

RFID Usage for Optimization Tire Control System

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Abstract. In transportation companies require to pay attention to assets that are owned in order to maintain efficiency in the activities of its usage and able to optimize expenditure/cost. One of these assets is a truck. In the world of transportation, the most faced obstacle is the embezzlement of truck tires. Embezzlement that is often done by truck drivers is exchanging new tires or tires that are still in good condition (70%) with used tires or tires that are in 30% condition (already worn out) in order to obtain additional income. This study aims to reduce truck tire embezzlement carried out by truck drivers. This research uses quantitative methods. Data were obtained from the assessment of trucking companies by giving a questionnaire to the company. By knowing the problems that exist in trucking companies, such as the loss of truck tires. This research can provide solutions to existing problems by implementing RFID information technology in companies. The result of the study are the use of RFID information technology needs to be applied in controlling the assets of truck tires.

Keywords: asset management, RFID, tire management system, tire control system

1. Introduction

Logistics activities in Indonesia are currently dominated by land transportation modes compared to other transportation modes. The percentage of logistics traffic flow through the land in Indonesia reached 2.5 million tons or reached 91.5 percent. While the logistical traffic flow in the sea lane is only 194.8 thousand tons, reaching 7.07 percent. Indonesia is a developing country whose economy depends on land transportation, especially trucks [1]. According to data from the Indonesian Automotive Industry Association (Gaikindo) until November 2018 for the bus, pickup and truck categories, total sales increased 18.9%. The highest increase came from the truck category which grew 28% year on year [2].

Based on data from the Indonesian Automotive Industries Association (Gaikindo), in 2017 there were around 6.2 million trucks in Indonesia. Trucks are a company asset that influences the company's operational processes. Assets can be classified into two main parts, namely current assets and non-current assets. Included in the current assets group are (a) Cash or cash that can be used to finance the company's operations. (b) Short-term investments (marketable securities). (c) Notes receivable. (d) Account receivables/business partners are bills to other parties (to creditors or customers/consumers). (e) Inventory. Whereas what is meant by non-current assets are: (a) Long-term investments. (b) Fixed assets are assets owned by companies whose physical appearance (concrete / real). (c) Intangible fixed assets. (d) Deferred charges (deferred charge). (e) Other assets [3]. Tire assets in trucking companies are included in fixed assets because they are tangible, not for sale, have value, have a useful life, and are used for company purposes. Besides that, the tire business in Indonesia is still growing along with the increase in sales of motor vehicles. The denser population of vehicles makes tire manufacturers continue to increase their production capacity. Director of PT Multistrada Arah Sarana Tbk (MASA) Uthan A Sadikin said, currently, the domestic tire market is quite dependent on the condition of car sales. If car sales increase, tire sales will also increase [4].

The need for the company to oversee assets, companies can implement asset management. According to British Standard Institution Publicly Available Specifications, management assets

are systematic and coordinated activities and practices through which an organization optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their life cycles for the purpose of achieving its organizational strategic plan [5].

In trucking companies, management of tire assets in the form of Tire Management System can be applied in the company. Tire Management System is a tire maintenance business concept that can optimize the age of replacing each tire, so that operational costs are lower and efficient and provide solutions to tire problems for consumers, with tire management and maintenance that are more professional and expert in their fields, so that the company's work results can be more maximal in carrying out its core business [6].

In carrying out its business, the company cannot be separated from the role of information technology. According to Hamzah B. Uno and Nina Lamatenggo, information technology is a technology used to process data. Processing includes processing, obtaining, compiling, storing, manipulating data in various ways to produce quality information, namely information that is relevant, accurate, and timely [7].

Casagras defines the Internet of Things, as a global network infrastructure, which connects physical and virtual objects through data capture and communication capabilities. The infrastructure consists of existing networks and the internet along with network development. All object offerings, sensors, and connection capabilities are the basis for independent service development and application cooperatives. This is also characterized by a high level of autonomous data retrieval, event transfers, network connectivity, and interoperability [8].

