Optimization Disaster Reacting Unit Based on Digital as a Disaster Mitigation on Indonesia National Roads

A B Utomo\textsuperscript{1}, T K Suryoaji\textsuperscript{2} and E K Friatmojo\textsuperscript{3}

\textsuperscript{1}Highway Construction Technology, Polytechnic of Public Work, Semarang, Indonesia
\textsuperscript{2}Directorate General of Highway, Ministry of Public Work and Housing, Indonesia
\textsuperscript{3}Building Construction Technology, Polytechnic of Public Work, Semarang, Indonesia
*Corresponding author: adityobudiutomo@gmail.com

Abstract. DRU or Disaster Reacting Unit is a set of construction heavy equipment used for natural disaster emergency response activities that affect national roads and bridges. DRU consists of excavators, motor graders, wheel loaders, vibro rollers, dump trucks, and dozers. Digital-based DRU management using \textit{E-peralatan} provides many changes compared to conventional methods including less standby time, faster equipment rental ordering time, cost certainty, time certainty, document administration certainty, and process certainty and can be used by anyone, at anytime, anywhere. Based on \textit{E-peralatan}, the mitigation of natural disasters that require DRU can be carried out on target with a good number of units of equipment needed, location, and shortly time of mobilization to the location.

1. Introduction

Balai Besar Pelaksanaan Jalan Nasional VII Semarang (BBPJN VII) requires equipment to support construction and maintenance national road and bridge in central java province \cite{1}. Data on the equipment owned by BBPJN VII is needed to determine the number of equipment and conditions of the equipment. The absence of an inventory in the form of an asset information system regarding equipment owned by BBPJN VII makes it difficult to check the amount of equipment and the condition of the assets. For this reason, data collection is needed to carry out an inventory and compilation of information systems on equipment owned by BBPJN VII. According to (MPW) Decree No. 09/PRT/M/2014, the equipment data that must be exist include type, brand, year of production, frame number, machine number, purchase price, workshop location, and current condition \cite{2}.

2. Literature review

DRU is a set of construction heavy equipment used for natural disaster emergency response activities that affect roads and bridges. DRU consists of 1 fleet of work units consisting of excavator, motor grader, wheel loader, vibro roller, dozer, and dump truck. DRU is alerted to handle natural disaster conditions such as landslides, floods, volcanic eruptions, and tsunamis. Landslides is the dominant or common disaster occurs on roads and bridges. Requirements that must be met in the management of the DRU include:

a) The equipment must always be in good condition or lightly damaged
b) The equipment must always be available whenever needed by any party
c) The equipment can reach the disaster location within less than 6 hours so that the workshop or heavy equipment workshop must be placed in a strategic location prone to disaster.
The intensity of disaster occurrence in a year is also not much, so if BBPJN VII invests funds in the form of heavy equipment, a lot of time will be wasted in standby activity. Other options for the use of the DRU are rent to public on condition that they are always in good condition or slightly damaged and if a disaster occurs, the DRU can be mobilized at any time. To improve productivity, it is essential to improve the performance of the construction systems. The desired production output is achieved through high equipment availability, which is influenced by equipment reliability and maintainability [3].

Manikandan [4] said that Quality of supervision, material management, site planning, constructability, and change management are the most significant management related factors that influence productivity directly. idle time, down time, poor equipment maintenance practices, improper determination of economic life and timing of replacement, poor training of equipment operators, equipment breakdown, over maintenance of equipment, huge capital investment during acquisition, balance of interdependent equipment, misunderstanding the scope of work carried out, unit cost of production and equipment suitability for job condition were found to be the major problems that affect construction equipment planning and management.

Problems arising from the management of DRU by BBPJN VII include:
a) DRU equipment rent services
   - Utilization of equipment by third parties through lending schemes (between administration and realization are out of sync) is no certainty of the rental fare, there is no certainty of the time of lending, the rental application process takes quite a long time, disorderly administration of lending equipment
   - Utilization of equipment by internal small unit of BBPJN VII is not accompanied by good administrative documents
   - The procedure for borrowing equipment has not been well publicized
b) Monitoring of DRU equipment assets
   - Many equipment assets in the BBPJN VII are not monitored for their utilization
   - There is no reporting system related to DRU equipment either monthly or quarterly

See that problem, it must be innovations system to solve. Characteristics of problem solving are:
a) The rent system – The large number of DRU equipment in the BBPJN VII has a large country income potential but a system must be built with characteristic are:
   - Effective & Efficient = Certain rental fare, easy to monitor the process
   - Faster = There is certainty about the time of rental, the process for submitting a rent application must be faster
   - Better = A simple process that does not violate applicable Indonesian rules
b) Monitoring System – The system can be accessed easily by interested parties anywhere, anytime and in real time.

3. The purpose of study
The purpose of this study is to collect data and inventory the equipment owned by BBPJN VII so that the equipment can be recorded in one system that can be accessed by the internal and external users. Equipment Information System also aims to provide information to the public about the condition and availability of equipment to facilitate the public in making leasing services. In addition, this information system can also facilitate managers in monitoring the condition of existing equipment.

4. Methodology
Framework before built this information system are as follows in Figure 1.
The absence of EIS makes it difficult to manage the equipment and the rental process of the BBPJN VII take quite a long time.

- Collect data and inventory of equipment owned by BBPJN VII
- Provide information to the public about the condition and availability of equipment to make it easier for the public to make rent.

Identifying the amount and condition of equipment owned by BBPJN VII

Formulate procedures for borrowing digital-based equipment (E-peralatan)

Inaugurate procedures for borrowing digital-based (E-peralatan) to be used by BBPJN VII

Figure 1. E-peralatan framework.

