

ANALYSIS OF USE OF COAL CRUSHER MACHINE ON THE EFFECTIVENESS AND EFFICIENCY OF COAL EXPORTS

Andini Oktavia¹, Andri Primadi², Bagus SetioAji³, Nita Rosmala Dewi⁴

^{1,2,3,4} Institut Transportasi dan Logistik Trisakti, Jakarta, Indonesia

✉ andienjetavia@gmail.com & setioaji415@gmail.com

Abstract: Coal crushing machine can be defined as a vital role in mining because it has a function as a coal crusher so that the coal production process depends on coal crushing machines. There are several obstacles in the coal production process and coal export process. The purpose of this research is to find out how to create the effectiveness and efficiency of coal exports and how to overcome the obstacles that occur during coal production. The method of this research used qualitative research. The data collected come from interviews, direct observation and other related official documents. The results of this study are the use of coal crushing machines in mining companies that can accelerate the production process of coal exports and make coal quality superior. Constraints during the coal production process can be overcome by checking the coal crusher regularly and making a measurable plan to create export effectiveness and efficiency.

Keywords: *coal crushing machine, effective and efficient, coal export, qualitative research*

Introduction

Indonesia is a country which is rich in natural resources and human resources. Indonesia's coal production has been driven mostly by coal exports and only a small share has fed the domestic market. However, this is expected to change markets based on national energy policies which prioritize coal sales for domestic markets. The potential of coal resources in Indonesia is very abundant, especially in Kalimantan and Sumatra islands and a small portion of the rest is scattered in several locations in Java, Sulawesi and Papua islands. Coal reserves reach billions of tons and 166 billion tons as resources. This makes Indonesia's coal reserves become 3% of global reserves (Ministry of Energy and Mineral Resources).

Indonesia has been carrying out international trade which is one of the important aspects for the country's economy, so it is not only for developed countries but also for developing countries like Indonesia. The development of world coal consumption continues to increase. The increase of world coal consumption is caused by the high demand of the world community, causing high world energy demand. International trade has various obstacles and risks in the implementation process. The main obstacle is in terms of Human Resources. Especially in Indonesia itself, there are still many exporters who send goods in small quantities, so it is necessary to consolidate export goods in order to provide

efficiency for exporters. Indonesia is one of the largest coal exporters in the world. Recent developments of the Indonesian coal mining industry have experienced very rapid export growth compared to competing countries, especially in the Japanese market which is dominated by China. The destination countries for Indonesia's coal export are dominated by Asian countries, such as India, China, Japan, Korea, Taiwan, Malaysia and others.

Indonesian coal has been included in the mainstay commodity in Indonesia's export activities because Indonesian coal has several advantages. In this study, international trade is specified in one commodity to measure the determinants of exports in Indonesia. In the process of sending goods abroad, business actors do not carry out all the tasks. These activities are usually assisted by a service company called a freight forwarder, with the consideration to facilitate the process of sending, transporting, and receiving as well as minimizing costs during the process.

Literature Review

Coal is a type of sedimentary rock, with carbon as the main mineral and hydrogen, sulfur and oxygen in its secondary minerals. The high content of these compounds makes coal flammable. Coal is a rock formed from the fossils of plants and animals that have been buried naturally more than 340 million years and have undergone a heating process in the soil for a very long time. Indonesia as a tropical country that has so many forests and mountains makes this country a very potential coal producer. Coal is one of the non-oil and gas export commodities that contributes to economic growth (Putra and Damanik 2017).

Coal Crusher machine or known as Coal Crushing machine is the main tool in controlling natural resources in the form of coal. Crusher can be defined as a vital role in mining because it has a function as a coal breaker so that the coal production process depends on the performance of the Coal Crusher machine. Crusher serves to break natural rock into smaller sizes according to the specifications needed for coal exports. Coal exports are the driver of economic growth in Indonesia.

Maintenance is a combination carried out for various actions to maintain a machine and repair it until it is acceptable to the desired condition. (Rachman, Garside, & Kholik, 2017). One of the functions that plays a very important role in ensuring the smooth implementation of production activities is the maintenance of

machines and other production facilities. Therefore, a company must always strive for machines and facilities in the best condition so that the production process can run smoothly. (Hasrul, Shofa, & Winarno, 2017).

