

Analysis to Optimizing Inventory Management in Dies–Mold Making Factory by Partial Least Square (PLS) Case Study: ABC Company

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Abstract:- Dies- mold making industry in Indonesia is growing fast for supporting many industry company in Indonesia. Dies- mold is very important to production process many industry. For making plastic product, aluminum product, and steel product. In mass production industry, good quality of dies-mold is becoming major factor to reach efficiency and cost effectiveness. Good quality dies-mold can support for big batch of production and small cycle time. One of industry using dies- mold is otomotif company. Many part of otomotif using dies-mold to mass production. Some example is engine component, frame component, plastic component, exhaust system and many others. In dies mold making company, production need a large cost. Raw material is special steel, and many others grade of steel. To made dies-mold need cutting tools with very high specification. Cutting tools is being large inventory because delivery more than 2 months. Inventory is being problem because not many company in Indonesia making special tools. Tools are imported from Japan, and Europe. Company problem is using inventory is less than 50%. This mean that many waste from inventory. Lean manufacturing lead us to know that one of waste is inventory. Path analysis with Partial Least Square (PLS) is used to analyze what factor is causing and high inventory. This result can lead many improvement.

Keywords:- Otomotif industry, Lean manufacturing, Inventory, Partial Least Square (PLS).

I. INTRODUCTION

PT ABC at Indonesia is one of factory to making dies for otomotif Industry. This company support OEM manufacturing of motorcycle to provide dies for dies-mold casting aluminum. Dies is very important for produce part of engine. Shape and quality of aluminum component is depend on quality of dies-mold. Most important characteristic of dies- mold is durability of life time. Initial crack is one of potential failure of dies. So that material of dies is very special. As usual, SKD 61 (H13) is special tools steel used for cavity dies. This material have special characteristic to production condition 600-700° Celsius and high pressure injection. This picture shown figure of dies-mold.



Fig 1:- Dies-mold for aluminum die casting

Process of making dies is shown :

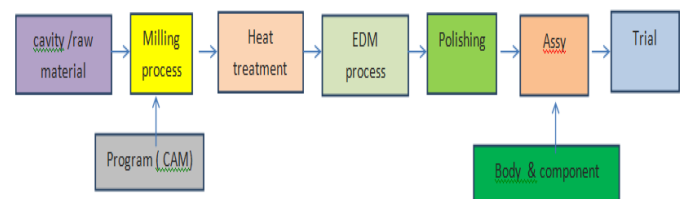


Fig 2:- Flow process making dies

SKD 61 (H13) first proceed in milling station using CNC machine to make basic shape. And after doing roughing process, material cavity is have to do heat treatment to reach 45-47 HRC hardness. After heat treatment process, cavity finishing shape by CNC. EDM process to made shape that difficult to do by milling process. For example rib, and hole. Polishing is next process to smoothing surface of cavity. After Assy with others component, dies ready to trial injection for next process.

In cost structure, milling process is most expensive process. Because of using high tech machine CNC, so need higher cost production for the process. In using cutting, milling process need a lot of cutting tools. Which delivered from Japan and other countries.



Fig 3:- Milling process

Inventory become large because cutting tools must ready at warehouse for providing order dies from OEM manufacturing motorcycle. This condition because tools must be import from Japan, Korea, Thailand maker. Inventory using is about 30%. This gap is waste in operation.

endogenous constructs behavior (PLS-SEM). The models can also be utilized in other outside of marketing, consumer behavior, advertising, and psychology. This technique can be used in the areas of manufacturing, quality and continuous improvement, etc. (Carlos Monge et al, 2014) Subramaniamet all (2017) in their research explain that PLS can doing model of how variable dependent impact to independent variable.

III. CASE STUDY

ABC company have problem in inventory vs using. 70% of inventory is not utilize, this mean a large of waste in operational management. path diagram help to find out what is factor of inventory that effect to high level inventory condition.

In PLS software, we input the data of inventory value, unit motorcycle production, delivery rate, min max ordering level, and daily using. When we run the software, we have result that min max ordering is the biggest factor to influence high level inventory condition.

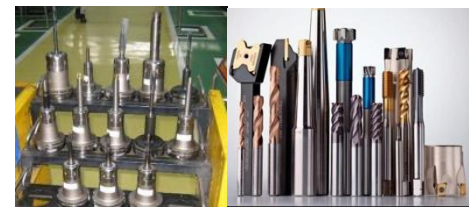


Fig 5:- Cutting tools

This process show step of research in ABC company. Research will conducted to find the best solution.

- Finding problem at company, gap inventory and actual using
- Literature review, find theory to solve problem
- Data collecting, find cause of high inventory
- Made model inventory, variable dependent and independent
- Run data by SEM PLS software
- Conclusion of model

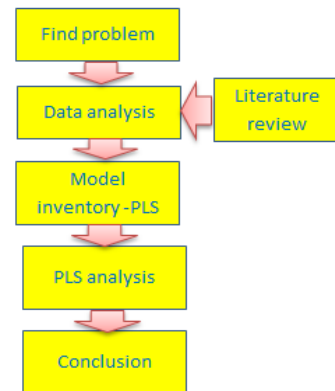


Fig 6:- Research model

II. LITERATURE REVIEW

Lean manufacturing 7 waste In manufacturing operation, 7 waste to be avoid and reduce are : 1. Overproduction (doing production over than request), 2. waiting (time to wait next process), 3. Transport (moving from line production to other line), 4 inappropriate processing (unnecessary process), 5.unnecessary inventory (stock raw material, finish good), 6. unnecessary motion, 7. defects (rejection).

