailed in-depth in this section.

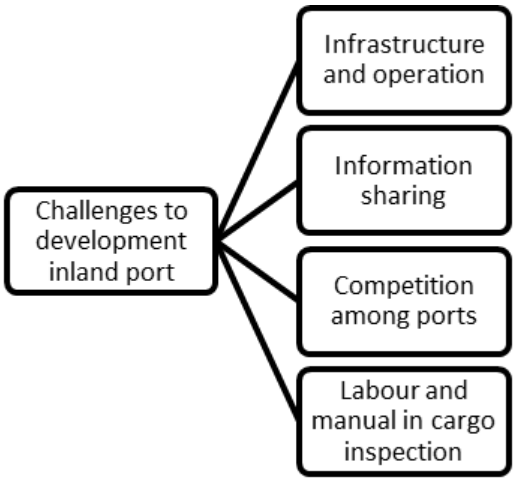

***Figure 1**. Research framework.*

The screening procedure successfully reduced the total number of papers to 100 publications focused on inland port research. In addition, by providing a more precise explanation for readers, this study grouped the detected documents based on a historical perspective, which spanned 2004 to 2021. Initially, we searched for documents in Google Scholar, Scopus and Science Direct using the necessary keywords and exclusion to get the best results that suited our objectives. This article analyzed journal or review papers based on their title, abstract, and keywords from 2004 to 2021. Articles must be authored in English and classified as journal articles. To identify errors from the flawed peer-review process, this analysis eliminated articles from conference proceedings and books. The initial search included the following keywords based on the research questions and the main topics identified earlier: “inland ports” and “challenges”. Furthermore, to extensively investigate the related literature, keywords focused on each of the three facets of inland port development, such as “inland port” and “infrastructure and operations or information sharing or competition among other ports” and “development”, were also scanned.

Before the screening, a sample of over 150 articles and recommendations to see whether they should be kept for further study or rejected. Discrepancies were discovered and addressed before the collection of over 100 publications was reviewed. Following publication exclusion based on title, keywords, and abstract, the remaining articles thoroughly examine. Data collected on the instrument used to measure the dimension of research interest and manually sorted literature relating to the inland port.

Selected papers were tallied and organized depending on their study emphasis and data gained from these results in *Table 1*.

Table 1. *Sampling summary.*

Classification criteria	References
Infrastructure and operations	Juma Mwendapole and Zhihong (2020) Polyzos and Tsiotas (2020) Khaslavskaya & Roso (2019) Zainuddin et al. (2019) Zainuddin et al. (2018) Gaal and Afrah (2017) Chen et al. (2016a) Chen et al. (2016b) Rahmanto (2016) Deng (2013) Roso (2013) Anor et al. (2012) Black et al. (2012) Leszek and Fechner (2012) Do et al. (2011) Nor and Ahmad (2010) Roso and Lumsden (2010) Scaramelli (2010)
Information sharing between crucial players	Inkinen et al. (2019) Jeevan et al. (2019) Heilig et al. (2017) Jager and Lin (2016) Sitorus et al. (2016) Monios and Wilmsmeier (2014) Olesen et al. (2013) Ye and Wang (2013) Duranton and Turner (2012) Roso et al. (2009) Van Der Horst and De Langen (2008)
Competition among other ports	Jeevan et al. (2019) Jeevan et al. (2018) Jeevan et al. (2016) Monios et al. (2016) Feng et al., (2013) Ng et al. (2013) Robles (2013) Cullinane et al. (2012)
Other challenges	Zin (2019) Jeevan et al. (2016) Roso et al. (2009)

Results and Discussion

Descriptive analysis

The total papers that we have reviewed are 100 articles related to the challenges and development of ports. Based on the *Figure 2*, among 100 articles on port/maritime

operation, less than 15% mainly discussed inland ports. Before the year 2010, the total number of publications in academic refereed journals was only 14 articles. After 11 years, the total number of articles significantly increased compared to the previous year, with 84 articles published from 2011 to 2021.

