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Fertilizer Storage Cost Optimalization on First Lean Warehouse of PT XYZ with Net Present Value and Equivalent Uniform Annual of Cost Method

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Abstract

As an agricultural country that has many plant commodities, the need for Fertilizer in Indonesia is very high and there are often shortages, especially of subsidized Fertilizer. Based on information from the website of the Directorate General of Agricultural Infrastructure and Facilities, Ministry of Agriculture of the Republic of Indonesia, it is stated that there are often cases of shortages of subsidized Fertilizer. Rules for Fertilizer distribution have been regulated through Minister of Agriculture Regulations. The large demand for Fertilizer will of course affect the production of Fertilizer factories which will also increase. The production and distribution processes that go through various stages will also influence Fertilizer uptake in each region that will receive Fertilizer distribution. According to the increasing of factory's production, warehouse capacity must be upgraded. The new rule from Board of Director to prohibit open storage, also reducing company's warehouse capacity. Hence, PT XYZ decided to rent a warehouse and need some feasibility analysis to prove that renting is the right decision. By the use of Net Present Value, Equivalent Uniform Annual of Cost, Cost Benefit Analysis, and Cost-Effective Analysis results Construct a new warehouse on company's land as the best way to reduce the storage cost.

1. Introduction

As an agricultural country that has many plant commodities, the need for Fertilizer in Indonesia is very high and there are often shortages, especially of subsidized Fertilizer. Based on information from the website of the Directorate General of Agricultural Infrastructure and Facilities, Ministry of Agriculture of the Republic of Indonesia, it is stated that there are often cases of shortages of subsidized Fertilizer. Rules for Fertilizer distribution have been regulated through Minister of Agriculture Regulations. Previously, the Government allocated subsidized Fertilizer in 2023 amounting to 9,013,706 tons. This amount consists of 5,570,330 tons of urea Fertilizer, 3,232,373 tons of ABC FERTILIZER, and 211,003 tons of special formula ABC FERTILIZER. In its current implementation, the Fertilizer that has been input and approved by the regent through the eAllocation application is 4.6 million tons of urea, 3.1 million tons of ABC FERTILIZER and 114,033 tons of Special Formula ABC FERTILIZER. The large demand for Fertilizer will of course affect the production of Fertilizer factories which will also increase. The production and distribution processes that go through various stages will also influence Fertilizer uptake in each region that will receive Fertilizer distribution. In short, the Fertilizer production flow from raw material to the consumer is Fertilizer production in the factory, then it will be sent to the UPP or Fertilizer Packing Unit where the fresh Fertilizer comes from the factory in bulk condition. After the Fertilizers are in bag condition, they will then be sent to the Warehousing Department Warehouse or also known as Line 1 Warehouse. The purpose of sending to the warehousing department is not only for the storage process but also to wait for the vehicle used to send the Fertilizers. The transportation used

to send Fertilizers to line 3 warehouses or buffer warehouses uses trucks. Sending Fertilizers to the buffer warehouse aims to ensure that the Fertilizers are sent to districts in Indonesia to be distributed to farmers. Based on data from PT XYZ, total production as of October 31 2022 reached 8.9 million tons/year, consisting of 5 (five) million tons/year of Fertilizer products and 3.9 million tons/year of non-Fertilizer products. It is also known that in the Fertilizer distribution process, Fertilizer will be stored first in Line 1 Warehouse with a storage capacity of 129,300 tons. Based on conditions in the field, PT XYZ has problems with storage capacity in its internal warehouse which is often full and even overloaded. Initially, the company could overcome overload by storing it in open storage. Open storage itself is the temporary storage of Fertilizer products in the Line 1 Warehouse yard and the PT XYZ Factory yard using pallets and covered with tarpaulin. However, open storage systems can pose a risk of product damage due to conditions that are difficult to predict. Apart from that, starting in 2022, based on an Order from the Board of Directors of PT XYZ, it is prohibited to carry out open storage. Therefore, PT XYZ carried out the warehouse rental process to a third-party. The warehouse rental system to third parties has an annual rental system that is paid at the beginning of the year. The budget required to rent a third-party warehouse certainly requires very large costs and needs to be considered for a long-term warehouse rental system. Therefore, a feasibility study is needed to invest in storing Fertilizer products. Analysis of investment feasibility studies to find alternative solutions for storing Fertilizer products in order to obtain minimum storage costs and maintain good quality Fertilizer products. A feasibility study is a comprehensive assessment and tries to highlight all aspects of the feasibility of a project or investment (Soeharto, 1999). The purpose of conducting a feasibility study is to avoid continuing to increase capital that is too large for activities that turn out to be unprofitable.