During this time of automation systems known today is the bar code system. The bar code system has limitations in data storage and cannot be reprogrammed for the data stored in it. But in RFID technology the process of taking or identifying objects or data is done contactless. According to Supriyono that RFID (Radio Frequency Identification) is a wave-based identification technology, the technology that is able to identify various objects without requiring direct contact [9].

2. Method

This type of research is a case study research that is case inventory which is used as an object of study. The method in this study uses a quantitative approach. This study was conducted at Trucking Companies in Indonesia. The type of data obtained is in the form of primary data and secondary data. Primary data was obtained from trucking company respondents by distributing questionnaires. Secondary data was obtained from several references from journals and websites.

3. Discussion and Result

In the trucking company, the truck fleet is the core of the company's operations and have a big impact on the performance of the company. In order for the truck fleet to operate properly, it is necessary to carry out regular maintenance and monitoring of the fleet. Driver and fuel costs are the biggest cost component in the operation of logistics trucks in Indonesia. Data from the Indonesian Logistics and Forwarder Association (ILFA/ALFI) shows that the transportation sector consumes 20% of the total national energy consumption. While 97% of total consumption uses fuel oil (BBM). Other costs such as driver salary (37%), maintenance (98%), and tires (2%). So, tire operating costs become a variable that affects the company's profit and loss [10].

One of the problems faced by trucking companies is losing tire assets. This problem affects the company's profit and loss. Tire management activities can use Tire Management System (TMS) and in this activity supervision of tire replacement is carried out by using the Tire Control System. The key to this problem is knowing and validating when the tire will be replaced with a new one, it is necessary to implement Information Technology because besides that the

world is facing industry 4.0, which means combining physical activities with technology. The use of RFID technology (Radio Frequency Identification) appropriate to reduce this problem. The use of RFID technology can be implemented on tires by considering the development factor of cargo cars which every year increases, land transportation modes dominate in logistics activities in Indonesia, and many trucking companies expect the ban of tires to be minimized to prevent loss of the company because the cost of procurement of tires is one of the cost variables that can affect the amount of profit or loss, especially in the trucking business. If in the past barcode has become the main way to track products, now RFID systems are the technology of choice for tracking humans, pets, and even vehicles. For example, the Michelin Americas Truck Tires recently started testing a radio frequency tire identification system for passenger car tires and small trucks . RFID transponders are installed inside the tire and store information in the tire and store identification information that can be associated with the vehicle identification number.

The types used are EPC Gen 2 ultrahigh-frequency (UHF) RFID tags. This type of RFID can penetrate the tire wall thickness by transmitting radio frequency waves even further. The purpose of Michelin manufacturing companies to apply RFID to their products is to add value to their products because tire users will easily track their tires. [11]. Michelin Americas Truck Tires is now embedding radio frequency identification (RFID) chips inside commercial truck tires and retreads, enabling fleets to better manage their tire assets throughout the full life cycle. Michelin made the announcement here at the ATA's Technology & Maintenance Council's Annual General Meeting [12].

The use of RFID technology on tires is by way of RFID filled with data of the identity of the truck fleet and the position of installation of tires to be installed by RFID tags, then RFID affixed inside the tire sidewall rubber when checking tire assets by using an RFID reader. There are 2 RFID tags, namely active and passive. Active RFID tags how it works is the trucks only pass through passive RFID tags without checking one by one truck tires, while passive RFID tags work by attaching passive RFID readers to truck tires one by one. RFID will be transmitting frequency and read by the RFID reader. The data contained in the RFID tags are the truck fleet police number, tire serial number, and tire position when installed on the truck. RFID tags will be read by the RFID reader during inspection or control of truck tires. If during inspection or control of the tire there is no data that is read by the RFID reader, this proves that the installed tire does not have RFID tags and this is can be an indication that there is embezzlement on the truck tire. After the inspection, the validation of the data and truck tires can be known. This was done to prevent the intention of the drivers to embezzle company tires so that tire fraud could be minimized and the company's operations became efficient because asset management was carried out properly.