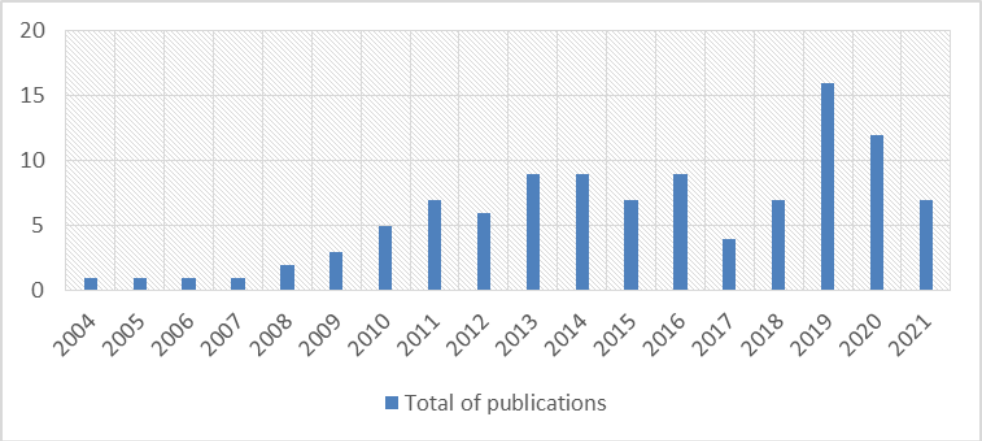

Figure 2. *The total of publications in the topic challenges of port.*

The subject area between the years 2004 and 2021 related to the port in worldwide. *Figure 3* shows the result of the research area in which social science is high with 337 papers and followed by environmental science (329 papers), Earth and Planetary Sciences (127 papers). On the other hand, other subject areas, such as Economics, Econometrics and Finance, Agricultural and Biological Sciences, Arts and Humanities, Decision Sciences, Engineering, and computer science, have published less than 100 articles.

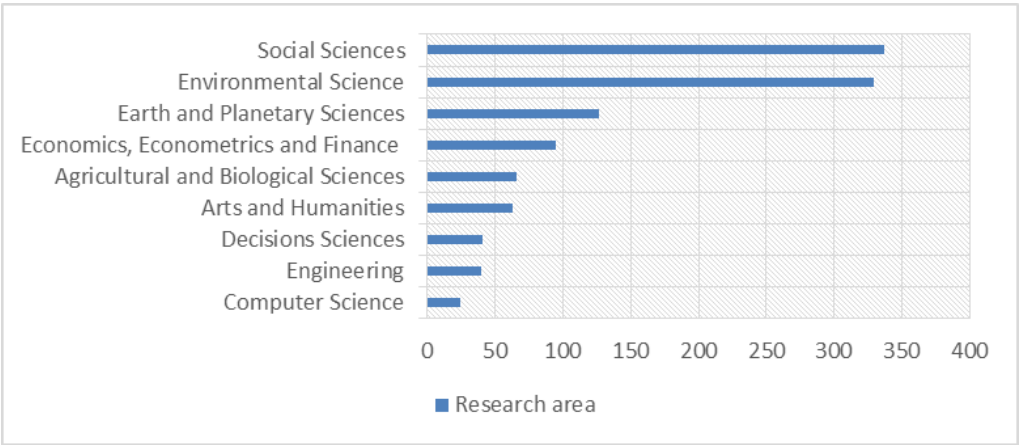

Figure 3. *Subject area in inland port research.*

From the analysis above, the increasing number of publications, it was claimed that ports are critical for transporting goods through containers, boosting economic activity, and enhancing logistical competitiveness. Furthermore, the results demonstrate the interdisciplinary character of inland port research, which integrated challenges of development inland port ranging from public policy reform to technical needs such as infrastructure and operations, information sharing, competition, labour, and cargo inspection.

Bibliometric analysis

Bibliometric analysis is a cross-disciplinary field of study that involves the quantitative examination of all forms of information using mathematical and statistical techniques. VOSviewer was used to process data from the Scholar engine to create network visualizations based on the processing methods.

Research that has influenced inland port investigations

The degree of significance was determined using a direct citation, considering the minimal number of citations. The direct citation has been used to assess the most essential works in a specific research area, with a normalized technique termed fractional counting used to mitigate the network's dominance of papers with a high number of sites. The software generates network maps with the colours and depth of fonts assigned to each author's node. The colours indicate a concentration of citations, with yellow being the most notable (Van Eck and Waltman, 2010). The font size also adds to the differentiation of each author's citation explosion, with more giant letters indicating a greater degree of citations (Van Eck and Waltman, 2014). The network's core contains the most critical research, which is often referenced and referred to in subsequent studies, while the islands around the core include research on an inland port. The study from the network's core in *Figure 4* reveals the inland port and challenges of development concepts as the most significant studies.

