

FRAMEWORK FOR COLLABORATION AMONG PORTSTAKEHOLDERS: LITERATURE REVIEW AND CASE STUDY

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ABSTRACT

Port is the main link in the distribution and transportation systems, and as an interface between sea transportation and other transportation modes. Competitive position of the port is not only determined by internal forces, but also influenced by the performance of the supply chain network. Port performance is affected by the strategy adopted by each of the stakeholders. Each stakeholder in each entity has a different purpose, interests, policies, management and ownership and there may be collaboration as well as competition and rivalry among them. Port does not only play an integral component of the transportation system, but also as a major sub-system of the global production system, an important node in the supply chain and a key component in determining the competitiveness of a country's economy. Therefore, collaboration between stakeholders of the port became an important and strategic issue to be discussed. Collaboration can determine the efficiency and effectiveness of operations of each entity, and may improve the overall performance of port operations, which in turn can improve the competitiveness of the port. In the supply chain literature, collaboration has been a topic much discussed, but collaboration involving port stakeholders only received very little attention. This paper presents a framework for collaboration between port stakeholders based on existing literature, and presents a case study of collaboration among them. We investigate current conditions, opportunities, barriers and challenges in the implementation of collaborative strategies. The application of windows slotssystem, berth guaranty, and a dedicated terminal in the port operations and how these could improve resource utilization are among collaborative issues that are discussed.

Keywords: port collaboration, horizontal collaboration, vertical collaboration, resource sharing, case study.

1. INTRODUCTION

Ports and terminals are widely recognized by researchers and practitioners as one of the important components in the supply chain activities (Tongzon et al. 2009). Ports are required to adapt to the needs and demands of the global supply chain. To meet these demands, ports should develop and implement collaborative strategies (Woo et al. 2013). Integration and collaboration are needed in particular to overcome the limitations of production capacity as a result of the limited resources of the port (Donk et al. 2008). Donk et al., (2008) refer to Van Donk and Van der Vaart (2004) point out that the resource sharing will trigger companies to collaborate. The main activities of the collaboration is to share resources and capabilities that make the players work together to create mutually beneficial results (Bahinipati & Deshmukh 2012).

Ability to provide services to the shipping lines is partly determined by the superstructures and infrastructure owned by the port. These services are facilitated with windows slots, defined as a schedule of arrival and ship service. Services performed by the port is affected by uncertainty, especially the uncertainty of arrival of the vessels. The most common causes are delayed departure from the previous port, the technical condition of the vessel damage and disruption, and the weather factors. Wang and Meng, (2012) divide ship disruption in two categories of uncertainty, namely uncertainty at sea and in port. Uncertainty in the sea includes bad weathers such as rain, snow, wind, tornadoes, storm, and tides. Uncertainty in ports is represented by various things such as lack of experience in navigating the vessel master, berth planning system, fluctuation of the crane handling and efficiency, and variation in the number of containers handled each week.

As stated above, port is naturally complex due to many entities that interact and influence each other while each of them could have different characteristics and interests (Bichou & Gray 2005). There have been little discussion in the literature that addresses the integration or collaboration in the port supply chain. More specifically, only a few discuss horizontal collaboration between terminal operators in the port. The purpose of this paper is to explore the opportunities, challenges and barriers in horizontal collaboration between terminal operators in the port. This research is exploratory in nature. Data was collected through semi-structured interview involving the operational and planning manager at a major container terminal in Indonesia.

The next section of this paper will present theoretical overview related to supply chain collaboration, port characteristics, and horizontal collaboration. This will be followed by a case study, related to windows and berthing slots contract, and berthing systems. The fifth section discusses results, in particular the obstacles to collaboration, opportunities and challenges in implementing the strategy of horizontal collaboration. The final part of this paper is the conclusions and suggestions for further research.

