

# Supply Chain Performance Measurement of Logistic Business Using SCOR Model in the Indonesian Main Ports

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**Abstract**— The aim of this research is to know and evaluate appropriately the process of Supply Chain Management measurement of the port operators in Indonesia. The targets of this research are some sea transportation companies, especially stevedoring companies in Surabaya, Semarang, and Jakarta. The experienced stevedoring companies in these ports will be able to help direct university students in the process of Independent Learning Independent Campus) in Indonesia through internship programs. The main problems in the delayed loading-discharging process are on the Stevedoring Labours, especially in the Port of Tanjung Perak, Surabaya, and the Port of Tanjung Priok, Jakarta, as well as non- Stevedoring labours in the Port of Tanjung Emas, Semarang. This study uses qualitative descriptive analysis with SCOR method through five measurement processes, namely Plan, Source, Make, Deliver, and Return. The loading-discharging condition in the three major ports in Indonesia becomes a benchmarking in this research. The research sample consists of some company leaders in the transportation and logistic industry as informants from FAB Enterprises group in Surabaya, Pelindo branch of Tanjung Emas Port, Semarang, and Pelindo Regional 2 branch of Tanjung Priok Port, Jakarta, as well as STIAMAK Barunawati, as academic institution in Surabaya. The findings of this research are knowing the determination of Dwelling Time related to the desired Container Yard in the port as the temporary warehouse of stevedoring company and the management of Stevedoring Labours in the port that must be paid attention.

**Keywords**— Supply Chain Management, Supply Chain Operational Reference, Stevedoring Labours, Dwelling Time, Stevedoring Labours.

## I. INTRODUCTION

### A. Background

Supply Chain Management in general is a series of activities that include planning, setting, and scheduling the product flow starting from procurement to distribution to consumers. Through Supply Chain Management, supply chain is designed in such a way that it can be carried out most effectively and most efficiently. Supply chain is a continuous process, starting from raw material purchase up to finished product, with some functions such as sales forecast, purchasing, production, distribution, sales and marketing, and with three main flows, namely materials, information, and money. Supply Chain Management has represented a new frontier to obtain competitive advantages. This study provides information to supply chain decision makers for the following questions: (1) How is the supply chain performance measurement?; (2) How does supply chain performance measurement use SCOR method? (3) How are the problems and challenges of supply chain process in the implementation of loading-discharging in the port? and (4) How to handle the problem of Stevedoring Labours in the port?

Based on the existing background and problems, the aim of this research is to analyze and evaluate the performance value of Supply Chain Management and optimize the improvement strategy than can be implemented in several Indonesian ports by using SCOR method.

In the research of loading-discharging in the port area according to [1], the factors that affect the different productivity of loading-discharging process are equipment and the depth of mooring pool. The use of SCOR integrated approach is to measure the performance of supply chain in the case study of company's real life especially Third Party Logistic Provider (3PL) [2]–[4]. They discuss how to take advantages of the third party's logistics to improve the performance of supply chain and conceptually discuss the relationship between 3PL and the performance of supply chain kinerja. Meanwhile, the study [5] assumes that the Fourth Party Logistic Provider (4PL) have necessary skills to manage and give added value versus internal solutions. Whereas [6], also explains the positive influence of 4PL in the complex disaster environment and give and provides key drivers to enhance and simplify the collaboration among humanity supply chain actors.

## II. LITERATURE STUDY AND HYPOTHESIS

### 1. Supply Chain Management

Theoretically, Supply Chain according to [7], [8] is a process from supplier through factories and distribution to end customers. It is an activity of managing various activities to change raw materials to become finished products and sent through a distribution system to consumers. Supply Chain Management manages the flow of information, products and services in the whole network, either customers, companies, or suppliers [9], [10]. In addition, Supply Chain Management according to [11], is an individual process of supply chain like

procurement, production, inventory and retail management through a possible process integration, digitalization and automation, and results in new analytical skills. Supply chain performance measurement frequently uses SCOR as guidance. Supply chain according to [12], [13], many parties are involved, both directly and indirectly, in fulfilling customer request. Supply chain includes not only producers and suppliers but also transporters, warehouses, retailers, and even the customers themselves.