1.1 Objectives

The primary objectives of this study are to assess the decision of PT XYZ of renting a third-party warehouse for long term business is a right decision. Not only to assess, but also to identify another feasible alternative that probably could be proposed for PT XYZ to gain more income by reducing cost.

2. Literature Review

Inventory management plays an important role for storage cost in company. By the problem of feasible alternative for Fertilizer inventory, economic engineering became the main focus of this problem. Considering the importance of storage cost, it is needed to do feasibility analysis for the warehouse investment system.

According to Sullivan (2013), Equivalent Uniform Annual of Cost (EUAC) are used to count whether the income of an investment undefined or when there are no income. The warehouse investment system are an investment without a real income. So that, EUAC are fit to count the feasibility of this investment.

3. Methods

The research was executed by initial stage identification by conducting field studies at XYZ CORP in the Warehouse Department as well as reviewing the literature. Field studies were carried out by observing the production process and conducting interviews with workers, supervisors, and manager. Through field studies and literature, problems were found regarding the increase of the storage cost. Then the background, problem formulation, and research objectives are built based on the problem.

The next stage is the process of collecting data so that it can be used as a basis for research. At this stage, data collection is carried out using historical company data to determine production and receipt data of the company's warehouse capacity, operational cost, and warehouse renting cost. Apart from that, interviews and observations were conducted to obtain information regarding the process of building warehouse. Then, it is a must for observation and found historical document about the cost of building warehouse and its component. After that, the data processed by using Economic Engineering by using Net Present Value (NPV), Equivalent Uniform Annual of Cost (EUAC), Cost-Efficient Analysis (CEA), and Cost Benefit Analysis (CBA).

3.1 Storage Cost

Storage costs according to Jay Heizer and Barry Render (2015:561) translated by Hirson Kurnia, Ratna Saraswati and David Wijaya are costs incurred because companies store or carry inventory for a certain time in the warehouse. Meanwhile, according to Manahan P. Tampubolon (2018:238) holding costs are the costs incurred in storing inventory, in an effort to secure inventory from damage, wear and loss.

3.2 Net Present Value

The Net Present Value (NPV) method is the present value of money or cash flow in the future by considering the interest factor or interest rate (Santosa, 2009). A positive NPV calculation means that the investment provides higher returns compared to the desired minimum rate of return. On the other hand, if the NPV is negative, it means that the investment will provide lower results than the desired minimum rate of return, then the investment should be rejected (Suliyanto, 2010). The formula used to calculate Net Present Value (NPV) is as follows:

$$NPV = -I + \sum_{t=0}^{n} \frac{NCF_t}{(1+i)^t}$$

With:

I : Initial Cost
NCFt : Net Cash Flow in t period
n : period
i : Discount rate
t : Periode

3.3 Equivalent Uniform Annual of Cost (EUAC)

EUAC is the annual cost of owning, operating and maintaining an asset over the asset's life cycle. EUAC is based on the annual worth (AW) method, where AW is annual equivalent income minus annual equivalent expenditure and minus annual equivalent capital recovery (Sullivan et al., 2013). EUAC is used in calculations if income is declared storage cost“none” or cannot be defined. A low EUAC value is considered storage costmore economically feasible compared to high EUAC values storage cost (Sullivan et al., 2013). The following is the calculation formula using EUAC:

$$EUAC = I(A/P\,, i\%, n) + O\&M + SV((A/F\,, i\%, n)$$

With:

I (A/P, i%, n) : Annual Worth of Initial Cost

O&M : Annual Operational Cost and Maintenance

SV (A/F, i%, n) : Annual Worth of Salvage Value

i% : Discount rate

n : Period

3.4 Cost Efficient Analysis (CEA)

Cost-effectiveness analysis seeks to identify and monetize the costs of a program. It then links these costs to specific measures of program effectiveness. The value of the program's cost effectiveness (CE) ratio can be obtained by dividing the costs by the effectiveness units (Cellini & Kee, 2015). According to Henry M. Levin, cost effectiveness analysis is an evaluation that considers aspects of the costs and consequences of an alternative problem solution. This is a decision-making tool designed so that decision-makers know exactly which alternative solution is the most efficient. The formula used to calculate Cost-Effectiveness Analysis (CEA) is as follows:

$$Cost\ Effective\ Ratio = \frac{Nilai\ Investasi\ Saat\ Ini}{Unit\ Efektivitas}$$