2. SUPPLY CHAIN COLLABORATION AND PORT CHARACTERISTICS

Collaborative supply chain is defined as two or more companies working together to plan and implement supply chain operations to create competitive advantage and achieve higher profits than when working alone (Simatupang & Sridharan, 2005). Collaboration in the supply chain network is done with the aim to reduce transaction costs, increase resources sharing, learning, and knowledge sharing (Cousins & Menguc, 2013). Woo et al., (2013) defines strategy in the port supply chain integration as a strategy undertaken to integrate the various functions and organizations in the supply chain to become an integral part of the supply chain. Song & Panayides, (2008) defines the terminal supply chain integration as the extent to which port establishes systems and processes and perform the relevant function to become an integral part of the supply chain. Port is an integral part of the supply chain, so that in addition to the internal efficiency and performance, port should also facilitate the efficiency and performance associated with the supply chain.

Container terminal is a place for the loading and unloading of container ships and a key point of sea transport network (Hsu 2013). Woo et al., (2013) suggested that one of the five components in the port supply chain integration is a long-term relationship. Tongzon et al., (2009) discuss that the success of the collaboration is determined by how the orientation of which is owned by the port and terminal operators collaborate. The success of the terminal operator to realize the collaboration is important in order to improve customer service and hence creates excellence and competitiveness (Tongzon et al., 2009).

One of the main challenges is the complexity of port operations due to the many parties involved and the complex nature of business processes (Cullinane et al. 2006). Coordination is necessary to avoid operating with high costs, improve service, and avoid suboptimal use of resources. Port is an important part of the cluster of logistics and transport operators with the ultimate goal of bringing value to the end customer (Song & Panayides 2008). Bichou & Gray, (2005) proposed a supply chain approach for developing port taxonomy.

Song & Panayides, (2008) mention that the container terminal is a central actor in the supply chain. Each terminal is managed by different terminal operator company. Therefore, the ability to integrate stakeholders in the port becomes interesting to discuss. The purpose of integration of the port is to create synergy or collaboration to convert interest among players in the port community in ensuring the reliability and sustainability of the service level of goods and services (Carbone Valentina & Marcella 2003).

The main activities of the collaboration is to share resources and capabilities that make the players work together to create mutually beneficial results (Bahinipati & Deshmukh 2012 ; Lin et al. 2013). Tongzon et al., (2009) suggested that the port could benefit by doing the relationship with stakeholders. Asset share has been proven to increase profits and enhance its service level. Hoshino, (2010) discusses the need for a balance between competition and cooperation among ports. In cases where several ports in Japan is steadily declining due to not being able to compete, a collaboration between the container terminal is needed to improve the ability to compete and create competitive advantage. Hoshino, (2010) found that some ports started doing sales and promotion of cooperation, simplification of procedures, cooperation in repositioning to maintain the availability of empty containers, even it is possible to cooperate in financial and investment equipment (Hoshino 2010).

Several studies were also performed to determine the correlation between collaboration with supply chain performance. Lorentz, (2008) examine the export-import collaboration activities carried out among companies across Russia and Finland borders, and concluded that the cross-border collaboration has a positive correlation to performance. Pramataris & Papakiriakopoulos, (2010) developed a performance measurement indicator system to measure the performance of companies that do a collaboration. The results show that collaboration can improve the performance of the company. Hsu, (2013) also conducted a study of container terminal operations in the customer perspective. Yeo et al., (2011) identified seven factors that affect the performance of the container terminal port service, hinterland condition, availability, convenience, logistics cost, the regional center and connectivity.

The integration of ports and terminals within the framework of the supply chain has been discussed at least by Song & Panayides, (2008) and Woo, (2013). Horizontal collaboration is done to improve operations at the port which is expected to bring improvements on the service level of ports and terminals, which will ultimately improve the performance of the supply chain. Some authors see the port as an entity in the supply chain. With this view port is only seen as one node, however when seen in more depth, the port consists of a couple of entities, where one another has mutual influence (Heaver 2010). Cullinane et al., (2006) say that the main challenge facing the port is that

port naturally has complex operations as a consequence of the many parties involved (export-import) and the complex interactions that occur between the port operations.

