

Profitability Evaluation Of Capital Investment With Net Present Value (Npv) And Internal Rate Of Return (Irr) Method In Pt GGG Karawang, West Java

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Abstract-In 2018, PT GGG plans to develop a new factory in Karawang area, West Java. Management will require the new plant will also be supported with a factory of packaging. Currently PT GGG is faced with three options in fulfilling the development plan of the packaging factory is whether to move an existing machine from the factory in Surabaya or still buy new machines from Switzerland or France in accordance with the needs of the company. The most feasible investment option chosen by PT GGG to increase its packaging production capacity by 30% at a new plant in Karawang West Java is the second alternative of purchasing a new machine from Switzerland. The alternative is chosen because it can produce the greatest NPV value when compared with other alternative that is Rp 1.341.290.049.333. Profitability of this investment proposal is also very high that is equal to 245.25% so that allows the company although it should come out big investment in front but will have the return of capital in the first year. After the sensitivity analysis is done for pessimistic and optimistic condition, alternative proposal 2 can also be said still feasible to be implemented because it has positive NPV. This means that this investment proposal has a very small risk of loss if it will be run because of high profitability and not easily affected by changes in economic conditions.

Keywords: NPV, IRR, Capital Investment, Investment in Java, Packaging Plant.

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I. Introduction

PT GGG is an Indonesian national tobacco company that produces several famous brands such as Gudang Garam International, Gudang Garam Surya, Gudang Garam Merah, Surya Pro, and others. In 2012 PT GGG has made a new investment to add cigarette packaging production machine in Surabaya factory. The investment is planned to increase production capacity by 40% from the previous year. To achieve these objectives PT GGG has purchased new machines from Switzerland as much as 9 units, following by recruiting several new experts associated with the operation of the machine that is 5 managers and 10 employees level supervisors. In 2018, it was found that the utilization rate of 9 units of machines purchased in 2012 was only 56%, while the target of production capacity increase which was originally set at 40% has been achieved. It can be concluded that in 2012 the company bought too many new machines so there are some machines that idle capacity today. Along with that in 2018 this PT GGG also decided to create a new factory in Karawang, West Java. The financial directorate of PT GGG wants that the new plant will also be supported by a packaging division located adjacent to the goal to accelerate the production flow. Management wants that the production capacity of the new plant will be 30% of that in Surabaya today.

PT GGG is currently faced with three options to meet the company's goal is to move the old machine already installed in Surabaya considering the utility is still low or buy a new machine output in 2018 which is separate from existing machines in Surabaya. The purchase option of the new machine will also consist of two choices whether to buy a machine from Switzerland or France. Each of these investment options has its own cost calculation borne by the company. The task of management is to determine the best investment option that can bring maximum profit for the company in the future.

Machine #	Uptime Year 2017	Machine Utilization	Speed avg (pcs/hour)	available hours/day	available days/week	available weeks/year	actual available hours for one year	Machine Output year 2017 (pcs)
1	80.33%	55.10%	216000	24	6	50	3,187	688,359,980
2	80.66%	55.10%	216000	24	6	50	3,200	691,187,800
3	81.26%	55.10%	216000	24	6	50	3,224	696,329,292
4	80.23%	55.10%	216000	24	6	50	3,183	687,503,065
5	80.24%	55.10%	216000	24	6	50	3,183	687,588,756
6	81.38%	55.10%	216000	24	6	50	3,229	697,357,590
7	78.13%	55.10%	216000	24	6	50	3,100	669,507,846
8	80.02%	55.10%	216000	24	6	50	3,175	685,703,543
9	79.88%	55.10%	216000	24	6	50	3,169	684,503,862
							Total	6,188,041,734

Table 1. Table for machine output at Surabaya Plant year 2017

From the above calculation if the average machine output per year of ± 680,000,000 pcs then the production target of 1,856,412,520 estimates can be achieved simply by using 3 machines only.