## 2. Loading-Discharging

Theoretically, loading-discharging activities include; (1) stevedoring; (2) cargodoring; dan (3) receiving; and (4) delivery [14],[15]. Stevedoring in the port needs to pay attention to the labour safety which is mediated significantly by the safety management supervision [16]. The result of research [17] reveals that infrastructure improvement will increase the productivity of port operation. According to [18] the efficiency of loading-discharging process in the port can minimize the ship cost budget. Meanwhile, the findings of [19] indicate that simultaneously container weight and the number of gang have a significant influence on the loading-discharging productivity.

Furthermore, the findings of [21] in Australia confirm that the initiation of stevedoring activities is a challenge to organizations including the less confidence at the workplace, high individualism, less resources. In the findings of [20] there are five variables that significantly affect the cause of idle time, and the operator activities in the gate-in process give the most significant influence to the idle time in the port services. Previous finding by [22], shows a positive integration of Dwelling Time special for import container loading-discharging in the Port of Tanjung Priok. Finally, the decisive answer is how long can Dwelling Time occur and be affected by the relationship among Consignee/Freight Forwarder, Customs and Excises, and Terminal [23].

## 3. Stevedoring Labours

Stevedoring activities which involve moving and loading goods from vessel to the port or vice versa are related to the high risk of work accident [24]. In general, [25] explains that age, breakfast habit and work duration have a relationship with the work fatigue of cargo stevedoring personnel in the port. Other finding by [26] in the Port of Tanjung Priok, indicates that the preparedness of human resources also becomes a determining factor. Whereas in the periodic checking on the Terminal Operating System (TOS) according to [27], it is necessary to do periodic preventive maintenance of loading-discharging equipment, hold trainings to improve human resource skills for stevedoring personnels so that their performance can be improved.

Furthermore, finding by [28], states that the higher the stevedoring personnel's skill the higher productivity of container loading-discharging at the civil depot. The result of research [29] shows that the inhibiting factors from the labors cause less-than-optimal preparation of loading space and tank washing. Whereas in the Port of Tanjung Perak, Surabaya, [30], [31] say that the field supervisor must also do a tighter and more assertive supervision to the stevedoring labours. The result of another analysis [15] in the Port of Marunda, North Jakarta,

showa that the competency of stevedoring labours in using the stevedoring equipment is not appropriate to result in performance in the forms of smoothness, speed, and safety of cargo stevedoring.

## 4. Third Party Logistic Providers

The Third Party Logistic providers are usually specialized in the integrated operation of warehousing and transportation services that can be improved and adjusted in line with customer need, based on market condition, to fulfill the demand and requirements of delivery services for their products [32]. Services are often beyond logistics to include added value services related to production or procurement of goods, like the services that integrate the parts of supply chain. The integrated service providers are referred to as third party providers of Supply Chain Management, or as Supply Chain Management service providers.

3PL targets certain functions in the supply management, such as warehousing, transportation, or providing raw materials. According to [33], in a logistic discussion with Adrian Logistik, The Third Party Logistic providers (3PL) and outsourcing almost all possible logistic functions are the strategies that have been known, proven, and very rigorous that result in financial and operational performance efficiencies that almost directly help companies reduce the cost and improve the supply chain performance.

Logistics is the core competence of the Third Party Logistic providers. With the advantage in cost and time saving according to [34], the providers may have better relevant knowledge and greater skills than the producing or selling companies, and may have more global networks that allow bigger time and cost efficiencies as well. Equipment and Information Technology system for 3PL providers are continuously renewed and adjusted so as to be in line with their customer and supplier need. Frequently, the producing or selling companies do not have time, resources, or expertise to adapt to their equipment and system quickly.

One of the weaknesses according to [34] is the loss of control experienced by the clients who use Third Party Logistics. When the logistics come out, 3PL providers usually assume communication and interaction with customers or company's suppliers. To reduce this, some efforts are made by 3PL to claim them as their clients, such as applying the client's logo on their assets and dressing up their employees like the employees of their clients.