3. HORIZONTAL COLLABORATION

In some of the literature mentioned there are two types of collaboration, vertical and horizontal. Vertical collaboration occurs when a company seeks to establish partnerships and forming relationships with some of the parties in the supply chain at different levels. The goal is to avoid unnecessary logistics costs. Strategic cooperation can improve response to customers by identifying ways to reduce or eliminate excessive costs, to improve the quality and reliability as well as increasing the speed and flexibility (Tongzon et al. 2009).

Traditional approaches typically use vertical collaboration strategy through acquisition or merger. Consequently, the organization is not lean, the obstacles are not able to respond quickly in a very complex market, on the other hand the company has limited efforts to expand and find it difficult to create a competitive advantage (Du 2007). To respond to this, companies must invest in large numbers, and when the economy grows unstable or fluctuating, it will be difficult for companies to make large investments in order to avoid the risks that arise in the long term. The company began to make the transition from vertical strategy to horizontal strategy.

Horizontal collaboration refers to joint activities of the company at the same level to reduce costs, improve service, and improve performance (Lozano et al. 2013). Horizontal collaboration is a business agreement between two or more companies at the same level in the supply chain or supply chain network so it is easier in working and cooperating to achieve the same goal (Reniers et al., 2010; Cousins et al., 2008). This can be achieved by taking appropriate action, utilizing and sharing resources such as machines, technology and labor (Bahinipati et al. 2009). Horizontal collaboration can potentially lower prices, reduce supply risks, reduce administrative costs. On the other hand it is useful as a group of network members to communicate and interact with each other. With this model, the company can not only enhance the core competence, but also helps companies that collaborate to avoid large investments and high risk (Bahinipati et al. 2009).

Collaboration must be mutually beneficial for the partners, although the benefits received are not to be divided equally, but based on the contributions made. Thing that needs attention is that the benefit received by the partner must be greater than the benefits received when done alone. Benefits received are not always in the form of financial and in a range of short-term, but may be non-financial and long-term. Collaboration should include the willingness to bear risk (risk sharing). Horizontal collaboration can reduce logistics costs (Yilmaz & Savasneril, 2012; Lozano et al. 2013). Mason et al., (2005) suggests there are two important reasons why transportation is a strategic business function, namely (1) the cost of transporting a large proportion of the cost of production, (2) there is a strong correlation between customer service levels and performance of transportation. However, the integration and collaboration may not work smoothly. Defee & Stank, (2005) suggested several factors that affect the success of the collaboration, including the existence of dominance and power, the level of competition in the industry, the maturity of the company, and the nature of the product.

Lorentz, (2008) stated that there is a component that allows the type of collaborative relationship, namely involvement in planning, controlling joint operations, communications, risk and reward sharing, trust and commitment, the nature and the scope of the contract, and investment. In the context of port terminals in addition to having to pay attention to these factors, other factors should also be considered such as geographical location, customs service, and administration.

4. FRAMEWORK

Figure 1 shows the horizontal collaboration framework, consists of four components, drivers, challenges, opportunities, and performance. The components were obtained based on the literature review and case studies. Capacity constraints and uncertainty encourages companies to collaborate. Collaboration is influenced by the opportunities and challenges, and barriers. With capacity constraints and uncertainty, horizontal collaboration is expected to improve overall supply chain performance. Horizontal collaboration by means of joint planning and operation, and asset sharing can improve operations capability. Operations capability can improve asset utilization and flexibility of operation. Service levels can be improved by increasing asset utilization, while improving operating flexibility can have positive impacts on the throughput. These will ultimately increase profits.