3.5 Cost Benefit Analysis (CBA)

According to Mare J. Schniederjans, Jamie L. Hamaker, Ashlyn M. Schiederjans (2004), Cost Benefit Analysis is a technique for analyzing costs and benefits which involves estimating and evaluating the benefits associated with alternative actions to be taken. This technique compares the present value of benefits with investments of the same investment costs as an aid in decision making. According to Keen (2003), defines Cost Benefit Analysis as an analysis that explains the business reasons why or why not a specific investment should be chosen. Cost Benefit Analysis (CBA) also identifies and places a dollar value on program costs, but CBA weights those costs against the dollar value of program benefits. Typically, one subtracts costs from benefits to obtain the net benefits from implementing an investment program (if the net value of benefits is negative, they are referred to as net costs). The Cost Benefit Analysis value can be calculated using the formula:

$$Cost\ Benefit\ Ratio = \frac{PW(B) - PW(O\&M)}{I - PW(MV)}$$

With:

PW : Present Worth

B : Investment Benefit

O&M : Operational and Maintenance Cost

I : Initial Cost

MV : Market Value

3.6 Warehouse for Agricultural Standard

Based on SNI 7331:2007, the following are standards that stipulate general warehouse provisions for agricultural commodities which include food crop and plantation commodity products that have a minimum shelf life of 3 (three) months and are packaged in sacks. Warehouses referred to in this provision are all rooms that do not move and cannot be moved with the aim of not being visited by the public, but for special use as a place to store goods that can be traded publicly.

3.6.1 General requirements

The warehouse location must meet the following requirements:

a. Near or on the side of class I, II, IIIA, IIIB, IIIC roads or other access via water to make it easier to get in and out of the warehouse area, thereby ensuring smooth loading and unloading and distribution activities.
b. In an area that is safe from floods and landslides.
c. Far from factories or warehouses for dangerous chemicals, public fuel filling stations and/or landfills/chemical waste.
d. Separate from other buildings in the vicinity so that the security and safety of the goods stored is more guaranteed and does not disturb the safety of residents in the surrounding area.
e. Not located in a former rubbish dump or former chemical factory.

3.6.2 Warehouse building construction requirements

Warehouse building construction must meet the following requirements:

a. The warehouse building frame must be sturdy to maintain the quality of goods and human safety.
b. The warehouse roof, which can be equipped with a lighting roof, is made of material that is strong enough and does not leak.
c. The walls of the warehouse building must be sturdy.
d. The warehouse floor is made of concrete or other strong materials to support the weight of the goods stored according to the warehouse's maximum capacity and is free from groundwater infiltration.
e. Water gutters are made from strong materials and ensure water flows smoothly.
f. The door must be made of strong, durable material and equipped with a strong lock, as well as a canopy to ensure the smooth entry and exit of goods.
g. Ventilations must be covered with barrier wire mesh to avoid disturbance by birds, mice and other disturbances.
h. Warehouse buildings have eaves of sufficient width so that rainwater does not hit the warehouse walls.
i. It is recommended that warehouse buildings run from east to west, so that they are exposed to as little direct sunlight as possible.

3.6.3 Warehouse facility requirements

The warehouse must have the following facilities:

a. Identify adequate aisle arrangements to support the smooth storage of goods and access for goods in and out.
b. Water and electricity installations with guaranteed supply to support warehouse operations.
c. Installation of hydrants and lightning protection equipment.
d. An office or administrative room equipped with a communications network.
e. Water channels are maintained so that water can flow properly to avoid waterlogging.
f. Security system, guard room and sturdy fence around it.
g. Bathroom and WC.
h. Yard or parking area with sufficient area.
i. Adequate berthing and loading and unloading facilities for warehouses located near or on the edge of other access via water.

3.6.4 Warehouse equipment requirements

The warehouse must have the following equipment:

a. The weighing equipment listed is valid for measuring the weight of goods.
b. Strong pallets to support piles of goods so that the quality of the goods stored is maintained.
c. Hygrometer and thermometer to measure humidity and air temperature in the warehouse.
d. Staple ladder to make it easier to stack goods in the warehouse.
e. Fire extinguishers that have not expired are the first means of response when a fire occurs.
f. First Aid Kit for Accidents (P3K) equipped with sufficient medicine and equipment.
g. Cleaning tools to maintain warehouse cleanliness.

4. Data Collection

4.1 Fertilizer Stock Planning 2023

Fertilizer stock planning in warehouse department shown in table belows. Based on this data, we can see that from May to December 2023, the storage capacity of the Internal Line 1 Warehouse was unable to store product stock. Therefore, it is necessary to rent an external warehouse belonging to a third-party with a total capacity of 74,200 tons (Figure 1).