## 5. Fourth Party Logistic Providers

The Fourth Party Logistics (4PL) has appeared as an ideal solution that allows companies in the world from various industries to have one point of accountability in both supply chain and demand. Almost 90 percent of respondents in a study of end users excerpt the above reason as the main drivers to implement 4PL strategy. Companies gradually realize that it is getting more important in the global economy not focus only on the core activities but also non-core activities like remote supply chain management to keep competitive. In addition, they switch to 4PL to build a closer relationship among the participants along the supply chain, to support the cost reduction initiative, to develop flexibility in facing uncertainties

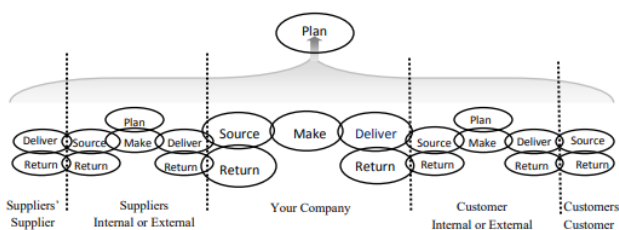
in supply and demand, and finally to have positive impacts on the bottom-line [35]. 4PL seems to provide competencies related to the available knowledge, information technology, and skills in building and maintaining a successful supply chain relationship [36].

### III. SCOR (SUPPLY CHAIN OPERATION REFERENCE) METHOD

One way to measure supply chain performance is by using SCOR (Supply Chain Operation Reference) method, and the Supply Chain Council (SCC) explains that the SCOR process stretches from suppliers to all customers [37]. SCC adds, the reliability of supply chain performance is the company's ability to perform a work as expected [38]. This SCOR Model is developed and is a modelling of supply chain improvement in developing countries. Now SCOR model includes all activities of suppliers, customers and all market interactions and consists of five core processes; (1) Plan, (2) Source, (3) Make, (4) Deliver and (5) Return which continue with the processes of categories, elements, tasks and activities (Figure 1) [13], [39]. SCOR Model according to [37], is a management tool used to overcome, improve, and communicate the Supply Chain Management decisions in the company and with suppliers and governments as customers.

SCOR Model is explained by [40] as a model that integrates business concepts from the processes of reengineering, benchmarking and measurement into its framework. In its development, five dimensions are used to determine the performance measurement, namely; (1) reliability, (2) responsiveness, (3) flexibility, (4) cost, (5) assets. SCOR Model consists of three top levels related to three processes at level 1. At level 2, which is a configuration level, it concerns process category, and level 3 is process element level. According to SCC, all performance attributes are interrelated by metric [41].

SCOR Model allows a leverage of capital management, creation of supply chain road map, alignment of business functions [37]. The implementation of SCOR model within certain limits is quite flexible and can be adjusted to enhance productivity in order to meet the needs. The measurement uses a series of structured metrics. In general, SCOR model has been applied through global market [39], [42], [43]. They add that SCOR 4.0 model can be used by public and private sectors to improve supply chain strategy in many countries [44]. Integration is fundamental in the use of all the equipment, resources, strategies and implementation of Supply Chain Management.



Source: [41]  
Fig. 1. Five Core Processes in SCOR Model

### IV. RESEARCH METHODS

This research is done in Jakarta, Semarang and Surabaya. Data is obtained from several port operators such as Pelindo Surabaya and Jakarta branches, stevedoring company like FAB Enterprises in Surabaya. This research is done for two weeks in the end of December 2021. It is a qualitative research using analysis model of Supply Chain Operating Reference (SCOR). The initial step in this research is identifying the supply chain processes of Stevedoring Company performed by FAB Enterprise. This step is done through a direct observation in the company to identify the problems existing in the research location. Subsequently, from the identified problems, problem formulation and research goal setting are made. The second step is data collecting and processing. Data from respondents is gathered through interviews with four informants from FAB Enterprise and Pelindo Surabaya branch and Pelindo Semarang branch. Next, the gathered data is analyzed. The steps of data processing include; (1) identifying the supply chain by observing the supply chain processes performed by the company, and then analyzed using the conceptual approach of SCOR version 11.0, (2) Determining the Performance Indicators based on the result of supply chain identification, and then putting them in the questionnaire.

### V. RESULTS AND DISCUSSION

#### A. Results of In-Depth Interviews

The objects of this research going through the process of in-depth interviews are the port managements as operators and stevedoring companies as executors in some ports in Surabaya, Semarang and Jakarta. Port operation activities involve stakeholders and collaborate with academicians in port administration, namely STIAMAK Barunawati in Surabaya. The interviews also involve student representatives from sea transportation and logistics department. The interviews take place in FAB Enterprises as the operator of Third Party Logistic (3 PL) or Fourth Party Logistic (4 PL).