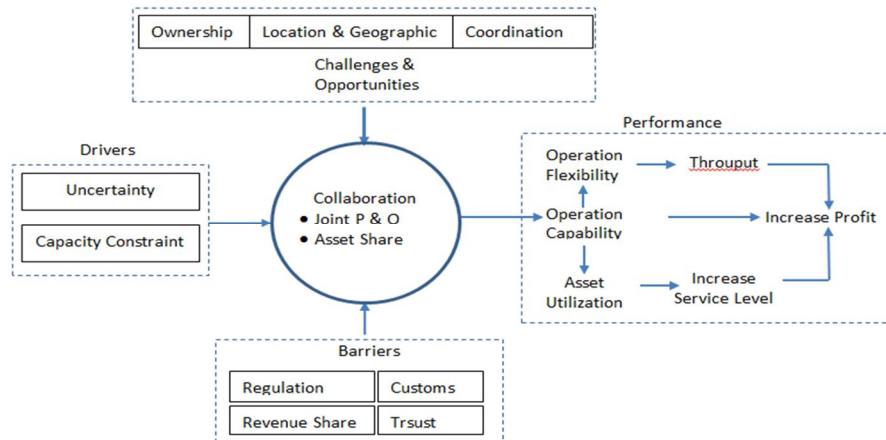


Figure 1. Horizontal Collaboration Framework

4.1. Drivers

There are two factors that drive collaboration, that is, capacity constraints and uncertainty. These two factors are interrelated to one another. Capacity constraints may be represented by the capabilities of infrastructure and superstructure such as length, width, and depth of the berth, container cranes, RTG, truck and container yard. Uncertainty may be divided into three groups, namely the ships arrival uncertainty, service uncertainty of the vessel, and cargo handling uncertainty in the terminal. Each component is described below.

- *Capacity constraint.* There are three possibilities for the capacity constraints that encourage collaboration, namely the lack of capacity, excess of capacity, and investment constraints (Wu et al. 2014). Excess capacity led to the existing facility being underutilized. The decision to increase the capacity is constrained by the limited availability of investment funds, regulatory constraints, and constraints due to technical problems. Available resources should be utilized appropriately and improvements of utilization can be achieved through horizontal collaboration (Bahinipati et al. 2009).
- *Uncertainty.* Uncertainty is divided into three categories, namely the ship arrival uncertainty, service uncertainty of the vessel in port and cargo handling uncertainty.
 - *Vessel arrival uncertainty.* Vessel uncertainty in the sea, including bad weather such as rain, snow, wind, tornadoes, storm, and tides (Wang and Meng, 2012).
 - *Vessel service uncertainty.* Uncertainty in ports due to such factors as lack of experience in navigating the vessel master, berth planning systems, fluctuation crane handling and efficiency, and variation in the number of containers handled in each week.

- Cargo service. Uncertainty due to the allocation and productivity of equipment, congestion in the terminal and container yard.

4.2. Opportunities and Challenges.

Opportunity and challenges are factors that support the occurrence of horizontal collaboration.

- *Ownership.* The success of the collaboration is determined by how each party see the value of collaboration while each party is an independent business entity (e.g., port and terminal operator). Important variables are related to the effect on the initiation of the collaboration of different entities and their willingness to collaborate (Ankersmit et al. 2014). Still few are discussing the influence of ownership on the success of a collaboration, but it can be said that the orientation of the owner will determine the success of the collaboration.
- *Geographic location.* Based on the survey results, in particular the joint operation of horizontal collaboration and asset sharing between terminals, may not be done if the terminal does not support location. Ideally to support collaboration, the berth should be at the same location (connected).

4.3. Barriers

To realize the collaboration, there are several challenges that must be faced, namely:

- *Trust.* Trust refers to the belief of an organization in the ability of other organizations. Anti-trust is distrust in the ability of the other party, which may be a barrier to collaboration (Bahinipati & Deshmukh, 2012; Reniers et al., 2010).
- *Coordination.* The success of collaboration is largely determined by the coordination between the parties, which is costly and takes a long time to realize(Lozano et al. 2013), but it can be useful to improve the trust (Wu et al. 2014).
- *Revenue Sharing.* One of the barriers in the collaboration is to determine the division of revenue or profit (Lozano et al. 2013). Collaboration must be mutually beneficial between the partners, although the benefits received are not to be divided equally, but based on the contributions made. Benefits received are not always in the form of financial.
- *Regulation.* Associated with the applicable laws and regulations, particularly those governing the management of ports and terminals. The discussion on the regulation has not been done, but it is necessary to include this factor as one of the factors that can hinder collaboration.
- *Customs.* Based on interviews with managers of the terminal, customs can be one of inhibiting collaboration.