From the respondent data obtained, the resulting data processing is as follows :

Table 1. Total fleet of trucks

	Frequency	Percent	Valid Percent	Cumulative Percent
< 10	3	25	25	25
11 - 20	2	16,7	16,7	41,7
> 20	7	58,3	58,3	100
Total	12	100	100	

Based on table 1. That from 12 companies, 3 companies have a fleet of less than 10 fleets with a percentage of 25%, 2 the company has a fleet of around 11-20 fleet with a percentage of 16.7%, and 7 company has more than 20 fleets with a percentage of 58, 3%.

Table 2. Total of customers handled

	Frequency	Percent	Valid Percent	Cumulative Percent
< 10	0	0	0	0
11 - 20	7	58.3	58.3	58.3
> 20	5	41.7	41.7	100
Total	12	100	100	

Based on table 2. That 12 companies, no company handled less than 10 customers, 7 companies handling customers around 11-20 customers with a percentage of 58.3%, and 5 companies handled more than 20 customers with a percentage of 41.7% .

Table 3. Total of shipment within a month

	Frequency	Percent	Valid Percent	Cumulative Percent
< 10	0	0	0	0
11 - 20	2	16.7	16.7	16.7
> 20	10	83.3	83.3	100
Total	12	100	100	

Based on table 3. That from 12 companies, no company sent less than 10 shipments within a month, 2 companies sent around 11-20 shipping with a percentage of 16.7%, and 10 companies sent more than 20 shipments with a percentage 83.3%.

Table 4. Type of tires used by the company

	Frequency	Percent	Valid Percent	Cumulative Percent
Original	9	75	75	75
Vulcanisir	3	25	25	100
Total	12	100	100	

Based on table 4. That from 12 companies, 9 companies used original tires with a percentage of 75% and 3 companies used vulcanised tires with a percentage of 25%.

Table 5. Duration of truck usage

	Frequency	Percent	Valid Percent	Cumulative Percent
< 10 years	11	91.7	91.7	91.7
11 - 20 years	1	8.3	8.3	100
> 20 years	0	0	0	100
Total	12	100	100	

Based on table 5. That from 12 companies, 11 companies duration of truck usage is less than 10 years with a percentage of 91.7%, 1 company duration of truck usage is around 11-20 years, and no company has a duration of truck usage of more than 20 years.

Table 6. Company needs to monitor tires

	Frequency	Percent	Valid Percent	Cumulative Percent
No	0	0	0	0
Yes	12	100	100	100
Total	12	100	100	

Based on table 6. That all companies agree regarding the company requires supervision of the tires in each fleet with a percentage of 100% of the 12 companies obtained.

Table 7. The intensity of a truck fleet maintenance

	Frequency	Percent	Valid Percent	Cumulative Percent
<3 months	1	91.7	91.7	91.7
4-6 months	1	8.7	8.3	100
> 6 months	0	0	0	100
Total	12	100	100	

Based on table 7. That from 12 companies, 11 companies of his truck fleet maintenance intensity of less than 3 months with a percentage of 91.7%, one company truck fleet maintenance intensity around 4-6 months with a percentage of 8.3% and no company is the intensity of maintenance the truck fleet is more than 6 months.

Table 8. The intensity of tire maintenance

	Frequency	Percent	Valid Percent	Cumulative Percent
< 6 months	4	33.3	33.3	33.3
7 - 12 months	6	50.0	50.0	83.3
> 12 months	2	16.7	16.7	100.0
Total	12	100.0	100.0	

Based on table 8. That from 12 companies, 4 companies tire maintenance intensity for less than 6 months with a percentage of 33.3%, 6 companies tire maintenance intensity around 7 - 12 months with a percentage of 50%, and 2 companies tire maintenance intensity for more than 12 months with a percentage of 16.7%.