Exports are one of the indicators in spurring a country's economic growth. As stated by Arianti, (Siahaan and Sihalohe 2017), economic growth is influenced by various factors, one of them is export. (According to Salvator in Ginting 2017), export is one of the engines driving economic growth. (Jung and Marshall in Ginting 2017) suggest that there are four hypotheses of the relationship between exports and economic growth. They are:

1. Exports as a driver of a country's economic growth (export-led growth);
2. Exports are the cause of the decline in a country's economic growth (export-reduced growth);
3. Economic growth that drives a country's exports (internally generated exports);
4. Economic growth causes a decline in exports from the country.

A research conducted by (Putra and Damanik 2017), explains that Indonesia has an engine of economic growth from oil, gas, and non-oil exports. The non-oil and gas sector themselves consist of the agricultural, industrial, mining and other sectors. Dewi (2018) which analyzed coal exports in Indonesia shows the result that the total GDP of the destination country has a positive effect on Indonesia's coal exports, so it can be said that the GDP of the destination country is one of the positive influences for Indonesia's coal exports.

According to Schemerhon Johnr Jr. (2018:23), effectiveness is the achievement of the output target (output) which will be measured by comparing the budget output or OA (supposedly) with the realized output or OS (actually) if $OA > OS$ then it will be effectively called.

According to Sedarmayanti (2014:22), efficiency is a measure of the level of resource use in a process. The more efficient or less resource use, the more efficient the process is. Process efficiency is characterized by process improvement so that it becomes cheaper and faster.

Framework of Thinking

The usefulness of coal crushing machines on the effectiveness and efficiency of coal exports is seen during the coal production process. So it is

necessary to do a comparison for the use of coal crushing machines and those that are not.

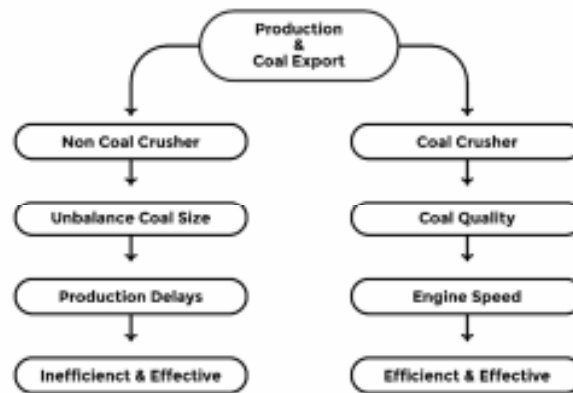


Figure 1. Framework

Hypothesis

Hypothesis is a temporary assumption of a relationship, cause and effect of the performance of the variables that need to be proven true. Hypotheses can be divided into descriptive hypotheses, comparative hypotheses, and quantitative or associative hypotheses in statistical form. The following are the hypotheses for this study:

- A. The use of a coal crusher can speed up the production process and make coal quality superior.
- B. Coal crushing machine will optimize existing resources in terms of cost savings.
- C. Coal crushing machine will make the quality and size of coal according to the request.

Method

The type of research used in this research is descriptive research through a qualitative approach. According to Moleong (2017:6), qualitative research is a research that intends to understand phenomena about what is experienced by research subjects such as behavior, perceptions, motivations, actions and others holistically and by means of descriptions in the form of words and language, in a special natural context by utilizing various natural methods.

Data Collection Method

Source of data is something that can provide information about related research. According to Sugiyono (2018: 456), the data used in this study use two types of data sources. They are as follows:

1. Primary data are obtained through interviews or filling out questionnaires, which mean that these data source directly provide data to researchers.
2. Secondary data are data sources that do not directly provide data to data collectors, for example through other people or through documents. In this study, the secondary data sources were in accordance with the Manpower Act, books, journals, articles related to research topics regarding the internal control system for payroll systems and procedures in an effort to support labor cost efficiency.