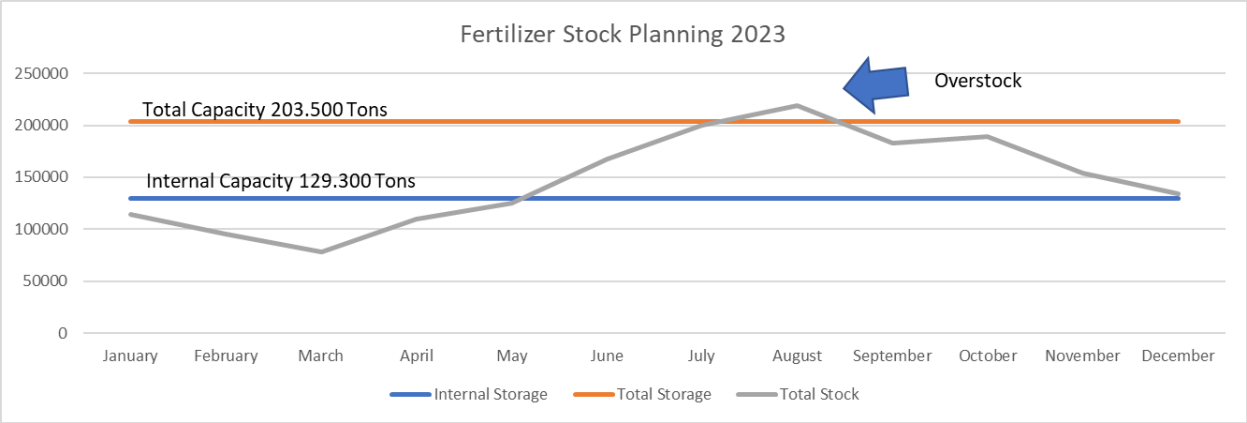


Figure 1. Fertilizer Stock Planning 2023

4.2 Warehouse Department Operational Cost 2023

Below are operational cost of the rented warehouse (Figure 2)

Electricity Cost	Rp	1,054,195,200
Water Cost	Rp	64,644,326
Heavy Equipment Cost	Rp	3,254,586,843
Stationary	Rp	51,000,000
Man Loading Cost	Rp	6,175,645,088
Delivery Cost	Rp	3,519,874,257

Figure 2. Rented Warehouse Operational Cost

5. Results and Discussion

5.1 Proposed Improvements

5.1.1 Alternative A – Construct Warehouse on PT XYZ's Land

Below are the investment cost for constructing a new warehouse on PT XYZ's land. It is shown that the total investment cost is IDR 115,027,949,163 (Figure 3 and 4).

ALTERNATIVE A		
Capacity 50000 Ton Bulk		
Initial Cost		
Investment	**Cost**	
Wwarehouse Construction		
Preparatory Working	Rp	9,504,967,428
Land Working	Rp	6,245,043,258
Foundation & Concrete Working	Rp	12,528,341,769
Steel Structure Working	Rp	14,623,567,559
Paint Working	Rp	3,406,299,582
Bulk Warehouse Facility Working	Rp	5,532,643,447
Warehouse Roof and Wall Working	Rp	16,061,419,256
Rain Water Channels Working	Rp	4,046,066,193
Warehouse Facility Working	Rp	972,521,381
Concrete Plate Road working	Rp	8,363,553,745
Hydrant Working	Rp	124,878,814
Finishing	Rp	2,910,405,897
Electrical Installation	Rp	59,529,000
Water Installation	Rp	5,595,700
Project Cost	**Rp**	**84,384,833,029**
Office Furniture	Rp	15,000,000
Pallet (22500 pcs)	Rp	18,675,000,000
Computer	Rp	13,750,000
Blower Fan	Rp	400,000,000
CCTV Installation	Rp	84,200,000
Wifi and Telephone Installation	Rp	6,000,000
Lighting Installation	Rp	50,000,000
Tools Cost	**Rp**	**19,243,950,000**
Total Cost	**Rp**	**103,628,783,029**
Tax 11%	**Rp**	**11,399,166,133**
Total Investment Cost	**Rp**	**115,027,949,163**

Figure 3. Investment Cost Alternative A

ALTERNATIF A

MARR =		**4.75%**
AOC (Annual Operating Cost) =	Rp	-
Building		
IC (Initial Cost) =	Rp	93,667,164,663
SV (Salvage Value) =	Rp	9,345,626,076
K (Life, years) =		10 Years
Tools		
IC (Initial Cost) =	Rp	21,360,784,500
SV (Salvage Value) =	Rp	1,079,416,920
K (Life, years) =		5 Years