Table 9. Procurement of tires on 1 truck unit

	Frequency	Percent	Valid Percent	Cumulative Percent
< 20 million	5	41.7	41.7	41.7
21 - 40 million	6	50.0	50.0	91.7
> 40 million	1	8.3	8.3	100.0
Total	12	100.0	100.0	

Based on table 9. That from 12 companies, 5 companies allocated costs to procure tires on 1 truck unit of less than 20 million with a percentage of 41.7%, 6 companies allocated costs to procure tires for 1 truck unit of around 21-40 million with a percentage of 50% and 1 company allocates costs to procure tires for 1 truck unit of more than 20 million with a percentage of 8.3%.

Table 10. Driver status

	Frequency	Percent	Valid Percent	Cumulative Percent
Employee	5	41.7	41.7	41.7
Outsource	7	58.3	58.3	100.0
Total	12	100.0	100.0	

Based on table 10. That from 12 companies, 5 companies the driver status is employees with a percentage of 41.7% and 7 companies the driver's status is outsourced with a percentage of 58.3%.

Table 11. Driver behaviour

	Frequency	Percent	Valid Percent	Cumulative Percent
Bad	4	33.3	33.3	33.3
Good	8	66.7	66.7	100.0
Very Good	0	0.0	0.0	100.0
Total	12	100.0	100.0	

Based on table 11. That from 12 companies, 4 companies assessed the behavior of drivers in their companies to have a bad habit with a percentage of 33.3%, 8 companies rated drivers in their companies as having good behavior with a percentage of 66.7%, but no company answered drivers in his company has very good behavior

Table 12. Had happened embezzlement tires

	Frequency	Percent	Valid Percent	Cumulative Percent
No	5	41.7	41.7	41.7
Yes	7	58.3	58.3	100.0
Total	12	100.0	100.0	

Based on table 12. That from 12 companies, 5 companies have never experienced embezzlement on truck tires with a percentage of 41.7% and 7 companies having experienced embezzlement in truck tires with a percentage of 58.3%.

Table 13. Driver embezzle the tires

	Frequency	Percent	Valid Percent	Cumulative Percent
No	4	33.3	33.3	33.3
Yes	8	66.7	66.7	100.0
Total	12	100.0	100.0	

Based on table 13. That from 12 companies, 4 companies never experienced the occurrence of tire embezzlement carried out by drivers with a percentage of 33.3% and 8 companies having experienced tire embezzlement incidents carried out by drivers with a percentage of 66.7%.

Table 14. Percentage occurs embezzlement tires

	Frequency	Percent	Valid Percent	Cumulative Percent
< 25%	7	58.3	58.3	58.3
26 s/d 50%	2	16.7	16.7	75.0
> 50%	3	25.0	25.0	100.0
Total	12	100.0	100.0	

Based on table 14. That from 12 companies, 7 companies have percentage of tire embezzlement in trucks less than 25% with a percentage of 58.3%, 3 companies have a percentage of tire embezzlement in trucks around 26-50% with a percentage of 16.7%, and 3 companies percentage occurred in the truck tire embezzlement of more than 50% with a percentage of 25%.

Table 15. Total of trucks applying technology

	Frequency	Percent	Valid Percent	Cumulative Percent
0	1	8.3	8.3	8.3
1 s/d 10	5	41.7	41.7	50.0
> 10	6	50.0	50.0	100.0
Total	12	100.0	100.0	

Based on table 15. That from 12 companies, 1 company has not had a truck fleet that applies technology with a percentage of 8.3%, 5 companies have implemented technology in about 1-10 truck fleets, and 6 companies have implemented technology on more than 10 trucks of fleets with a percentage of 50%.