The purpose of the study is to obtain data, so the data collection method is the most vital step in a study. Researchers who conduct a research will not get the desired data if they do not know the methods of data collection. According to Sugiyono (2018:224), when viewed from the source of the data, the data collection can use primary and secondary sources. The data collection methods in this study are as follows:

1. Observation.

According to Sugiyono (2018:229) observation is a data collection technique that has specific characteristics when compared to other techniques.

2. Interview

Interview, according to Sugiyono, (2018:140), is a conversation with a specific purpose carried out by two parties, namely the interviewer who asks questions and the interviewee who provides answers to the questions given.

3. Documentation

According to Sugiyono (2018:240), documentation is a record of events that passed in the form of pictures, photos, sketches and others.

Discussion and Result

1. Targeted Coal Production Time Planning

Constraints that occur if the company does not do good and measurable planning in designing the speed of the coal crusher machine, then this will cause delay in production process and coal export.

According to Ari Harisman (2022), to achieve the production target, the company can make plans for the speed of the coal crusher machine to produce a measurable and effective Lead Time. To measure the accuracy of production, planning is needed to meet the needs that have been targeted by the company so that the costs required and the time set become more efficient. Production is an activity that converts inputs into outputs. These activities in economy are usually expressed in product function where the product function shows the maximum amount of output that can be produced from the use of a number of inputs using certain technologies. Production is often defined as the creation of use, where use means the ability of goods or services to meet human needs or factors of production which the objects are provided by nature or created by humans that can be used to produce goods and services, according to Manalu, E., Sianturi, FA, & Manalu, MR (2017).

Table 1. Coal production planning table

No.	A year	A month	A day	A hour
1	3.500.000 Ton	324.000 Ton	10.800 Ton	600 Ton
2	2.400.000 Ton	216.000 Ton	7.200 Ton	400 Ton
3	1.800.000 Ton	162.000 Ton	5.400 Ton	300 Ton

Source : Ari Harisman

According to Ari Harisman as the owner of the construction company and mining equipment said that planning is calculated on production needs in the past one year which is calculated by the formula:

$$\text{Production 1 Year / 1 Month / 18 Hours} = \text{Machine speed in 1 hour}$$

Dynamic machine movements can cause excess or shortage of stock, then the company must provide stockpile to maintain coal availability.

The table above is the time variation planning for coal production provided by the company to the customer, then the duration is made to ensure that the customer can produce coal production on time according to demand.

2. Coal Crushing Process

Crushing is a process that aims to liberate the desired mineral from the mineral impurities. Crusher can be used to reduce the size or change the shape of the mine material so that it can be processed further. Primary crushing is the first stage of crushing, the crusher usually used at this stage is the primary jaw. Mined rock after arriving at the stock room is carried by a dumptruck and then spilled into a hopper, from the hopper to the jaw crusher for crushing. From the crushing process, it is carried by a belt conveyor and then size filtering occurs. After being filtered, it is then passed through a belt conveyor to the stockpile. So these tools play an important role in this process to accelerate the formation of the desired coal. Therefore, the coal crusher machine must be maintained regularly to reduce the risks that exist because it will disrupt the production process and hinder the efficiency of coal exports.