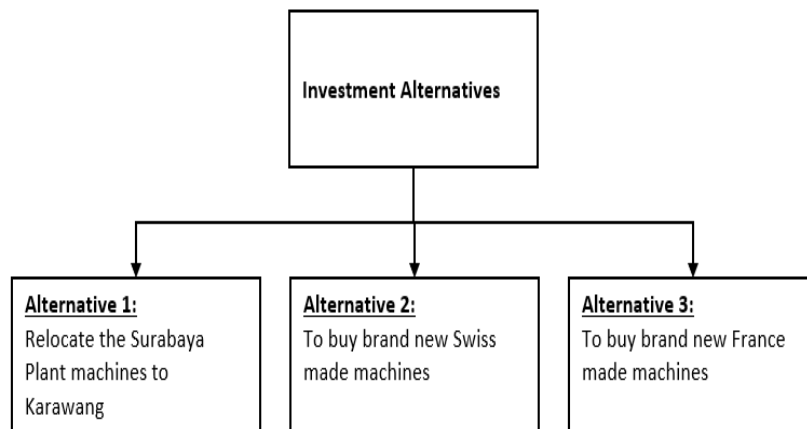


Figure 1. Diagram for 3 Investment alternatives

The author is interested to conduct research related to the case study experienced by PT GGG at this time. The author will provide an evaluation based on the NPV and IRR assessment methods of the choices considered most feasible by the company.

II. Theory and Methods

2.1 Net Present Value (NPV)

Net Present Value (NPV) is a method to evaluate the feasibility of a project most frequently used in some companies. This method calculates the present value of money from the expected net cash in future compared to the amount of investment to be made (Anthes, 2003). The difference between the value inculcated in the initial investment compared to the present value of the cash inflows is estimated to be obtained from the investment is what is called the net present value.

$$NPV = \sum_{t=1}^T \frac{\text{Cash Flow}_t}{(1+i)^t} - \text{Initial Cash Investment}$$

Equation 1.Formula for NPV

Remark:

- Cash Flow : annual net cash flows generated by the project
- Initial Cash : present value of the initial investment cost
- i : discount rate
- t : time period

2.2 Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is a method that calculates the interest rate (discount rate) which makes the present value of all estimated cash inflows equal to the present value of the expected cash outflow (Hazen, 2009, pg. 1030-1034). IRR is the interest rate that makes the calculated NPV value to be equal to zero.

$$NPV = -I_0 + \sum_{n=0}^N \frac{C_n}{(1+r)^n} = 0$$

Equation 2.Formula for IRR

Remark:

- NPV : NPV value
- Cn : annual net cash flows generated by the project
- I₀ : present value of the initial investment cost
- r : internal rate of return

2.3 Sensitivity Analysis

Sensitivity analysis is a risk analysis technique where NPV projects are calculated based on assumptions if the worst and best conditions are to occur. This analysis is conducted to anticipate the state of the company in the future due to instability of input variables associated with the calculation of feasibility analysis of an investment. Sensitivity analysis uses three scenarios where the condition is pessimistic, normal, and optimistic. Pessimistic condition where sales quantity decrease 5% every year, normal condition where conservative sales quantity is assumed every year there is no increase, and optimistic condition where sales quantity increase 5% every year.

III. Result And Discussion

3.1 Required Data

To be able to do this research smoothly then researchers need some data as follows for the purposes of analysis:

- 3.1.1 Details of new machine purchase costs, along with installation costs and technicians.
- 3.1.2 Estimated maximum production capacity that can be produced by each machine both old and new.
- 3.1.3 The amount of labor required and the size of the salary range to run a machine both old and new.
- 3.1.4 Electricity needs of every machine both old and new.
- 3.1.5 Estimated cost of capital required by the firm, assumed same for all investment alternatives.
- 3.1.6 Machine maintenance costs every year both old and new.
- 3.1.7 The cost of removal per machine from Surabaya to Karawang if alternative 1 is executed.
- 3.1.8 Estimated economic value (age of depreciation) of each machine both old and new.