#### 1. Participation of Partners in Activity Execution through In-Depth Interviews

##### a) In-Depth Interviews with the Management of FAB Enterprises, Surabaya

SCOR Method with Five Performance Measurements of Plan-Source-Make-Deliver-Return

The main businesses of FAB Enterprises are logistic industry, ship agency, logistic stevedoring and delivery from ship to factory warehouse. The company's main businesses concern the end to end proces until door to door process and many import activities especially from China. Cartel business is still dominated by Tempura, Meratus, and Pelni. Indeed, there is an imbalance in the growth of import and export; the national growth is usually seven percent, but now is still five to seven percent. The market share of the company comes from domestic expenditures and now mostly medical devices.

Mainly the business processes carried out by 4PL actors are; Customer Clearance, Stevedoring, Trucking, Heavy Equipment, Warehousing and Factory. Flour factory for import with wheat raw material is in Gresik. The supply chain movement monitoring by FAB is through Marine Traffic application. Other processes through Port Clearance, Bill of

Lading, Stowage Plan, Quarantine for discharging permission and as 4PL actor or coordinating some stevedoring companies through a good communication process with the responsibility is still in each Stevedoring Company. Every ship agency must have Business License of Ship's Agency. 3PL and 4PL are different in the asset ownership, and now FAB Enterprises has no competitor in the port although Pelindo actually can act as 4PL because it also handles the wharf management. Meanwhile, in the increase of Level of Service (LoS), Pelindo Tanjung Perak branch in Surabaya as the operator as well as executor is categorized as 3PL, especially in Cargodoring, area A. The movement process of supply chain in the stevedoring activities in the port is under the supervision of Harbormaster and Port Authority Office with the work division where the Port Authority Office has to supervise justice problems in the port whereas Harbormaster must check the seaworthiness of the berthed vessels. Special for Return process. Customer complaints. From the realibility, the customer complaint level is still reasonable.

Today there are many inefficiencies such as stevedoring outside the rules. For example, stevedoring labours usually have three shifts but it becomes 6 shifts or 4 gangs to 2 gangs in the real operation. It is not the task of stevedoring company. Stevedoring condition is much affected by Truck Waiting time. Are there product returns? Product returns still exist, but not always every year with a maximum value of 80 tons of product shipped annually. Product will be returned in case of spill and damage. Identification of product condition; every product is always identified using IT and has been in line with the procedures. Authorization of defective product return; the authorization is still on the company as the shipper. Scheduling product return; According to the Standard Operation Procedure, product return is kept scheduled. The company is still responsive and committed if there is a delay in the product return. FAB Enterprises has a motto: delivery as soon as possible.

*b) In-Depth Interviews with the Management of Tanjung Emas Port, Semarang*

Pelindo as the operator has given a detail explanation concerning the stevedoring condition in the Port of Tanjung Emas, Semarang. Port of Tanjung Emas is supported by some equipment: Tugboats, Scouts, Kepil Ships, Warehouses, Stacking Yard and Unloading equipment, and provides services that include: Ship Services, Goods Services, Terminal Services, Land, Buildings, Water and Electricity Services. Although there have been additions to Nusantara port facilities, berthing large ships in Semarang Port is still limited. At that time, the ships with maximum draft = 5 m or a size of  $\pm 3,500$  tons deadweight can berth in Nusantara Wharf. Meanwhile, ships with a draft  $> 5$  m still have to dock outside the port or off the coast which is  $\pm 3$  miles from the wharf. Hence it is known as the REDE Port. Since 1970, the flow of ships and goods through Semarang Port tends increase every year. According to the data of 1970-1983, the average increase of annual goods flow is more than 10%. Regarding the limited port facilities, such as inadequate depth and width of channel for the entry/exit of oceangoing vessels, the Government decides to expand Semarang Port. One of the services provided is ship operation

in the port, such as stevedoring activities. One of the stevedoring activities performed is loading-discharging oil products at the bulk liquid wharf. In the process of loading-discharging oil products, there may be some obstacles and disruptions causing delays in the stevedoring process that lower the performance of the Port Business Entity.

In term of management, the Port of Tanjung Emas, Semarang needs the facilities and supporting equipment for container loading-discharging. So, the number of necessary equipment that must be provided by the port administrator will surely be influenced by the number of containers to be discharged or loaded in the port as well as the port lay-out. It is necessary to evaluate the capacity of the facilities and stevedoring equipment owned by the container terminal of Tanjung Emas Port, Semarang, so as to give the level of optimum service in the stevedoring process in the container terminal to anticipate the future need.