Table 16. Application of technology to truck tires

	Frequency	Percent	Valid Percent	Cumulative Percent
Not Yet	11	91.7	91.7	91.7
Done	1	8.3	8.3	100.0
Total	12	100.0	100.0	

Based on table 16. That from 12 companies, 11 companies have not used application technology on their trucks with a percentage of 91.7% and 1 company has used application technology on their trucks with a percentage of 8.3%.

Table 17. The technology that applied to trucks

	Frequency	Percent	Valid Percent	Cumulative Percent
RFID	0	0	0	0
E-Seal	0	0	0	0.0
GPS	9	75.0	75.0	75.0
Nothing	3	25.0	25.0	100.0
Total	12	100.0	100.0	

Based on table 17. That from 12 companies, there is no company that applies RFID and E-Seal technology to its truck fleet, 9 companies have implemented GPS technology on their trucks with a percentage of 75% and 3 companies have not applied technology to their truck fleets with a percentage of 25%.

Table 18. The role of technology in trucks

	Frequency	Percent	Valid Percent	Cumulative Percent
Unimportant	0	0.0	0.0	0.0
Important	5	41.7	41.7	41.7
Very Important	7	58.3	58.3	100.0
Total	12	100.0	100.0	

Based on table 18. That from 12 companies, no company stated that the role of technology in trucks is not important, 5 companies stated that the important role of technology in trucks with a percentage of 41.7% and 7 companies stated that the role of technology in trucks was very important with a percentage of 58.3 %.

Table 19. The need for applying technology to TMS

	Frequency	Percent	Valid Percent	Cumulative Percent
No	1	8.3	8.3	8.3
Yes	11	91.7	91.7	100.0
Total	12	100.0	100.0	

Based on table 19. That from 12 companies, 1 company does not require the application of technology in Tire Management System with a percentage of 8.3% and 11 companies require the application of technology to the Tire Management System with a percentage of 91.7% the reason is that there are not many fleets owned by the company.

Table 20. Technology can be the solution to reduce tire embezzlement

	Frequency	Percent	Valid Percent	Cumulative Percent
No	1	8.3	8.3	8.3
Yes	11	91.7	91.7	100.0
Total	12	100.0	100.0	

Based on table 20. That from 12 companies, 1 company stated that technology could not be a solution to reduce tire fraud with a percentage of 8.3% and 11 companies stated that technology could be a solution to reduce fraud on tires with a percentage of 91.7%.

4. Conclusion

From this study it can be concluded that the operation of trucking companies often experiences loss of assets in the form of tires. Investment in the procurement of tires is quite large and tires are included in the fixed assets of trucking companies because they are tangible, not for sale, have value, have a useful life, and are used for company needs. Loss of tire assets is one of the large cost variables that can affect the amount of profit or loss, especially in the field of trucking. The implementation of Tire Control System has a great opportunity to monitor tire assets. From the above data, it can be concluded that most companies use original tires in the operation of trucks at a considerable cost of around 21-40 million in the procurement of tires in 1 truck unit. The company's intensity in maintaining their trucks is less than 3 months while the tire maintenance intensity is carried out every 7 - 12 months. The status of drivers who are mostly outsourced has good behavior, but do not guarantee drivers not to cheat, because tire fraud often occurs by company truck drivers because companies have not implemented a technology on their truck tires, so companies need information technology to monitor the company's truck tires, because the percentage of tire fraud carried out by truck drivers is quite high at 66.7% and most companies only use GPS information technology in truck operations. The role of technology in trucks is very important and can be a solution to reduce embezzlement on truck tires. Therefore the company needs to apply technology to the Tire Control System so that it can minimize losses. Truck companies want to focus on their core business, which is delivering consumer goods, but besides needing to maintain good assets by using Tire Management System which is managed by parties that work with truck companies, good tire asset monitoring by utilizing information technology namely Tire Control System, one of device that is used is RFID, the advantage of using RFID is that the frequency radio can penetrate the tire wall, high accuracy (validation) and this is done to prevent the intention of the driver to embezzle the company's tires so that tire embezzlement can be minimized.

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