3.2 Costing Assumptions

As the basis for calculating the projection of cash flows over the next eight years, from 2019 to 2026, the following assumptions will be calculated:

3.2.1 Inflation rate

Inflation is used as the basis for calculating the increase in expenses annually. During the investment appraisal period it is assumed that the inflation rate will always remain unchanged. Determination of the inflation rate used in this study refers to the average rate of inflation during the last 5 years of 2013-2017 period as contained in the following table:

Period	Indonesian inflation rate
2013	8.38%
2014	8.36%
2015	3.35%
2016	3.02%
2017	3.61%
Average	5.34%

Table 2.Inflation rate

3.2.2 Rate of Interest

The interest rate is used as the basis of discounted rate in the calculation of NPV and IRR. Both methods take into account the concept of time value of money so that the projected cash flow to be received in the future should be calculated with the value of money now using a discounted rate as a divisor. The investment that will be conducted by PT GGG uses its own internal financing capital not through credit in the bank so that the comparison data used is the deposit interest rate with the assumption that if the investment fund is not used for business containing business risk then deposited in the bank can obtain minimum profit the equivalent of safe deposit interest. The deposit rate data used in this study refers to the maximum interest rate guaranteed by the Deposit Insurance Agency (LPS) on average during the last 5 years of 2013-2017 period as contained in the following table;

Period	Deposito Interest Rate
2013	7.00%
2014	7.75%
2015	7.50%
2016	6.25%
2017	6.00%
Average	6.90%

Table 3.Interest rate

3.2.3 Sales Projection

It is assumed that the machine procurement plan at Karawang branch can be run at this time then with the lead time of installation of the machine about 4 months then the initial estimate of year 2019 all machine can already produce normally. In determining the projected quantity of product sales based on the production output target 30% of the current production capacity in Surabaya is 1,856,412,520 pcs. There are 3 scenarios that will be executed in the current calculation that is at a pessimistic condition where the sales quantity decreased 5% every year, during normal conditions where the quantity of sales is assumed to be conservative every year there is no increase, and when conditions are optimistic conditions where the quantity sales have increased 5% annually. Below is the table of calculation result of sales quantity projection during project period with 3 condition scenarios:

Period	Pessimist (-5%)	Normal (0%)	Optimist (+5%)
2019	1,856,412,520	1,856,412,520	1,856,412,520
2020	1,763,591,894	1,856,412,520	1,949,233,146
2021	1,675,412,299	1,856,412,520	2,046,694,803
2022	1,591,641,684	1,856,412,520	2,149,029,543
2023	1,512,059,600	1,856,412,520	2,256,481,021
2024	1,436,456,620	1,856,412,520	2,369,305,072
2025	1,364,633,789	1,856,412,520	2,487,770,325
2026	1,296,402,100	1,856,412,520	2,612,158,842
Total	12,496,610,507	14,851,300,160	17,727,085,272

Table 4.3 Scenarios of sales (pcs)

Determination of the selling price per unit of production is set by the management of Rp 300 per pcs and will increase every year by 10% adjusted according to the inflation rate and the estimated increase in production costs.

Period	Price / Pcs
2019	300
2020	330
2021	363
2022	399
2023	439
2024	483
2025	531
2026	585

Table 5.Estimated price per pcs by period

The projected sales turnover is used as the basis for calculating income in profit or loss before being reduced by operating expenses.

Period	Pessimist (-5%)	Normal (0%)	Optimist (+5%)
2019	556,923,756,000	556,923,756,000	556,923,756,000
2020	581,985,325,020	612,616,131,600	643,246,938,180
2021	608,174,664,646	673,877,744,760	742,950,213,598
2022	635,542,524,555	741,265,519,236	858,107,496,706
2023	664,141,938,160	815,392,071,160	991,114,158,695
2024	694,028,325,377	896,931,278,276	1,144,736,853,293
2025	725,259,600,019	986,624,406,103	1,322,171,065,553
2026	757,896,282,020	1,085,286,846,713	1,527,107,580,714
Total	5,223,952,415,797	6,368,917,753,848	7,786,358,062,738

Table 6.Estimated of sales by period

3.2.4 Cost of Goods Sold (COGS)

Cost of goods sold represents expenses incurred by the company for the purchase of raw materials and production support. The amount of COGS depends on the quantity of goods produced because of its variable cost. This means that the greater the quantity of goods produced will be the greater the burden of COGS. In determining the COGS, the company's management controls very tight costs where there is a policy that the COGS per unit of output should not exceed 60% of the selling price, this is to maintain the company's profitability ratio where other operating expenses are estimated at 20% of the selling price so the company is still can reap net income in the range of 20% of the sale price before taxes and depreciation of fixed assets.