The obstacles in the process of ship's berthing are the wharf, weather, and the availability of facilities and infrastructures provided by the port management unit. These obstacles can be coped with through the improvement of port services, among aother are the maximization of wharf use by a determination based on the existing schedule, providing the ship with information on daily weather report. The performance system in Semarang Container Terminal is not good yet. This can be seen from the average dwelling time which is still too long. The optimization of dwelling time needs to be done to get the balance of projected increase of sales and as the compensation for the limited terminal facilities and infrastructures. One way is implementing the container handling procedures by using the application of Cost Terminal Operation System.

The volume of cargo shipment using container through the Port of Tanjung Emas is increasing from year to year. Cargo shipment using containers allows the goods to be unitized so that the operation becomes faster, more effective and more efficient. In addition, the use of containers is also expected to increase the amount of cargoes that can be handled. However, container services in the container terminal of Tanjung Emas Port Semarang is recently facing some obstacles that affect their speed.

These obstacles are: (1) not maximal use of gantry crane and rubber tyred gantry in serving the container loading-discharging, (2) untidy arrangement of containers in the stacking yard, (3) service time for the trucks from outside that carry export containers coincides the time when chassis trucks serve the loading onto the vessel, so that it slows down a process; the same thing also happens in the discharging process, and (4) the number of chassis trucks does not meet the configuration of operational standard.

Stevedoring labours are commonly an inseparable part of human resources in the port. The phenomena that happen to Stevedoring Labours are uncertain wage and the risk of occupational disease and work accident. Loading-discharging work is categorized as heavy work and has a high risk of accident especially during manual loading. In 2017 there were seven cases, in 2018 as many as 8 cases happened, and until September 2019 there had been 6 cases of work accidents.

According to the survey, work accident is caused by unsafe behaviour.

Now, port terminal operator services have been well done by port of Tanjung Emas, Semarang, able to accomplish the terminal operator services which are used for ship's berthing and the administration in the related agencies which can be completed well.

*c) In-Depth Interviews with the Management of Tanjung Priok Port, Jakarta*

Port of Tanjung Priok handles more than 30% of Indonesian non-oil commodities. Moreover, 50% of all cargo inflow/outflow from and to Indonesia are sent through this port. Therefore, Tanjung Priok is the barometer of Indonesian economy. Complete intermodal facilities in this port can connect Tanjung Priok to all cities in Indonesia. With modern technology and facilities, Tanjung Priok has been able to serve next-generation ships which directly go to various international trade centers (direct call). The port development is directed to be able to anticipate the acceleration in cargo stevedoring through the availability and completeness of facilities for specialized services. The construction of inner road, the widening of channel and ship's entry gate (to become two-way traffic) and the deepening of channel up to -14 m LWS are the prioritized programs to be done.

Port of Tanjung Priok is the origin of a city and the city development starts from the north side of Jakarta. The main problem according to Deputy General Manager is that automation will not be applied in the trucking activity since there will be something lost. From the high logistic cost, it will also give impact on the truck drivers who will lose their job. Now there is a condition of truck waiting time. Indeed, the condition is different. In Shanghai China, with few workers and many uses in Information Technology it is easy to monitor the condition. Special for truck management, now it has used the system of Single Truck ID.

There are 3,200 Stevedoring labours consisting of 2,400 old Stevedoring labours and 800 new Stevedoring labors, but they are not under Pelindo management. Indeed, it must be clear who is fully responsible for the management of Stevedoring labours. The problem of Non- Stevedoring labours should also be paid attention, such as their welfare whether it is under the authority of Ministry of Cooperatives or Port Authority; how to manage Stevedoring labours as middle men under 4PL and 3PL, and the fate of truck drivers if the Automation is applied. The problem of truck drivers is a classic one. As the habit of drivers where at Closing Time, they just want to enter the port at the last moment, resulting in truck waiting time in the long queue of trucks outside the gate although outside the port, as wide as 4 hectares of vacant land has been provided. There is also a need for legal counseling about the safety of Stevedoring labours work at Tanjung Priok Port in carrying out loading and discharging activities on ships, because it is a type of high-risk work that requires extreme caution from the Stevedoring labours and work safety protection from the Employer. Have the Stevedoring labors in the Port of Tanjung Priok Jakarta performed their work in compliance with the safety standard and work protection?