4.4. Collaboration Process

- *Joint Planning and Operation.* Joint planning is a strategic component in the collaboration (Thakkar 2012) which can be used to improve the performance of the two different systems (Kim & Cavusgil 2009). Joint planning and operation is also based on trust and equity, there is a shift in responsibility for the entire party (Braziotis & Tannock 2011). Joint planning and operation can improve the performance particularly in the long-term financial performance (Zhao et al. 2013). Horizontal collaboration can be done by means of capacity sharing, joint planning, and handling service (Ankersmit et al. 2014).
- *Asset Share.* One way that can be taken to achieve a competitive advantage in the collaboration is through resource sharing (Mena et al. 2009). Mena et al., (2009) assert that collaboration means working together to utilize the resources necessary to achieve effective operation in

accordance with the strategy and objectives of the parties involved. It takes trust, expertise, and good ability to integrate its resources. The success of the company in assets sharing depends on the ability of the company to make projections of customer demand changes. Resources sharing in the context of horizontal collaboration in the container terminal can reduce costs, particularly the cost of transportation (Ankersmit et al. 2014), and improving performance (Reniers et al. 2010).

4.5. Performance

Horizontal collaboration could provide benefits such as lower price, reduced supply risk, reduced administration costs (Wilhelm 2011), cost savings; (Wu et al. 2014), better access to market, pooling or swapping of technologies and production volumes, access to specialized competences, lower risk of R & D, enjoying the larger economies of scale, benefiting from economies of scope, etc. Horizontal collaboration could help companies to focus on improving productivity and profit (Reniers et al. 2010).

Lozano et al., (2013) suggested that the benefit of horizontal collaboration is the result of a resume of some authors. Here are some of the benefits that can be obtained from collaboration:

- 1) Financial opportunities: a potential for cost reduction provides a strong incentive to partner. Closer collaboration may lead to cost reductions in different areas like transportation, inventory, handling or development;
- 2) Service level enabled through collaboration: integrating activities in the supply chain through partnerships can often lead to service improvements for customers, e.g. in the form of shorter lead times, increased delivery frequency and more timely and accurate information;
- 3) Market position: collaboration can enhance companies' competitive position or market power, provide entry into new markets and access to technology and innovation to stimulate product development;
- 4) Return on collaboration investments: return on investments is often a strong driver for partnerships. By achieving profit stability or growth in the collaborative agreement, a relationship is strengthened, often leading to long-term commitments, reduced variability in sales, and joint use of assets.

5. CASE STUDIES: JICT and Koja Container Terminal

Case studies conducted on two container terminals are located at Tanjung Priok Port. Port of Tanjung Priok has five container terminals, namely the Regional Harbour Container Terminal (or known as berth 009), berth 300, Terminal 3, Koja Container Terminal, and Jakarta International Container Terminal (JITC). To discuss horizontal collaboration strategies in particular sharing resources and joint operation, only two terminals are discussed in the case studies, the TPK Koja and JITC. There are three reasons for choosing these two terminals. First, both are the biggest terminals in Tanjung Priok Port. Second, both are in the same location and the same side. This is a main prerequisite for joint operation. Third, both terminals are owned by the same company. Infrastructure and equipment owned by the both terminals are showed in Table 1.

