ISSN No:-2456-2165

Case Study: Acceptance Analysis for New Tire Building Machine Technology using Overall Equipment Effectiveness Methodology

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Abstract:- The Choice of technology for competitiveness advantage of company is importance. All company has effort to achieve the effectiveness equipment as world class manufacture. One of alternative solution is new investment in the machine especially for manufacture that already operates with old machine. They will invest in new machine with new technologies that have characteristic high speed, high output and good quality result. These decision need to be evaluated or verification for acceptability judgment. This research is case study to measure the real achievement for the investment of new machine technology in tire industry. The data analysis use real time data acquisition for production record and loss time to measure availability, performance and quality. The three indicators converted to OEE index for new machine as integrated part in the investment decision. From these study show that index OEE machine achieve 85.83% and could be used as world class manufacturing.

Keywords:- *Acceptance Analysis, OEE.*

I. INTRODUCTION

The increasingly fierce level of competition in maintaining market share and high and varied demand levels from consumers is a challenge for the business community to be able to respond and create superior products to meet the customer's demands and expectations. Capacity building and customize products are one of several alternatives that can be chosen by business actors to answer these challenges. Of course, to increase production capacity and the diversity of products produced requires equipment (machinery) that has a high level of availability and productivity and quality and of course flexibility changeover is faster and easier.

PT. X, which is engaged in the tire industry with machines that are now owned by production, only reaches 85% of the set schedule and with a defective product level reaching 4% per year, of course it is very difficult to be able to answer the challenges mentioned above. So that the management of PT X in an effort to increase the capacity and fulfill the variety of products requested by consumers decided to invest in a new machine, namely the type of building machine (brand sefe run) that has the latest technology with high production capabilities and has a shorter change over time, due to all devices these machines can be operated and controlled based on computers by utilizing artificial intelligence as the main control.

The purpose of this study is to determine the level of machine effectiveness (safe run) with the overall equipment effectiveness (OEE) method as one indicator of acceptance towards the investment of the new machine.

II. LITERATURE REVIEW

A. Investment

Investment is an activity that contains elements of sacrifice or expenditure for a hope in the future (Prihastono, Hayati, 2015). According to Atmaja (2008), investment (investment) is a field of finance that is also related to corporate funding decisions, but seen from another perspective, not from the company but from the capital provider (investor).

According to Husnan and Muhammad (2000) as quoted (Supeni, Fadah, Utami) there are several benefits that can be obtained from investment activities, including:

- Employment.
- Increased output produced.
- Savings in foreign exchange or additional foreign exchange and so on.

B. Acceptance

Acceptance is which means "accept" or "provide support". Acceptance is one method to give a decision to accept or reject a product offered. In this research, product acceptance is in question about the acceptance of a new machine investment project to increase production capacity using the Overall Equipment Effectiveness (OEE) method.

C. Overall Equipment Effectiveness (OEE)

When an organization or company decides to invest in the form of new equipment with a specific purpose, of course it is expected that the investment in the new equipment can fulfill the purpose of the investment, namely the maximum output in accordance with the standard equipment received. It turned out that it was not enough to just invest in equipment to be able to meet these expectations, training operators and maintenance staff was also important to be able to get results

according to the equipment standards. There are three facts that result in equipment failure to produce products maximally (Boris, "Total Productive Maintenance", 27), namely:

- Equipment can stop completely.
- Equipment can work slower than its ability.
- Equipment can produce products that do not meet standards.

These three facts often occur when the equipment starts production and equipment that has been used for production though, and these facts will directly affect the profit of the organization / company because if the equipment stops completely and runs below its capacity, of course the output in the form of product quantities cannot be fulfilled and if the equipment produces a product that is not in accordance with the standard, of course, it will increase the cost of production due to material, labor, energy will be in vain, besides that there will be additional costs for repairs (rework) so that the product can meet the prescribed standards. Even worse if the product does not meet the standards and passes to customers other than the company will experience greater losses due to having to pay the customer complaint and could be the customer will leave us and switch to our competitors, and it takes 5 years or more to get back to us (Boris, "Total Productive Maintenance", 28). So to anticipate the conditions as mentioned above, the equipment must be able to produce a quality product with the maximum amount and time. TPM has a measurement tool to consider all these things, namely Overall Equipment Effectiveness (OEE). OEE is a comprehensive measure to identify the productivity of machines / equipment, this measurement is important to know which areas need to be improved and which areas are bottlenecks on the production trajectory (Nursubiantoro, Puryani, Rozaq journal University of Development "Veteran" Yogyakarta) In OEE there are three sizes for know whether the equipment is able to work effectively, the three sizes are:

➢ *Availability (Tool Availability)*

The availability of equipment can be defined as the probability of a component operating according to the function at a certain time in the operating conditions that have been set, (Ebeling, 1917, quoted in the journal DarmawanSetyoKoncoro).

Availability is a ratio of the amount of time that can be used for production to the total time provided (Boris, "Total Productive Maintenance", 29).

In this case management decisions that determine what can be called downtime are decisions to determine the value of downtime as needed (Boris, "Total Productive Maintenance", 29).

➢ *Performance (Equipment Performance)*

If the tool works under its capabilities / its capacity is a loss equivalent to 50% downtime. Performance is defined as the ratio of the number of products successfully made to the number of products planned (Boris, "Total Productive Maintenance", 29)

➢ *Quality (Product Quality)*

Why is quality also an important variable in OEE?