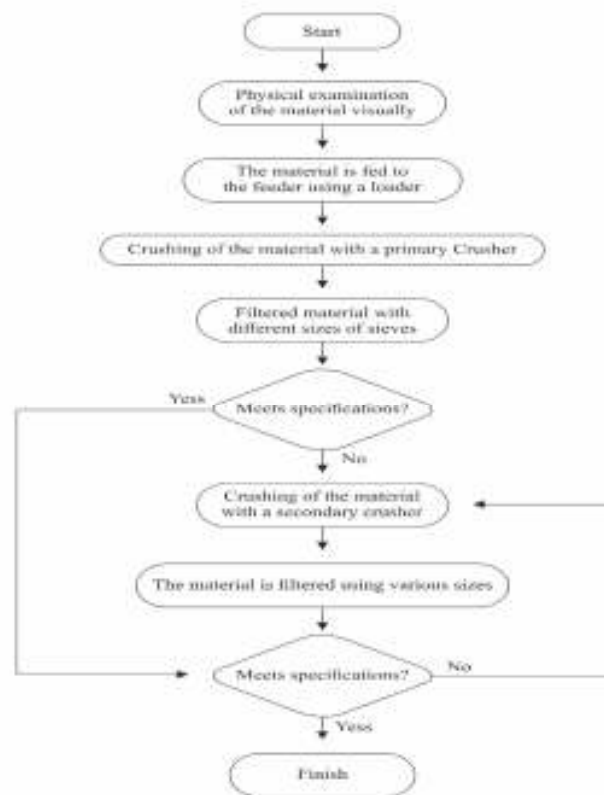


Figure 2. Coal Production Process

Constraints during the coal production process arise when the coal crusher is damaged, stones are stuck, it rains, power goes out and the electric panel burns, the company must provide electrical panels that can automatically be used as a backup power source from diesel generator, if the power goes out.

2.1. Stockpile

The transfer of coal production usually uses a dump truck from the stockpile to the jetty. The initial investment costs are much more efficient than using a belt conveyor, but this will cause wasting time because the dump truck does not carry any load when returning to the stockpile. This will cause significant cost overruns issued by the company for the use of diesel fuel in Dump Trucks.

Stockpile is also a place for storing / stacking coal mining products. Coal stockpile is a place for stacking or stacked materials to be taken, processed, marketed or used later for short-term or long-term disruption long. Stockpile also serves as a process of homogenization and/or mixing of coal to prepare the required quality. Coal stockpile management is a process of planning, controlling, coordinating and organizing resources to achieve goals effectively and efficiently.

In general, coal mining companies use trucks to transport their products from the stockpile to the jetty. The use of this mode is arguably cheaper because the rental price is quite low, but this truck will cause a waste of costs, because the truck does not carry any cargo when returning to the stockpile which causes disadvantages of using diesel fuel. Careful planning will result in a sufficient supply of coal if demand increases anytime. This can prevent waiting time.

2.2. Coal Barging

The barging process can also be referred to as the process of moving coal from the stockpile to the barge using a barge loader conveyor or using a dump truck. In this activity there are several things that must be considered:

- determining the barging schedule on time and accurately;
- monitoring and controlling production to keep the barging process on time.

3. Export

3.1. Coal Export Flow

Export is the delivery of goods or commodities traded abroad. Export activities are usually carried out by a country if the country produces goods in large quantities and the need for these goods has been fulfilled domestically.

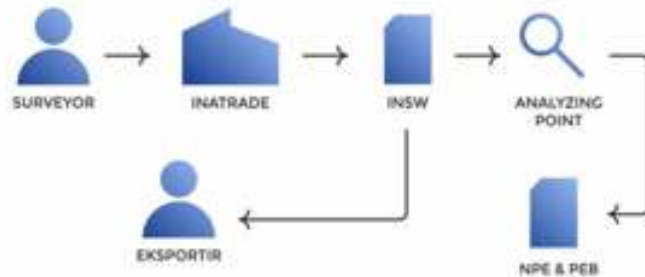


Figure 3. Coal export flow

Export activities can be carried out when the exporter has the following requirements:

1. having a registered exporter license (ET);
2. inspection by surveyors;
3. paying royalties and income tax article 22 to the government.

The procedure of coal export is as follows:

1. completing application form for loading bulk goods to the head of the customs service office;
2. after the application is approved by the head of the office, the outside service officer is in charge of loading;
3. after loading is finished, the surveyor makes a report containing data including the amount, origin, type of coal, calories and proof of payment of royalty payments;
4. report is sent to the minister of trade, then forwarded to the INSW portal;
5. the exporter then makes PEB and pays PPI tax with amount less than 1/2 % of the PEB as mentioned in Article 22;
6. then transferred to the NSW portal for checking related to prohibited and /or restricted goods (lartas) by Customs;

7. if the lartas (prohibited and /or restricted goods) are met, the Customs Service Computer system (SKP) will proceed and check the PEB data;
8. because coal involves latex products and there is a payment as mentioned in Article 22, further research is carried out by the point analysis officer;
9. if the requirements are complete, the NPE & PEB number will be issued immediately; and
10. finally, the ship will be dispatched immediately.