EOY	Income	Cashflow	Building Depreciation	Tools Depreciation	Cashflow	NPV
0	Rp -	-Rp 115,027,949,163	Rp -	Rp -	-Rp 115,027,949,163	-Rp 115,027,949,163
1	Rp -	-Rp 14,468,043,689	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 26,956,471,063	-Rp 26,956,471,063
2	Rp -	-Rp 15,393,969,088	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 27,882,396,462	-Rp 27,882,396,462
3	Rp -	-Rp 16,318,335,604	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 28,806,762,978	-Rp 28,806,762,978
4	Rp -	-Rp 17,306,885,760	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 29,795,313,135	-Rp 29,795,313,135
5	Rp -	-Rp 36,671,034,009	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 49,159,461,384	-Rp 49,159,461,384
6	Rp -	-Rp 19,495,484,952	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 31,983,912,327	-Rp 31,983,912,327
7	Rp -	-Rp 20,705,888,479	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 33,194,315,854	-Rp 33,194,315,854
8	Rp -	-Rp 22,001,237,101	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 34,489,664,476	-Rp 34,489,664,476
9	Rp -	-Rp 23,387,710,057	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 35,876,137,432	-Rp 35,876,137,432
10	Rp -	-Rp 14,446,898,688	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 26,935,326,063	-Rp 16,510,283,066
10	Rp -	Rp 10,425,042,996	Rp -	Rp -	Rp 10,425,042,996	
PW		-Rp 269,903,330,209			**-Rp 429,682,667,340**	**-Rp 360,962,751,012**

Figure 4. Cashflow and Present Worth Alternative A

It is shown that Alternative A are worth IDR- 360,962,751,012 in present time.

5.1.2 Alternative B – Buy New Land and Construct Warehouse

Below are the investment cost for buy new land and construct warehouse. It is shown that the total investment cost is IDR 303,027,949,163 (Figure 5).

ALTERNATIVE B		
Capacity 50000 Ton Bulks		
Initial Cost		
Investment		**Cost**
Land (47000 m2)	Rp	188,000,000,000
Warehouse Construction		
Preparatory Working	Rp	9,504,967,428
Land Working	Rp	6,245,043,258
Foundation & Concrete Working	Rp	12,528,341,769
Steel Structure Working	Rp	14,623,567,559
Paint Working	Rp	3,406,299,582
Bulk Warehouse Facility Working	Rp	5,532,643,447
Warehouse Roof and Wall Working	Rp	16,061,419,256
Rain Water Channels Working	Rp	4,046,066,193
Warehouse Facility Working	Rp	972,521,381
Concrete Plate Road working	Rp	8,363,553,745
Hydrant Working	Rp	124,878,814
Finishing	Rp	2,910,405,897
Electrical Installation	Rp	59,529,000
Water Installation	Rp	5,595,700
Project Cost	**Rp**	**84,384,833,029**
Office Furniture	Rp	15,000,000
Pallet (22500 pcs)	Rp	18,675,000,000
Computer	Rp	13,750,000
Blower Fan	Rp	400,000,000
CCTV Installation	Rp	84,200,000
Wifi and Telephone Installation	Rp	6,000,000
Lighting Installation	Rp	50,000,000
Tools Cost	**Rp**	**19,243,950,000**
Total Cost	**Rp**	**103,628,783,029**
Tax 11%	**Rp**	**11,399,166,133**
Total Investment Cost	**Rp**	**303,027,949,163**

Figure 5. Investment Cost Alternative B

ALTERNATIVE B			
MARR =		**4.75%**	
AOC (Annual Operating Cost) =	Rp	-	
Building			
IC (Initial Cost) =	Rp	93,667,164,663	
SV (Salvage Value) =	Rp	1,186,337,290,979	
K (Life, years) =	Rp	10	Years
Tools			
IC (Initial Cost) =	Rp	21,360,784,500	
SV (Salvage Value) =	Rp	1,075,802,499	
K (Life, years) =	Rp	5	Years

EOY	Income	Cashflow	Building Depreciation	Tools Depreciation	Cashflow	NPV
0	Rp -	-Rp 303,027,949,163	Rp -	Rp -	-Rp 303,027,949,163	-Rp 303,027,949,163
1	Rp 23,262,226,350	Rp 8,930,861,644	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 26,819,792,081	-Rp 26,819,792,081
2	Rp 24,502,103,015	Rp 9,253,837,512	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 27,736,692,877	-Rp 27,736,692,877
3	Rp 25,808,065,105	Rp 9,642,477,266	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 28,654,015,214	-Rp 28,654,015,214
4	Rp 27,183,634,976	Rp 10,036,972,821	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 29,635,089,529	-Rp 29,635,089,529
5	Rp 28,632,522,720	-Rp 7,880,272,750	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 49,001,222,844	-Rp 49,001,222,844
6	Rp 30,158,636,181	Rp 10,839,741,317	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 31,807,322,238	-Rp 31,807,322,238
7	Rp 31,766,091,489	Rp 11,245,749,031	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 33,008,769,833	-Rp 33,008,769,833
8	Rp 33,459,224,166	Rp 11,653,051,576	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 34,294,599,964	-Rp 34,294,599,964
9	Rp 35,242,600,814	Rp 12,060,075,075	Rp 8,432,153,859	Rp 4,056,273,516	-Rp 35,670,953,113	-Rp 35,670,953,113
10	Rp 36,299,878,838	Rp 1,188,635,549,026	Rp 8,432,153,859	Rp 4,056,273,516	Rp 1,139,847,242,813	Rp 2,327,260,336,291
10		Rp 1,187,413,093,478	Rp -	Rp -	Rp 1,187,413,093,478	Rp -
PW		Rp 504,045,720,055			Rp 1,727,603,929,435	**1,727,603,929,434.80**