- If the quality is poor or the product fails to pass to the customer, we have a worse problem than just a decrease in production. There is a risk of losing customers.
- The more likely the engine will fail or produce substandard products, the more testing must be done to capture failure.

So that the two consequences of an equipment that produces non-standard products will have an impact on additional costs that should not have happened, which is why product quality is also one of the variables in calculating the effectiveness of the equipment (OEE).

The coverage referred to quality in OEE is the ratio of products that are not in accordance with the standard to the number of products made.

To determine the effectiveness of the equipment based on the three measurement variables above, the TPM has a measuring instrument called Overall Equipment Effectiveness (OEE) which is the product of the three measurement variables.

How do you know the level of acceptance of the equipment if the OEE value has been obtained? Japan Institute of Plant Maintenance (JIPM) has set benchmark standards that have been widely practiced throughout the world. The following OEE Benchmark is quoted from the site www.leanproduction.com:

- If OEE = 100% then production is said to be perfect, that is, the production process makes the product flawless, with fast performance and no downtime.
- If OEE = 85% of production is considered world class, for many companies this OEE score is a suitable score to be a long-term goal and a good indicator of new equipment.
- If OEE = 60% then production is considered reasonable, but shows that there is a large room for improvement.
- If OEE = 40% then production has a low score and must be immediately carried out improvement by finding the cause of the low value of the three measurement variables above.

III. RESEARCH METHODOLOGY

This research was conducted at the building production department of PT. X by calculating the overall equipment effectiveness (OEE) value of the new engine which is expected to be able to increase production capacity and can serve the customize of the products that consumers want. The study was carried out for 22 working days with time work 3-shif machine, which is 1st shift from 07:00 ~ 15:00, 2nd shift from 15:00 ~ 23.00 and 3rd shift from 23:00 ~ 07:00 with each rest hour – per shift is 1 hour.

ISSN No:-2456-2165

Retrieval or collection of data in this study is secondary data obtained from production reports in real time that can be accessed from the existing system facility in the company. The data taken is in the form of task time data, production, and downtime, data defects (repairs and Scrap).

IV. RESULT AND DISCUSSION

Management of PT. X to increase its production capacity decides to invest by purchasing the latest automatic machine that has a higher performance (in specifications) compared to the machines that have been installed previously. In accordance with the management decision to increase production capacity as needed, it is planned that in the initial stage, 20 new units will be purchased. To prove whether a new machine that will be installed can really get the results according to the needs or not, a trial of the installation of 1 machine unit with a series of activities is carried out to testing the performance of the new machine. The testing results data is obtained as follows:

- Testing was carried out for 22 days.
- The 22-day production data is as follows:.

Day	Schedule(pcs)	Actual (pcs)
1	500	495
2	770	796
3	858	902
4	1167	1164
5	755	793
6	930	969
7	780	774
8	940	937
9	1249	870
10	1100	1052
11	1140	1029
12	1101	972
13	1242	1180
14	1086	929
15	1264	1166
16	1150	1050
17	1254	1195
18	1236	1188
19	1217	1193
20	1120	1071
21	1137	1178
22	1150	1133
Total	**23146**	**22036**

Table 1:- Production Result

- Machine down time data during testing as follows ;

No	Causes	Downtime (minutes)
1	Machine	2237,81
2	Materal	605.34
3	Man	0.00
4	Others	476,81

Table 2:- Downtime Machine

"Others = Change over + minor stoped"

- Defective product data during testing is as follows:

Produksi	Scrap	Repair	Total
20903	0	12	12

Table 3:- Defective product data

From the data obtained as contained in the above tables, the next step is to calculate the OEE value based on the above tables to provide a reference to management whether the new engine is included in the category of good or not feasible or not to continue in the plan to increase production capacity. The calculation of the OEE value is done with 3 measurement variables, namely:

- Availability, is the ratio of the amount of time that can be used for production of the total time provided. Where it is known:

Available time (tasktime) is 22 days – and the rest time converted to Minute is:

= (22 x (60x24)) – ((3x60)*22)
= 27720 minute.

Downtime = machine stop + others
= 2237.81 + 476.81
= 2714.62

Availability (%) = (Available time-down time)/(Available time) x 100%
= (27720-2714.62)/27720 x 100%
= 90.20%

- Performance is the ratio of production quantity relative to the production planning.

Where is:
Production Planning (22 hari) = 23146 pcs
Actual Production = 22036 pcs

$$\text{Performance (\%)} = \frac{\text{Actual production}}{\text{Production Planning}} \text{ X } 100\ \%$$

$$= \frac{22036}{23146} \text{ x } 100\%$$

= 95.20 %

- *Quality*, is ratio for the good product result compare to total production.

Where is:
Production Quantity = 22036 pcs
Scrap Quantity = 0 pcs
Repair Quantity = 12 pcs
Quality(%)

$$= \frac{\text{prouduction quantity} - \text{defective quantity}}{\text{production quantity}} \text{ X } 100\%$$

$$= \frac{22036-12}{22036} \text{ x } 100\%$$

= 99.95 %

From the three indicator, OEE index could be calculated as follow:

OEE = Availability x Performance x Quality
= 90.20% x 95.20% x 99.95%
= 85.83%

V. CONCLUSIONS AND IMPLICATION

With the known OEE value of 85.83%, according to Japan Institute of Plant Maintenance (JIPM) standards it can be concluded that the investment of new machines is in the category of "world-class production", and is an indicator of acceptance in the good / proper category for new equipment.

From the OEE value obtained it is recommended to continue the project of installing a new type of machine to increase the capacity and customize of the product to improve the company's competitiveness.

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