Managing Dead Stock Spare Part Using House of Risk Framework

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Abstract **: House of risk framework had been applied widely for identify root cause of problem in supply chain. However, house of risk framework usage to mitigate problem in spare part stocks are still limited. In this paper we employ *house of risk* Framework to identify root cause of problem in spare parts stock (dead stock). The result of this research could be used as comparison of house of risk framework in spare parts stocks. With a eminent confidence, house of risk framework suggest several factor that contribute to dead stock namely: spare part user, time limit in inventory, mismatch inventory data. House of risk also suggest corrective action needed to resolve this problem, such as promoting regulation conformity for spare part usage and inventory, and assign budget for each stock users to track and control spare part consumption for each users.**

Keywords – **Dead Stock, Spare Part Inventory , House of Risk, Manufacturing Company,**

I. INTRODUCTION

Spare part inventory existed in company for minimize duration of machine outage. Excellent spare part inventory will contribute to smooth repar and maintenance process. Irrespectively from their advantages, managing spare part inventory is challenging a task. Spare part inventory have a purpose to conform spare part for maintenance (process that already planned) and repair (Process that can't be planned)[1]. If for instance there is no repair existed, means there are some spare part inventories that were not used. This situation will caused that some of spare part will become a dead stock[2]. Dead stock inventory is unfavourable from company because it will tie the capital to handling the inventory.

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Dead stock has a major impact on costs of the inventory. It's prominent for company to always manage its stock from dead stocks. In the past literature dead stock habitually correspond with obsolete product or obsolete raw material [3], [4]. In the context of product inventory, dead stock was antecedent of life cycle of product [3]. Product with shorter life cycle will have a bigger risk to contain dead stock in its inventory. However in spare part inventory these will not always the case, Dead stock in spare part take place because of various reason such as rapid change in technology, production structure, order process that exceeding actual needs, as well as Mistakes in order and inventory, and differences between technical and construction[5]. With a numerous cause existed in spare part inventory, imply that dead stock in spare part context will get more complicated rather than for product inventory .

Company usually handle dead stock in product inventory by take disposal of excess inventory [6]. Various actions regarding disposal policies in company such as selling it with discounted prices, modify or take the parts, and last option is donate it. Either way, all the action taken will affect on lower cost of storing the dead stock. In contrast, spare part stock can't be disposed easily. Spare part inventory characterise by specific specification[7] that means company will encounter a hardship in finding a buyer that need the spare part. This difficulty will get doubled when company can't take dispose their excess inventory because of legal issues.

Improving inventory performance required detailed investigation on process related and improve the process by omitted process that contribute to dead stock in spare part inventory. In perform that task there are several frameworks that can be used such as Root Cause Analysis, House of quality, FMEA and House of risk. Root Cause Analysis is the most common method used to identify problem[8]. House of quality framework offer a way to translate consumer needs in company activity and process[9]. *Failure Mode and Effects Analysis* (FMEA) is work by evaluate procedure to establish potential failure modes and determine the effect of every single activity on system performance [10]. Above all there are house of

risk model that intensify by Pujawan and Geraldine (2009) [11]. This framework perform the task by identify and measure risk concerning problem company faced. This risk measurement then applied to mitigate risk while take account resource and financial constraint.

II. METHODOLOGY:

This paper applied house of risk for improvement method in large manufacturing company producing fertilizer in Indonesia. The company spare part inventory ranging from large size inventory such as turbine blade and boiler to small size inventory such as nut and bolt.

House or Risk framework performs with several Steps[11] :

1. Identification of risk events and assessment of their severity
   This process runs by elaborate business process to detailed process and search for negative event that can be occur (risk Event). Risk event identified by take interview and focus group with manager. The next step is to give assessment to risk event based on their severity or impact if risk event occurs.
2. Identification of Risk Agent
   Risk agent in company taken from factor that could have influence activities of process in company regarding business process. Risk agent will have a score that reflect likelihood or probabilities the event occurs.
3. Correlation between risk agent and risk event
   In this stages correlation between risk agent and risk event identified. These processes determined by assign score that represent correlation between risk agent and risk event.
4. Accumulated Risk Score.
   Risk score is derived from collaborate risk event score, risk agent and correlation between risk agent and risk event.
5. Prioritizing action to minimize risk agent
   These processes begin with identification of possible action to minimize risk agent. Next move is to place score correspond with likelihood for improvement action took place.

III. RESULT

There are 4 risk event linked with improvement of inventory management consequently to increase inventory turnover. Severity of risk event ranged between 1 (No impact if the risk event occur) until 10 (hazardous impact if the risk event occur). As can be seen from table I severity from risk event is in the serious stake (and hazardous impact stake.