Figure 6. Cashflow and Present Worth Alternative B

It is shown that Alternative A are worth IDR 1,727,603,929,434.80 in present time (Figure 6).

5.1.3 Alternative C – Rent a Warehouse

Below are the investment cost for renting third-party warehouse. It is shown that the total investment cost is IDR 294,659, 338,334 (Figure 7).

ALTERNATIF C		
Capacity 48800 Ton Bulk		
Initial Cost		
Investment	**Cost**	
Standar work		
Warehouse rent (10 yrs)	Rp	246,264,913,364
Investment	**Rp**	**246,264,913,364**
CCTV Installation	Rp	84,200,000
Wifi and Telephone Installation	Rp	6,000,000
Blower Fan	Rp	400,000,000
Office Furniture	Rp	15,000,000
Computer	Rp	13,750,000
Pallet (22500 pcs)	Rp	18,675,000,000
Tools Cost	**Rp**	**19,193,950,000**
Renting Cost Total	**Rp**	**265,458,863,364**
Tax 11%	**Rp**	**29,200,474,970**
Total Investment Cost	**Rp**	**294,659,338,334**

Figure 7. Investment Cost Alternative C

ALTERNATIF C											
MARR =			**4.75%**								
AOC (Annual Operating Cost) =	Rp		-								
Building											
IC (Initial Cost) =	Rp		-								
SV (Salvage Value) =	Rp		-								
K (Life, years) =			10 Years								
Tool											
IC (Initial Cost) =	Rp		19,193,950,000								
SV (Salvage Value) =	Rp		960,447,500								
K (Life, years) =			5 Years								
EOY		Income		Cashflow		Building Depreciation		Tools Depreciation		Cashflow	NPV
0	Rp	-	-Rp	19,193,950,000	Rp	-	Rp	-	-Rp	19,193,950,000	-Rp 19,193,950,000
1	Rp	-	-Rp	37,393,461,166	Rp	-	Rp	3,646,700,500	-Rp	41,040,161,666	-Rp 41,040,161,666
2	Rp	-	-Rp	39,714,973,750	Rp	-	Rp	3,646,700,500	-Rp	43,361,674,250	-Rp 43,361,674,250
3	Rp	-	-Rp	42,121,184,582	Rp	-	Rp	3,646,700,500	-Rp	45,767,885,082	-Rp 45,767,885,082
4	Rp	-	-Rp	44,680,480,702	Rp	-	Rp	3,646,700,500	-Rp	48,327,181,202	-Rp 48,327,181,202
5	Rp	-	-Rp	66,596,794,145	Rp	-	Rp	3,646,700,500	-Rp	70,243,494,645	-Rp 70,243,494,645
6	Rp	-	-Rp	50,298,918,543	Rp	-	Rp	3,646,700,500	-Rp	53,945,619,043	-Rp 53,945,619,043
7	Rp	-	-Rp	53,380,053,559	Rp	-	Rp	3,646,700,500	-Rp	57,026,754,059	-Rp 57,026,754,059
8	Rp	-	-Rp	56,658,352,356	Rp	-	Rp	3,646,700,500	-Rp	60,305,052,856	-Rp 60,305,052,856
9	Rp	-	-Rp	60,146,722,291	Rp	-	Rp	3,646,700,500	-Rp	63,793,422,791	-Rp 63,793,422,791
10	Rp	-	-Rp	63,858,929,060	Rp	-	Rp	3,646,700,500	-Rp	67,505,629,560	-Rp 66,545,182,060
10	Rp	-	Rp	960,447,500	Rp	-	Rp	-	Rp	960,447,500	
PW			-Rp	413,147,993,396					-Rp	569,550,377,654	**-Rp 441,048,016,442**

Figure 8. Cashflow and Present Worth Alternative C

It is shown that Alternative A are worth IDR -441,048,016,442 in present time (Figure 8).