Based on that Information System Framework, this study is done by the method as in Figure 2.

Figure 2. Research methodology.
5. Results and discussions

5.1 User interface

The E-peralatan information system was made in Indonesian Language to match the needs of the Indonesian community. It consists of the following components:

a) Main page (Home)

This page is the main page of the E-peralatan application (Figure 3). On this page displays simple information sections that can be accessed by publics, namely, the header section, menu section, and banner section as well as search engine.

b) Facilities of E-peralatan

Facility that available in E-peralatan system are divided into 2 user sides including:

i) External users, namely the customer, publics and other institutions or companies
   - Equipment search facility
   - Equipment rental booking facilities
   - Rental’s administrative documentation facility
   - Rental payment facility

ii) Internal users, namely administrator and manager at BBPJN VII
   - Equipment data inventory facility
   - Facilities for managing equipment rental by external parties
   - Monitoring of equipment operational facility
   - Equipment maintenance management facilities

New procedure for E-peralatan by external users is designed more modern, simple, eye-catching, and easy to understand by anyone also can sync with their email facility as notifications. According to (MPW) Decree No. 09/PRT/M/2014, users apply the letters to equipment manager accompanied by description of the type of equipment, location, time period, and purpose of use [2]. The thing that is complained about this process is that there is no certainty how long it takes to get the permit and how much the total cost must be paid. Sometimes the manager is so busy that the approval of the permit will take a very long time. E-peralatan is designed with digital letter, digital document, and digital signature so that it can simplify the permit approval. New procedure for E-peralatan by external users (Figure 4):

a) Open the website address www.palan.mapgeo.id (Figure 3)
b) Type the name of the equipment you want to search for example "excavator" or "loader"
c) Enter the start and end date of the rent
d) Click the "search" icon
e) The equipment availability page and location will appear. When we click on the details, the desired equipment identity will appear (Figure 5)
f) Click "booking" to proceed. Fill identity data along with resident card or passport and application letter (application letter format is in the download menu)
g) When the file is complete the notification will be sent via email along with the attachments to the required administrative files
h) Make a payment when there is a notification in the email and upload the proof of payment again in the application
i) Complete the equipment retrieval file and the equipment is ready to operate
j) Perform equipment returns within the agreement period. If the time limit is exceeded, an additional fee will be charged according to the provisions

![Figure 4. Bisnis process of new E-peralatan.](image)

![Figure 5. Availability of equipment.](image)

![Figure 6. Back office of E-peralatan.](image)

5.2 Back office system
The back office E-peralatan information system is intended for administrators or internal BBPJN VII to manage the operational DRU. The facilities available in the back office system as shown in Figure 6 include:

a) Equipment Inventory facility. Identity and conditions of all equipment can be recorded in this facility
b) Waiting list management facility. All rental request submitted by the publics will be recorded at this facility for later verification and approval.

c) Approval facility. This facility is used to process approval documents and orders to pay rental fees through a designated bank account.

d) Mobilization facility. This facility is intended to process the documents needed to mobilize DRU from the workshop to locations.

e) Equipment history facilities. This facility is used to record equipment renting process documents, tenant identity, and equipment operations.

f) Monthly and quarterly facility. This facility will automatically provide reports to the management regarding the hours operation in every 1 month and 3 months.

The development of the E-peralatan give many advantages compared to the conventional system. The comparison performance of E-peralatan and conventional system can be seen in table 1.

| No | Parameter                              | Conventional System                                                                 | E-Peralatan                                                                 | Description                                                                                                                                                                                                 |
|----|----------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Permit cost                            | There is a fee to create, duplicate, and send documents                               | There are no fee for document creation, copying, and shipping               | With E-peralatan all registration and document submissions are done digitally                                                                                                                                  |
| 2  | Permit time                            | There is no certainty of completion time from 2 days to 14 days                      | Permit time in complete condition is 2 hours                               | All processes and document can be monitored in real time                                                                                                                                                    |
| 3  | Equipment rental fee                   | There is no certainty of equipment fee                                               | There are rates that are clearly stated in the application                 | All price are listed in the application                                                                                                                                                                    |
| 4  | Mobilization for disaster mitigation   | It is difficult to monitored Existing equipment conditions and location              | Existing equipment can easily be monitored for its condition and location   | The equipment’s location and conditions data recorded in the application on real time                                                                                                                      |
|    |                                        | It takes coordination up to 1 day for the equipment to arrive at the disaster site   | Mobilization equipment to disaster area less than 6 hours                  | Relocation in workshop makes every disaster area more accessible                                                                                                                                          |
| 5  | Equipment maintenance                  | Maintenance data is done manually so that spare parts planning is less effective    | Maintenance is carried out periodically and digitally so that spare parts planning is more effective | Equipment maintenance data recorded in the application                                                                                                                                                     |
| 6  | Equipment usage documentation          | Manually and untidy documentation                                                   | Digitally and tidy documentation                                           | All document are done digitally in the application                                                                                                                                                        |

6. Conclusion

By using E-peralatan, DRU operations have become more optimal where standby time is utilized through equipment rental schemes. Combination of E-peralatan and setting up the workshop location makes every disaster point more accessible so that it can be reachable less than 6 hours. Compared to conventional systems, equipment data owned by BBPJN VII can be better organized with E-peralatan. E-peralatan can make easier to find out information about equipment and the condition of existing
equipment. The public can lease equipment with cost certainty, time certainty, administrative document certainty, and process certainty. Processing time for leasing equipment to operational time is faster than the previous from 14 days to 2 hours. E-peralatan can be used as a substitute for log book operation and maintenance of equipment. E-peralatan with simple user interface can be operated by anyone, anytime, and anywhere.

7. References

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