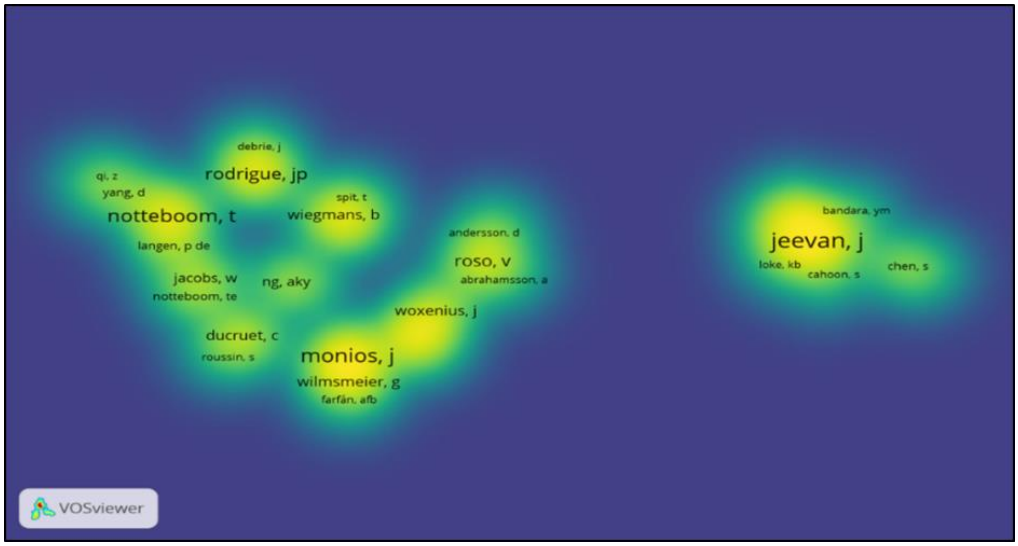

Figure 4. *The authors most influential works on inland port research.*

Keywords on the inland ports research

VOSviewer in *Figure 5* can determine the primary importance of the subjects under investigation based on the co-occurrence of the keywords. Keywords are subjects or concepts provided in articles to help academics, researchers, and professionals locate a related subject using the search engines of their choice. Each node represents a term, and the line thickness indicates the degree of connection between the keywords detected. One term from the category ‘port’ served as the focal focus of the study, followed by two keywords from the categories ‘challenge’ and ‘system’, three keywords

that are inextricably linked. The first is a challenge; it is firmly correlated with infrastructure, inland terminals, and integration, while the second is a system that is highly correlated with information and procedure. Moreover, the terms of congestion, competition, cargo, and inspection also appeared on the map. To conclude, the map shows that the development of ports has been related to these challenges.

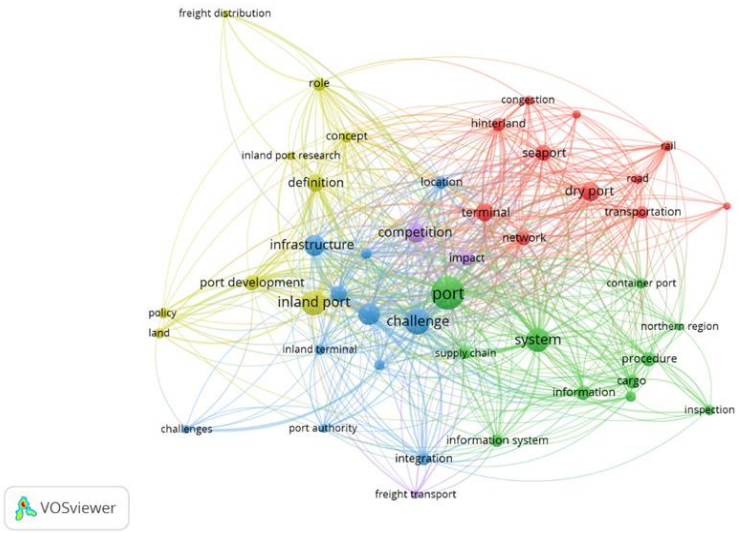

Figure 5. *Term co-occurrence analysis.*

This research objectives to review the challenges such as transport infrastructure and operations, sharing information between crucial players, competition between ports, high-cost labour, and non-automatic cargo inspection to develop an inland port at BKH. The findings showed that these challenges had affected the development of an inland port at BKH.

RQ1: Does the infrastructure and operations effect the development inland port at Bukit Kayu Hitam? As mentioned in the previous chapter, we can conclude that infrastructure and operations affect the development inland port at Bukit Kayu Hitam. First, it is the lack of transport infrastructure quality. According to Zainuddin et al. (2019a), the infrastructure required to facilitate transloading in inland ports. Lack of infrastructure quality for transport limits inland ports in connection with manufacturers or seaports. Another port faced transportation constraints, including minimum inland waterways access, low rail link capacity, and limited railway length. This ultimately prevented it from delivering on client expectations and offering more frequent train services, including cross-border train services, which would have allowed a greater volume of freight to paid at lower costs. Besides, according to Do et al. (2011), the economic zone is growing slowly because of underdeveloped transportation infrastructure, which cannot provide sufficient support for economic development.