Tabel 1. Infrastructure and Equipment

Description	TPK Koja	JICT 1	JICT 2
Berth			
Length	650 m	1640 m	510 m
Width	40 m	26,5-34,9 m	16 m
Draught	-14 m	-11 s.d -14 m	-8,6 m
Container Yard			
Area	25,72 Ha	45,50 Ha	9,24 Ha
Capacity		39.884 TEUs	7056 TEUs
Ground Slot			
Export	7696 TEUs	1027 TEUs	104 TEUs
Import	7560 TEUs	693 TEUs	200 TEUs
Reefer	310 plug	564 plug	78 plug
Equipment			
Quay Crane Container	7 bh	16 bh	3 bh
Rubber Tyred Gantry Crane	25 bh	63 bh	11 bh
Head Truck	48 bh	128 bh	13 bh
Chasis	60 bh	128 bh	21 bh

(Source: IPC 2, Annual Report 2013)

Determination of Production Capacity with Windows Slot

One of the activity that is important here is to determine the number of vessels that could be serviced by the slot windows system. Determination of windows slots is done by considering the infrastructure and equipment owned terminals, such as length, width and depth of the berth, the number and capacity of container cranes, number and capacity of RTG, extensive container yard, and the number of trucks. The length and depth of the berth determine the number of vessels that can be served.

Berthing Contract

Based on availability and the capacity, the terminal offers windows and the availability of facilities owned (such as container cranes, RTG, container yard, and the number of trucks) to the shipping company. Instead, the shipping company delivering ship schedules and data services to the needs of the terminal. The data presented include technical data and projected volume of cargo ships. If both parties agree then in the next process, particularly on berthing contract signing, which includes berthing schedule, the estimated capacity (week/month/year), and duration of contract will be decided. With berthing contract, both shipping line and port/terminal have agreed to respect the use of windows slots. The windows contract can be composed of multiple services. Only vessels registered in the berthing contract are eligible for services.

Open Stack

Open stack is a policy provided by the terminal to export container stacking. Closing time period is given by the terminal to take container imports. JICT and Koja Container Terminal deploy an open stack policy consecutive H-4 and H-5 of ship arrivals (ETA) and the closing time of H + 4 and H+5 of the ship's departure time (ETD). Early stack can be done with very special considerations, and subject to progressive tariff. If the container is not taken after the deadline passes, then the container will be moved to a temporary store (overbrenge) and progressive tariff is imposed. Shipping line (or consignee) will be charged progressively.

Berthing Policy and Uncertainty

By the agreement through berthing contract, the operator terminal or shipping lines should commit to fulfill the agreements. Berthing agreement in contract usually consists of two things, namely unloading volume and berthing time. In regard to berthing, it is crucial to make berthing accuracy in accordance with a predetermined schedule. Incompatibility of ship arrival schedule to make berthing can affect the overall schedule, particularly for the ship concerned and also the possibility of another vessel will be disrupted. Shipping company has to update the position of the vessel to the port and in particular to the operator terminal. Furthermore, the shipping lines and terminal address will determine the estimated time of arrival (ETA) of the vessel and the estimated time of departure time (ETD).

The cause of delayed ship can be affected by many factors, but the most common one is the delay from the departure of the ship from the earlier port, the technical damage of the vessel, and weather factors. Wang and Meng, (2012) divide ship disruption in two categories of uncertainty, namely uncertainty at sea and uncertainty in port. Uncertainty in the sea may include such factors as bad weather such as rain, snow, wind, tornadoes, storm, and tides. Uncertainty in ports may be due to lack of experience in navigating the vessel master, berth planning system, fluctuation crane handling and efficiency, and variation in the number of containers handled at each week.

JICT and Kojana Container Terminal impose a tolerance policy with time delay but still included in windows slots. There are at least two considerations, the first was the estimated time required to perform loading and unloading. The second consideration is vessels that are potentially affected by the delay and hence may have to be reallocated / moved to a different berthing time. Illustration in Figure 2 exhibits four different situations. The left part represents the first ship while the right part is for the second ship. In (a), both ships arrive at their given time window. In (b), the first ship arrives late and occupies berth until the ETA of the second ship, but causing no service delay for the 2nd ship. In (c), the first ship is late and the departure time enters the windows slot of the second ship, but given the second ship is also arriving late, no delay in its service. In (d), the arrival of the second ship is earlier than the departure of the first ship and hence, it has to wait until the berth is available.