5.2 Validation

Below are the recapitulation of all alternatives initial cost, O&M cost, salvage value, NPV, EUAC, Cost Effectivity Analysis, and Cost Benefit Analysis (Figure 9).

	Initial Cost		Operational & Maintenance		Salvage Value		NPV		EUAC		Cost-Effective Analysis	Cost-Benefit Analysis
Alternative A	Rp	115,027,949,163	Rp	19,233,878,990	Rp	11,497,231,075	-Rp	132,933,585,392	Rp	32,916,272,389	Rp 6,724	0.8017
Alternative B	Rp	303,027,949,163	Rp	19,073,678,990	Rp	1,189,564,698,477	Rp	1,727,603,929,435	Rp	57,508,860,090	Rp 11,747	0.3722
Alternative C	Rp	313,853,288,334	Rp	18,709,092,105	Rp	1,920,895,000	-Rp	441,048,016,442	Rp	98,666,608,553	Rp 20,155	-1.2552

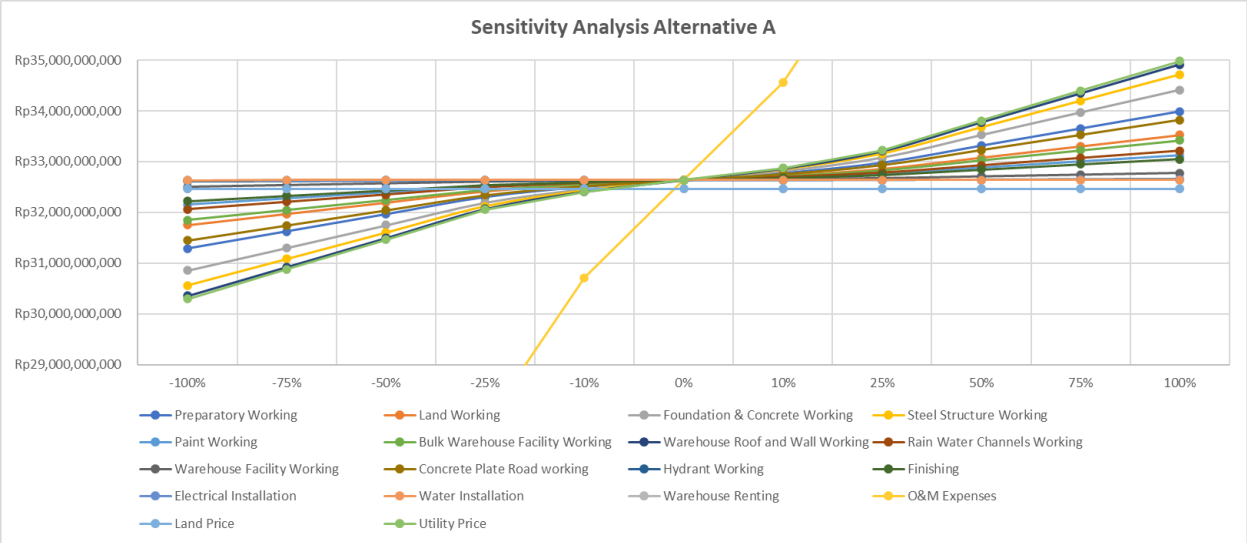
Figure 9. Alternatives Recapitulation

It is shown that Alternative A has the best storage cost about IDR 6,724. Instead, Alternative B has the best NPV about IDR 1,727,603,929,435.

5.3 Sensitivity Analysis

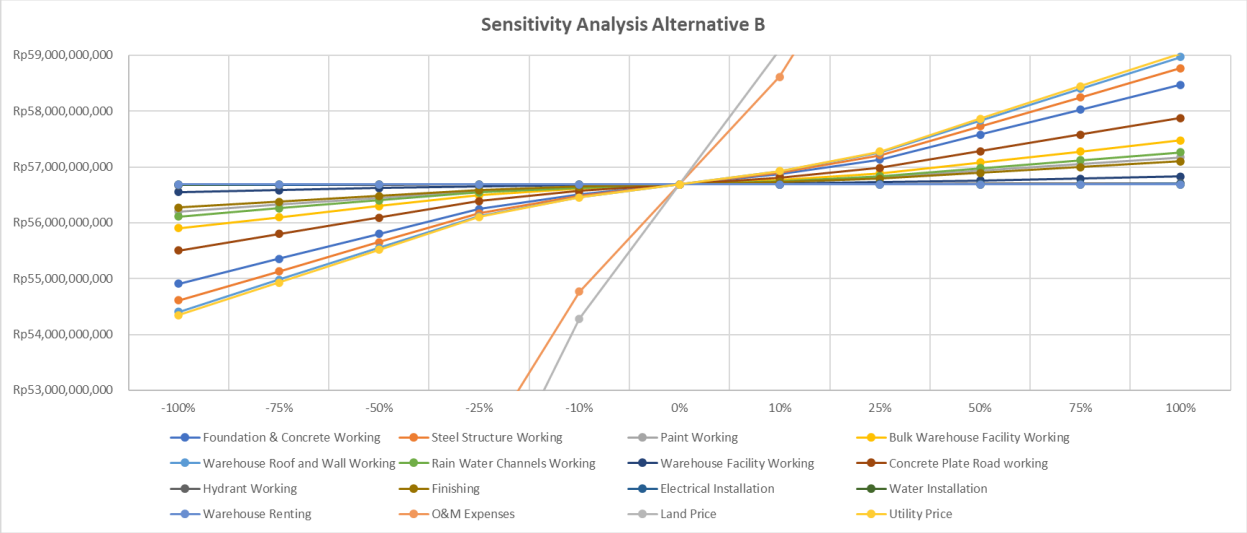
5.1.1 Alternative A – Construct Warehouse on PT XYZ's Land