Second, the road network system impacts port operation based on efficient land use and road network integration. Zainuddin et al. (2019a) cited that large freight numbers transported to and from significant seaports via the road system. Over-use of road infrastructure in this region has significantly degraded road conditions. Besides, this creates congestion on the roads and highway, resulting in delays in the shipping schedule to seaports.

RQ2: Does the information sharing between crucial players effect the development inland port at Bukit Kayu Hitam? It has shown that the information sharing between crucial players affect the development of the inland port. Monios and Wilmsmeier (2014) stated that the marine sector's commercial aspect leads to information imbalance among stakeholders since one party's information may not be readily accessible. On average, one to two hours required to move and re-order the containers, given the timetable of the vessels at seaports. This will result in more container vessel emptiness and harm the ports' reputation with its customers. On the other hand, ports and inland ports working together may improve port efficiency by decreasing vessel turnaround time and minimizing demurrage costs for shipping lines. Therefore, information communication technology is required to coordinate information across the port system.

RQ3: Does the competition with seaport and inland terminals have an effect on the development of an inland port at Bukit Kayu Hitam? The findings from other journals show that few researchers reflect on competition between seaport and inland terminals that affect inland port development. In certain circumstances, seaports and inland ports are unable to comply, preferring to compete for dominance of the cargo industry. The competitive partnership between seaports and inland ports has complicated container transfers between seaports and inland ports (Cullinane et al., 2012). However, inland ports and seaports are components of container seaport systems, and competition among them will enhance their performance more individually than collectively. Inland ports will face competition with inland terminals due to the length of time spent and its distance from and at the seaport. Apart from their time advantages and distance, inland ports may withstand competition by offering unique services from other inland terminals. This method may help inland ports gain more customers and decrease competition from other inland terminals (Jeevan et al., 2016). To conclude, a lack of cooperation with seaports will not utilize the inland port's capability. Also, without the connectivity and time advantage, inland ports cannot survive competition by not providing differentiated services from other inland terminals.

RQ4: Does the high-cost labour and manual in cargo inspection have an effect on the development of an inland port at Bukit Kayu Hitam? According to the overall analysis of publication trends in this field, it is clearly stated that recently, there has been serious interest in evaluating labour costs and non-automatic cargo inspection as significant issues at ports operations. Highly trained labour at inland ports eliminates avoidable errors and operational lapses, which lowers delays and ensures the seamless functioning of seaports. According to FDT (2007), a skilled team with the appropriate degree of competencies must run the inland port to minimize delays at seaports.

Using the experienced labour at PBCT may help decrease operational inefficiencies, attract new Thai customers, and enhance container delivery timeliness to other ports. It shows that the operations at inland ports need highly trained labour and the labor cost will be high because of the new development inland ports at BKH. In addition, cargo inspection is a crucial part of international trade. Cargo inspections can be used to prevent smuggling and evasion of customs duties (Zin, 2019). To adapt to non-automatic cargo inspection at BKH inland port, they can install the high-tech clearance facilities to reduce stay times at the inland port, including establishing an auto-gate system, a fast lane, and integrated cargo systems, or 'I-Care' (CDP, 2016). To summarize, by not providing professional workforce from different organizations, inland port cannot reduce the labour cost. Additionally, there are limitations in fund

allocation caused by inland ports unable to provide these services at the required standard and are still reliant heavily on manual procedures for operations.

Conclusion

This article reviews the development of inland ports and its associated challenges. This study performed a comprehensive review of the literature in inland ports to address their roles and functions and identify challenges to inland port development. Inland ports confront a variety of challenges, which differ by country. The primary challenges were transportation infrastructure and operations, information sharing, competitiveness, high-cost labour, and non-automatic cargo inspection. Furthermore, this research adopted a qualitative method research methodology, consisting of a qualitative phase comprising the literature review from other researchers. The SLR utilized in this study was used to better understand the current academic literature on the challenges associated with inland port development and evaluation and offer helpful ideas for future research.

Last but not least, propose BKH inland port should focus on efficiency to assist container seaports and boost its competitiveness. As a result, it is essential to overcome the present difficulties confronting inland ports, both in financial and operational infrastructure. Notably, coordination and cooperation between inland ports, seaports, and other stakeholders may benefit all parties involved and help boost Malaysian national and international commerce. Additionally, the expansion of inland ports in Malaysia strengthens seaports' ability to handle substantial container traffic and throughput from the foreland and hinterland.

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Conflict of interest

The author confirms that there is no conflict of interest with any parties involved with this study.

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