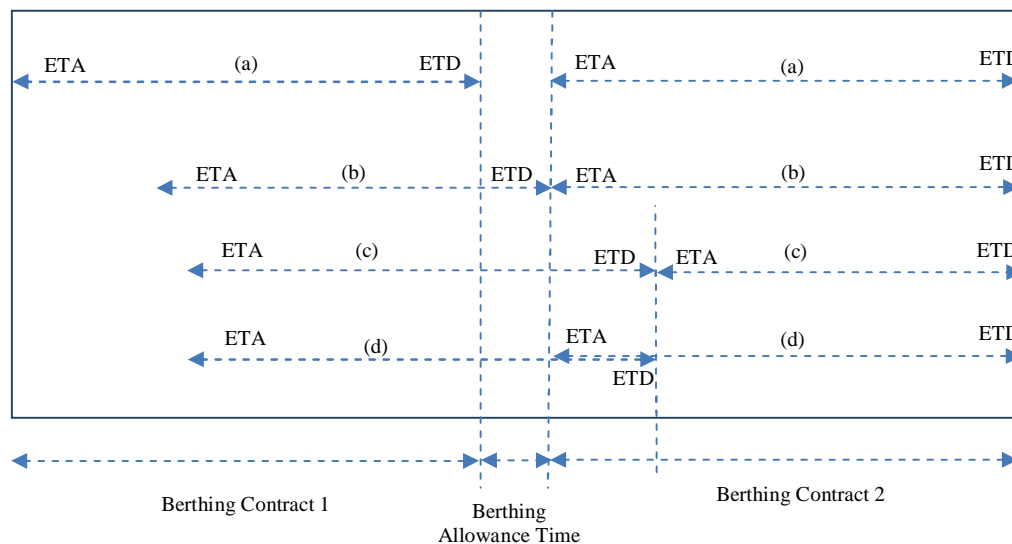


Figure 2. Berthing System

If the ships can not be served, then the ships will wait at the pool to get permission for berthing. In such conditions, ships must bear the cost of operations while waiting in the pool. In some cases ships usually consider looking for alternatives to make berthing at other terminals. If the ships decides to berthing at other terminals, ships could only do the loading, because the container to be loaded has been prepared in advance to do a stacking where the ships has a windows slots. The consequence is that the shipping lines must bear the cost twice as much, that is to berthing at another terminal and back to the terminal where the container is stacked.

Another condition that occurs when ships do not come in accordance with windows is to use the remaining time in the windows for berthing. Usually ships into account and decide the number of containers that must be unloading and the number of containers that can be loaded. For this condition usually ships containers should prioritize in prior of loading and utilizing the remaining time to be fully utilized to load the container. Obviously here there will be no whole container can be loaded. Decisions must be taken to minimize the accumulation of delays in the next port, the risk is the entire container can not be loaded. Shipping lines will consider the overall of the cost of waiting for the costs that must be paid, including costs complain of container that can not be transported.

6. DISCUSSION

Uncertainty is a factor that can not be controlled, both by shipping lines or by port authority. In general, higher level of uncertainty should be coped with better flexibility. However, flexibility in terms of capacity is not an easy matter in port. Most ports have a fixed capacity while demand for serving ships is highly uncertain. While increasing flexibility by adding capacity is costly, an opportunity to work with lower level of capacity but with better service level may be achieved through collaboration among port operators. Under demand uncertainty, collaboration in terms of resource sharing as discussed earlier in this paper can potentially improve service level as well as resource utilization. The discussion on various aspects of collaboration between port terminal operations has been in the literature for some time. Ankersmit et al. (2014) suggest that capacity constraints and higher uncertainty encourages the terminal operators to increase their capacity or to collaborate. Heaver, (2010) revealed that there is a strong desire among existing firms in the supply chain network to collaborate in order to improve the reliability either individually or as a whole supply chain. Resources or assets share could be used together in order to create a mutually beneficial outcome (Bahinipati et al. 2009); (Bahinipati & Deshmukh 2012). Horizontal collaboration can be done by way of capacity sharing, joint planning, handling service (Ankersmit et al. 2014).