3.2. Export statistics for the last 3 years

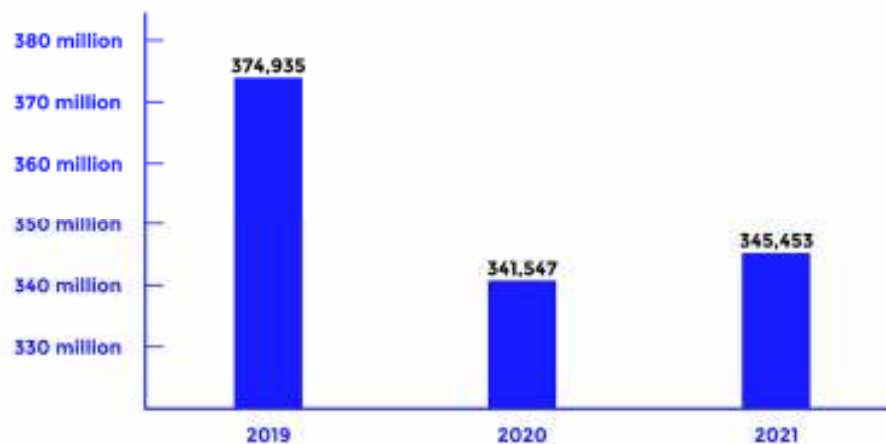


Figure 4. Central statistics agency

In 2019 Indonesia's coal production produced around 374,935 million tons. In 2021 Indonesia's coal production decreased from the previous year of around 341,547 million tons. In 2022, Indonesia's coal production has increased again by around 345,453 million tons. According to a report from the Central Statistics Agency (BPS), Indonesia's coal export volume in the second quarter of 2022 had a net weight of 99.49 million tons.

3.4. Transportation of Coal Export

A barge is a cargo ship that generally does not have its own propeller and thus relies on tugs to provide it with propulsion, while tugboats are the main propulsion of the barge, which is connected to the barge using towing ropes. Barges are the main choice for transporting large quantities of coal. In Indonesia, barges have been widely used since 1980.

The transportation is not arbitrary and must be supervised by supervisors who are in charge of supervising the loading and unloading of coal into the barges. In addition, the barge before starting the operation needs to be tested for feasibility by BKI (Indonesian Classification Bureau). This is done in order to minimize the risk of accidents that often occur while operating such as leaks, damaged components, and collisions. Barges that have been tested for feasibility are expected to be safe in their operations to transport coal to their destination.

A tugboat is a ship that can be used to maneuver / move, mainly towing or pushing other ships from ports to seas or through rivers or canals. Tug boat on coal transportation is very useful and so important in the role of transportation. The function of the tug boat is not only to guide other ships but also to ensure the implementation of mooring and unmooring. This is important to do when there is a process of transporting coal at the wharf. The presence of a Tug Boat will make the transfer easier.

4. Factors of coal crusher machine effectiveness and coal export efficiency

- a. Careful planning. Coal production planning will measure the time and ensure the total duration of coal production is achieved.
- b. Coal crushing machine and machine support equipment. Before the coal crushing machine works, the mechanical equipment will be checked first, so it won't take time and trained operators will be needed to prepare the mechanical equipment.
- c. State and type of material. The size of the material greatly affects the circulation time of the excavator and will affect the performance of the crusher.
- d. Machine breakdown. If the machine has trouble for the coal production process, the planning will fail.
- e. The effect of rainy weather greatly affects the mechanical equipment that is working. If it rains heavily, the operating time of the mechanical equipment on the transportation of minerals will stop. The machine must be protected from flooding and high-water discharge so that the durability of the coal crusher is maintained. This stopped production process causes waiting time which affects the amount of coal stock produced.
- f. Operator skill and experience. Educated and experienced operators will understand how to operate a tool so that it can move more freely and they do not

interfere with the work of other tools.

g. Use of dump trucks. The use of dump truck will waste the company's costs and time.

h. Freight forwarders. The role of freight forwarders affects the effectiveness and efficiency of coal exports because freight forwarders will be responsible for the timeliness and risks that occur from the beginning of the coal process to the dock to the customer. Export documents, transportation and others will be handled by the freight forwarder from start to finish. Therefore, freight forwarders must provide trust and can provide services that are relatively inexpensive.