Below are the sensitivity analysis of Alternative A's factor. It is shown that the most powerful factor that affect investment is Operational and Maintenance Cost factor.



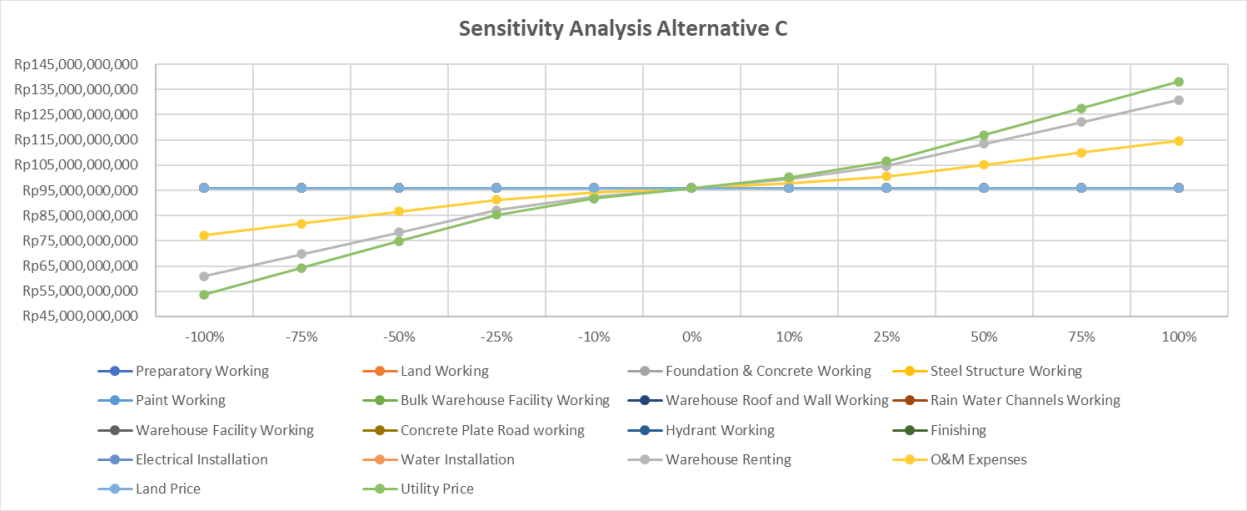
5.3.2 Alternative B – Buy New Land and Construct Warehouse

Below is the sensitivity analysis of Alternative A's factor. It is shown that the most powerful factor that affect investment is Operational and Maintenance Cost and land price factor.



5.3.3 Alternative C – Rent a Warehouse

Below are the sensitivity analysis of Alternative A's factor. It is shown that the most powerful factor that affect investment is utility price factor.



6. Conclusion

PT XYZ's decision to rent the third-party warehouses to increase the storage capacity of the Line 1 warehouse is not appropriate for a long period of time. This option should be exercised in a short period of time (temporary). The proposed alternative is building a new warehouse on PT XYZ's internal land, building a new warehouse on new land, or continuing to rent the warehouse. The results of the investment feasibility analysis, found that the option of building a warehouse on PT XYZ's internal land is the best alternative because it requires the smallest investment value of IDR 115,027,949,163, the largest NPV value is – IDR 133,789,477,582, the smallest EUAC value is IDR 32 ,916,272,389, the smallest Cost-Effective Analysis value is IDR 6,724 per ton, and the Cost-Benefit Analysis value is 0.8017. In this way, minimal storage costs are obtained. Hence, alternative B is the best alternative whether PT XYZ planned to gain profit in the future by selling their property and costs about IDR 1,727,603,929,435.

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