Some authors argue that horizontal collaboration can reduce costs (Lozano et al., 2013; Wu et al., 2014; Reniers et al., 2010; Juan et al., 2014). But there has been no empirical study that investigate how collaboration can reduce costs (in terms of horizontal collaboration in port). Horizontal collaboration emphasis on asset utilization (Bahinipati et al. 2009; Ankersmit et al. 2014) that have an impact on increasing service levels. Service level will have an impact on the berthing time. Berthing time would have contributed to the shortening of the dwelling time and delivery time, as well as fuel consumption.

Tabel 2. Existing condition, barriers, opportunities and challenges of horizontal Collaboration

Factors	Existing Condition	Opportunities	Barriers	Challenges
Uncertainty	High uncertainty of the ship arrival causes the ship does not dock on shedulle.	Berthing Flexibility (Docking flexibility)	Assignment of equipment Revenue allocation	Distance fromstacking area
Berthing contract	Separate based on internal capacity.	Joint capacity	Administrative and Legal contract	heterogeneous and contract flexibility
Berthing system	Separate is causes asset unutilized (idle) or queuing (over capacity) due to berthing uncertainty	Joint Operation Rearrangement windows slot	Schedulle uncertainty Revenue sharing	Berthing Flexibility due to uncertainty
Layout &Geografis	Berth is connected. Availability & Feasibility Infrastructure movement.	Joint planning and operation	Administrative and Legal contract Revenue sharing	Proportional sharing dan win-win solution.
Infrastructure and Superstructure Utilization	Asset unutilized (idle) or queuing (over capacity) due to berthing uncertainty	Joint planning and operation	Revenue sharing and coordination	Revenue sharing
Ownership	The same owner (IPC2 & HPI), operational separately	The same owner	Legal administrative	Owner Orientation

Barriers such as trust (Bahinipati & Deshmukh, 2012; Reniers et al., 2010), coordination (Lozano et al. 2013); (Wu et al. 2014), and revenue sharing (Lozano et al. 2013) in the context of collaboration between JITC and Koja Container Terminal can be easily overcome as there is no ownership issue, that is, the two are owned by the same party. For different terminals, ownership issue will remain a barrier. These barriers may be reduced if there is a strong motivation, encouragement and orientation of these companies to collaborate. Reniers et al., (2010) stated that the collaboration-oriented company has the capability and willingness to collaborate. Another obstacle that needs attention is the existence of different regulations that govern the ownership of the operator terminal. There are constraints pertaining the administrative requirements related to customs. Table 2 show a resume of the current conditions, barriers, challenges and opportunities in implementing horizontal collaboration.

7. CONCLUSION

In this study we have developed a framework of horizontal collaboration among port terminal operators. As arrival of vessels in port is highly uncertain, horizontal collaboration is believed to improve both service level and facility utilization. We also presented the results of a field research in a large port in Indonesia to obtain insights on how the horizontal collaboration works, the opportunities, and the challenges. Our preliminary results suggest that the success of horizontal collaboration is determined not only by the willingness of the port operators to collaborate, but also the setting of the port infrastructure. Sharing resources for loading and unloading, for example, would be possible if the two or more collaborating parties manage facilities which are physically adjacent so that vessels could have an easy alternative for berthing. This study will be extended to include more in depth case analysis to map the current state of horizontal collaboration. Adding other ports as a case would also be an important extension from this study. In addition, we aim to also do some modelling work to evaluate different collaboration mechanism and its impact on business performance of the collaborating parties.

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