*B. Discussion*

Recently, the problem of Dwelling Time has decreased from five days to three days. This in the Port of Tanjung Priok cannot be compared to the Port of Singapore as a Transshipment port, whereas the Port of Tanjung Priok is just a Gate Way port. The Port of Tanjung Priok is a part of Sea Toll, an end to end business the volume management that can reduce the cost. Stevedoring Companies must begin from the ownership of heavy equipment, market, revenue sharing. To compare and evaluate since 2018, the management of heavy equipment in China with the loading capacity of three to four tons is not the best scheme for the Port of Tanjung Priok. Now, the consignees still want that their cargo stay for three days in the Stacking Yard, not rent outside the port.

As a conclusion, in 2020 the dwelling time for export activities has a duration of 3.2 days. This indicates a longer time than the average from 2019 up to 2020. The average of Dwelling Time for export activities in Jakarta International Container Terminal Inc for two men year is 3.01 days. The median value is lower than the daily average, for two consecutive periods, causing the Dwelling Time in Jakarta International Container Terminal Inc still very high, although the average duration still complies with the Minister Regulation of 2015, that is three days. In the period of 2011-2017, it has been studied by [22] that the result of analysis indicates a positive integration of Dwelling Time special for import container loading-discharging in the Port of Tanjung Priok and it is still categorized as very high, with the average duration for seven years is 5.5 days.

This research is in line with the previous findings by [45] in the Port of Tanjung Priok which indicates that the role of operator assistant is very meaningful for the operator to operate the container loading-discharging equipment safely in the Port of Tanjung Priok, Jakarta. Moreover, based on the field findings [46] regarding four port performance indicators, it can be concluded that the Port of Tanjung Priok still has to keep improving to become a world-class port. Other findings [26] in the Port of Tanjung Priok indicate that the main factors influencing the safety in loading-discharging dangerous goods are port supporting facilities and infrastructures. According to the analysis by [47] in the Port of Tanjung Emas Semarang, the smoothness of all operation highly depends on the service of chassis truck in the container yard such as the arrangement of container stacking patterns or the optimum use of rubber tyred gantry. The danger of stevedoring work using cranes in the Port of Tanjung Perak Surabaya has been controlled up to the stage of ALARP (As Low As Possible Reasonably Practicable) [48]. In addition, the preparedness of Stevedoring labours also becomes a determining factor. Another finding by [49], supporting this research, reveals that stevedoring process and ship's document processing have significant influences on the performance of related agency.

This research is also in line with the finding [23] that actually the Dwelling Time in the Port of Tanjung Priok does not need to occur if all the involved parties can solve all the problems quickly, the completion of activity document is done by the Customs and Excises with the consignee/freight forwarder through the processes of pre-permit, customs

clearance, and post-permit. The problem of Dwelling Time, especially in the Container Terminal in the Port of Tanjung Emas Semarang, also supports this research by saying that frequently the length of container processing is not known; for example, users do not complete the necessary documents, import container processing is longer than export container processing and the documents must be checked the Quarantine and the Customs and Excises [50].

Finally, this research also supports the findings [51] in the Jamrud terminal of Tanjung Perak Port, Surabaya, indicating that stevedoring equipment, Stevedoring Labours, and ship's service are significantly correlated to form the stevedoring performance.

## VI. CONCLUSIONS

The result of this research is knowing the determination of Dwelling Time related to the expected Counter Yard in the port as a temporary warehouse of Stevedoring Companies. Management of Stevedoring Labours must also be paid attention since it is not port operator who is responsible but the main management must be clear, whether it is the Port Authority.

Based on the interview with the informants, especially 3PL and 4PL service providers in the port, the service now is still dominated by 3PL party as the field operator. Only in the Port of Tanjung Perak Surabaya operator serves as 4PL executor. The interview using SCOR method is quite systematic and measurable to get some findings and implications that are useful to be informed to the policy makers and operator in the government and port at national level.

Through such a research activity university students are expected to adapt and collaborate quickly through information and communication technology and the process of collaboration with their partners outside the campus. In order to sharpen the programs of Independent Learning Independent Campus in the future, especially for research strengthening, students are invited to participate in the discussion and Focus Group Discussion with business players in the port and port operator as well nas to help prepare final report and draft research journal. .

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