TABLE I
Risk Event Identified

Risk Event	Code	Mode
Dead Stock Spare Part	E1	8
Fast moving stock that were not used by user	E2	8
Non Fast Moving Sparepart that were not used by user	E3	7
Stock that mismatch with specification	E4	7

Inventory issue is affected by several factors. In this case there are 15 risk agent that identified as indicated in table II. Score of risk agent represent likelihood the factors come about. The likelihood score extend from 1 (Never) to 10 (always).

TABLE II
Risk Agent Identified

Risk Agent	Code	Mode
Damages Spare-part in warehouse	A1	7
Inventory data mismatch with actual	A2	8
Precautious buyer behavior (Pileup Stocks)	A3	4
User division discontinue	A4	2
Standard material classification not included in inventory policies	A5	4
Lack inventory maintenance	A6	2
No limitation on duration of inventory	A7	8
Low accuracy forecast	A8	7
Government regulation regarding asset disposal	A9	2
Machinery modification	A10	7
Unsafe Storing	A11	9
Spare part not exchangeable by user	A12	8
Mistyping Product requirement	A13	2
User	A14	10
Faulty Plan from PGM	A15	4

Correlation between risk event and risk agent build by linked up risk event impact score and risk agent likelihood. There are 2 Outcome of this process. First result is correlation matrix as you can be seen in appendix 1. Second outcome is the risk agent rank with most significant effect on issue. The output shown that the most significant factor in inventory issue is user, no time limit on inventory and there is mismatch in inventory data.

TABLE III
Improvement Action Identified

Code	Improvement Action
PA 1	Increase coordination between user,PGM, procurement and vendor via *review meeting*
PA 2	Spare Part Management training for employee
PA 3	Add policies concerning stock and non-stock item
PA 4	Promoting spare part usage and inventory regulation conformity
PA 5	Enhance intensity and mechanism of stock inspection
PA 6	Adapt stock category to routine stock and non-routine stock
PA 7	Collaboration in inventory management together with other parties within PIHC Holding
PA 8	Assign budget to each stock user
PA 9	Define standard part name and number

Improvement action is obtained from results of discussion and brainstorm with inventory staff, manager and procurement. Table III summarize 9 improvement actions that can be applied to correct the issue in spare part inventory.

The last part of house of risk is to measure priority of the corrective action. This framework evaluates these priorities through the comparison between their likelihood and the significant of the problem corrective action solved. Result shown that logical action to prioritize is Promoting spare part usage and inventory regulation conformity (P4) and (P8) Assign budget to each stock user. The complete result attached at appendix 2.

IV CONCLUSION

This paper implements house of risk framework in order to assign corrective action needed to improve spare part inventory performance. House of risk give guidance on which factor need prioritize and by what means corrective action must take place.

The prevailling factor contribute to dead stock is spare part user, inventory policies regarding time limit on inventory and mismatch data in inventory. As a consequence there will be several actions that can take place. The first prioritize action must take by company is to promoting spare part usage and inventory regulation conformity. Example of this action is by give time limit for spare part user to utilize the spare part soonest as possible. This action hopefully will reduce dead stock as result of user actions.

Second corrective action that should be consider is to assign budget to each stock user. This action will attach every stock with its user, user will take a considerable action in way they employ spare part. As has been noted this result is match with the factor that influence inventory most (spare part user).

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APPENDIX

APPENDIX 1
Matrix 1 House of Risk

	Risk Agent															
Risk Event	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	Si
E1	9		1	9	3	9		3		1	3	9		1		8
E2	3	9					9	3	3	3		3	3	9		8
E3	1	9					9		1	9		3		9	9	7
E4			9				3			9		9	1	1	1	7
Oj	7	8	4	2	4	2	8	7	2	7	9	8	2	10	4	
ARPj	721	1080	284	144	96	144	1248	336	62	1106	216	1440	62	1500	280	
Pj	6	5	8	11	13	12	3	7	14	4	10	2	15	1	9	

APPENDIX 2
Matrix 2 House of Risk

	Improvement									
Agent	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	PA 7	PA 8	PA 9	ARP_j
A14	3		3	9			1	9		1500
A12		1	9	3		1	9	9	3	1440
A7	3	3	9	9		9	3	3		1248
A10	9		1		3			1		1106
A2		9	1	1	9				9	1080
TEk	18198	14904	30878	30132	13038	12672	18204	31310	14040	
D_k	4	3	5	3	3	4	5	5	3	
ETDk	4549,5	4968	6175,6	10044	4346	3168	3640,8	6262	4680	
Ranking	6	4	3	1	7	9	8	2	5	