Taichi Ohno explain that Toyota manufacturing strategy is how to eliminate waste. So that company will be lean. And one of strategy is Just In Time, zero inventory. Supplier Toyota will send the product when there is request from Toyota. They call the request signal as Kanban. When inventory is so big value, potential to defect, rust, and missing (Toyota Way, Jeffry K. Liker).

The JIT advocates the elimination of waste by simplifying production processes, reductions in set up times, controlling material flows, and emphasizing preventive maintenance are seen as ways by which excess inventories can be reduced or eliminated, and resources utilized more efficiently (Kannan and Tan, 2005). Partial Least Square is one of method to analyze path and finding what factor is the most influence for independent variable.

To evaluate the inventory model, Partial Least Square (PLS) analysis and Structural Equation Modeling (SEM) techniques was adopted. PLS-SEM path modeling was adopted for several reasons; first of all, the model of the present study includes formative construct (e.g., lean manufacturing practices), and, unlike CB-SEM approach, PLS-SEM are (PLS) analysis and Structural Equation Modeling (SEM) techniques was adopted. Second reason, PLS does not need large data. This make PLS more suitable for study and analysis for inventory problem to find biggest factor. (Hana Arrfou et al, 2016).

The structural equation models CB-SEM and PLS-SEM can be used, in a reliable and statistically significant manner, to test theories (CB-SEM), to develop theories, or to predict

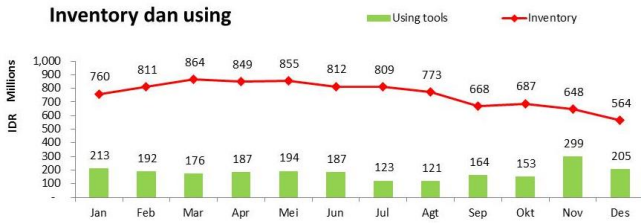


Fig 4:- Inventory vs using (Internal data ABC company)

Next step after data collecting is make model inventory with $Y = \text{inventory}$, and X variable is aspect that influence inventory.

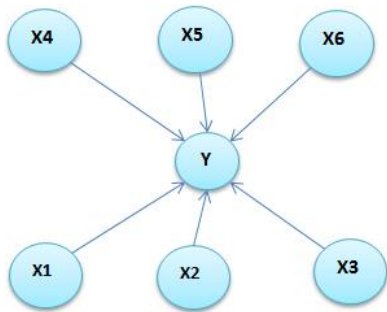


Fig 7:- Inventory model

Some variable to be analyze is listed below.

| Variable | Description |
|----------|-----------------------|
| Y | Inventory |
| X1 | Using |
| X1.3 | Motor unit production |
| X2.1 | Min order |
| X2.2 | Lead time |
| X2.3 | Price tools |

After running PLS software, this is result path of model with all coefficient.

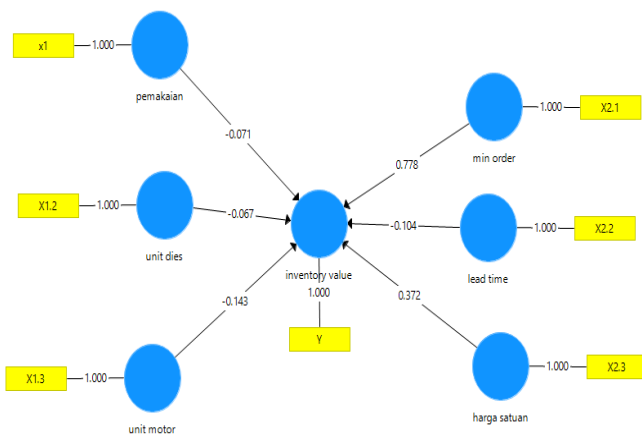


Fig 8:- Path Coefficient model inventory

IV. CONCLUSION

PLS can help to analyze what factor influence high value of inventory. Factor which give biggest influence to high inventory is X2.1 (Min Order) 0.778 score coefficient path. This condition is same with actual condition. Min max

ordering is set with high level, because company don't want lose any die-mold orders. This company have to improve strategy of ordering method from min order to another method. Hong Sen (2017) in his paper recommended that Just In Time system is very powerful system to significantly reduce inventory. Min order in this company is to high if compare using every month. So that the value of min order to trigger purchase mut be evaluated. This path model presented to company and management make some activity plan to improve ordering system.

Company activity plan improvement.

- Forecasting data more accurate every 3 months
- Vendor managed inventory (Just In Time) coordination
- Supply chain management(yearly contract with supplier)
- Information data sharing from motorcycle factory until tools supplier.

After improving, supplier more clear to know how much will order cutting tools. With this information supplier can managed inventory, stocking at warehouse and delivery to ABC company according delivery schedule.

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