Conclusion

Based on the results of the research that has been described and analyzed, the researchers draw the following conclusions:

1. The coal crusher machine can speed up the coal production process. To create the effectiveness of coal production, it is necessary to plan the time and amount of production as well as proper scheduling. The Coal crusher machine will produce measurable coal production, taking into account the number of coal production targets and the amount of stock that will be prepared to prevent the risk of production delays. If production is hampered due to engine failure, the previously generated inventory will be sufficient to provide coal reserves for export, this can minimize the risk of delays in shipping or exporting coal.
2. Creating new strategies by perfecting Standard Operating Procedures for machine operators will improve the performance of a work unit so that the output is maximized. Work evaluations such as making progress reports, supervision, paying attention to equipment and facilities, preparing coal supplies in case of rain are needed to be done so that there is no disruption during the production process. There is a replacement of electricity with generators when the power goes out because the mechanical equipment stop anytime. Replacing the Dumptruck into a Belt Conveyor will minimize cost wastage. The belt conveyor will be more effective for time and efficient for costs and this tool runs non-stop from stockpile to jetty for moving cargo. Using reliable and cheap freight forwarder services are needed because the role of freight forwarders is to take care of the coal export

shipping process from start to finish. If all are implemented, the risks that occur will be smaller and the incurred costs will be low.

3. The coal crusher machine will produce superior quality coal. The coal crusher machine will produce coal according to customer demand due to the rhythmic movement of the coal crusher machine and consistent engine speed; and maximize the use of all available resources so that nothing is wasted.

Reference :

TToha, M., Teknik Pertambangan, J., Teknik, F., Sriwijaya Jl Raya Palembang Prabumulih, U. K., & Selatan, S. (2019). *ANALISIS EFISIENSI KERJA DAN PRODUKTIVITAS PENGANGKUTAN BATUBARA SISTEM SHOVEL-DUMP TRUCK*. 3(3).

Setiawan, A., Wibowo, A., & Rosyid, F. (2020). Analisis pengaruh ekspor dan konsumsi batubara terhadap pertumbuhan ekonomi Indonesia. *Jurnal Teknologi Mineral Dan Batubara*, 16(2), 109–124. <https://doi.org/10.30556/jtmb.Vol16.No2.2020.1081>

Melawati Puspita Dewi. (2018). *ANALISIS EKSPOR BATUBARA INDONESIA*.
Andrika. (2017). *EFISIENSI PRODUKSI CRUSHERDALAM PENGOLAHAN ANDESIT PADAPENAMBANGAN ANDESITPT. KOTOALAM SEJAHTERAJORONG LUBUK JANTANNAGARIMANGGILANKECAMATANPANGKALAN KOTO BARUKABUPATEN LIMAPULUH KOTA PROVINSI SUMATERA BARAT*.

Bulo', R., Nugroho, W., & Dinna, F. (2017). *ANALISIS PRODUKTIVITAS UNIT PEREMUK BATUBARA (CRUSHING PLANT) UNTUK PENCAPAIAN HASIL PRODUKSI DI PT. CMS KALTIM UTAMA KECAMATAN SAMARINDA UTARA KOTA SAMARINDA PROVINSI KALIMANTAN TIMUR (The Analysis Of Productivity Of Crusher Unit For Improvement Of Productions In Pt. Cms Kaltim Utama Sub District Of North Samarinda of Samarinda City East Kalimantan Province)*.

Bahauddin, A., Ekawati, R., & Riza Hafidz, M. (n.d.). *PERENCANAAN PERSEDIAAN BATUBARA DENGAN MEMPERTIMBANGKAN BIAYA TRANSPORTASIMENGGUNAKAN MODEL P BACK ORDER DI PT. ABC*.

Asef Sumantri. (n.d.). *ANALISIS MANAJEMEN STOCKPILE BATUBARA UNTUK MENCEGAH TERJADINYA SWABAKAR DI STOCKPILE PLTU DESA TELUK SIRIH PROVINSI SUMATERA BARAT.*

Edo Fernando, & Faris Primayudha. (2020, March 30). *Berbagai Jenis Crusher Yang Digunakan pada Industri Pertambangan.* Duniatambang.Co.Id.