3.2.5 Machine Requirement and Production Capacity

To meet the production target of 30% of Surabaya's current capacity of 1,856,412,520 units, the following calculations are required:

3.2.5.1 Alternative 1

Due to the old machine that has been used for 6 years then the production capacity is equal to the current in Surabaya which is 216.000 /hour.

3.2.5.1 Alternative 2

Due to the new machine purchased from Switzerland the production capacity can be 10% larger than the machine in Surabaya so the output will be 237,600 / hour.

3.2.5.1 Alternative 3

Due to a new machine purchased from France but at a cheaper cost than a Swiss machine the production capacity of 0.833 times from the Swiss machine is 197.921 / hour.

Additional for alternative 1 where the plan will be there will be 3 machines that moved from Surabaya to Karawang then the company will be charged removal fee of Rp 6 billion / machine. The removal costs are quite large as they include the dismantling of installed construction machinery, cabling, container hauling costs, redevelopment in new places, and the cost of bringing in foreign technicians as experts for reconfiguring machine systems. For alternative 2 if you want to buy a new machine from Switzerland then the cost of each machine is Rp 50 Billion, while alternative 3 if you want to buy a new machine from France then the price of each machine is Rp 30 Billion. Alternatives 2 and 3 have no longer charged the transfer fee because the machine to be installed is a new machine.

3.2.6 Machine Maintenance Costs

Every year the company is charged with machine maintenance costs including the cost of replacing the machine spare parts, the cost of machine repair in case of damage, and the cost of consumables spare parts such as machine lubricants, rubber coating, and so forth. Currently from the data in Surabaya it is known that the average machine maintenance cost of Rp 638.8 million / year for each machine. Machine maintenance costs are assumed to increase every year by 5% equals the normal rate of inflation. Here is a projection of machine maintenance costs during the project period:

Period	Maintenance cost	Machine qty	Maintenance cost total
2019	638,800,000	3	1,916,400,000
2020	670,740,000	3	2,012,220,000
2021	704,277,000	3	2,112,831,000
2022	739,490,850	3	2,218,472,550
2023	776,465,393	3	2,329,396,178
2024	815,288,662	3	2,445,865,986
2025	856,053,095	3	2,568,159,286
2026	898,855,750	3	2,696,567,250
Total	6,099,970,750	24	18,299,912,250

Table 7.Maintenance cost by period

3.2.7 Sales Fee

For production machinery investment project is currently not burdened by the cost of sales and marketing, because the packaging division is only a supporting unit of PT GGG who do not perform marketing activities, all output of production is absorbed entirely by PT GGG for raw materials manufacture of cigarettes.

3.2.8 Final Project Value

At the end of the project period after the fixed assets are fully depreciated then there is no final value of the project because the machine will not be sold to other parties or rejuvenated. Although the machine's economical age has expired but the machine will continue to be used as much as possible until completely damaged cannot be used again. Management's consideration is that the machine that has been installed, configured, and composition of the material therein is one of the secrets of the company that is not allowed to dispose of the asset to an outsider.

3.2.9 Electricity Costs

The cost of electricity for the operation of the machine is determined based on the Basic Electricity Rate (TDL) for the Industry currently in effect at Rp 1,000 / KWH. The cost of electricity is assumed to increase every year by 5% to the normal rate of inflation. It is known that the average electricity consumption of each machine per hour is 500 KWH for the 2012 shifting machine from Surabaya, whereas if a new machine purchased from Switzerland or France can save power consumption by 15% to 425 KWH per hour. Machines operate 24 hours a day, 6 days a week, and 50 weeks in 1 year. The projected electricity costs during the project period for alternatives 1, 2, and 3 can be seen in the appendix at the end of this study.

3.2.10 Employee Salary Cost

For the operational implementation of a machine required various types of employees ranging from managers, supervisors, chief operators, operators, packing, and manual sorting. It is known that the composition of the employee's current salary is as follows:

- Manager = Rp 25.000.000 /month

- Supervisor = Rp 12.000.000 / month
- Head Operator = Rp 8.000.000 / month
- Operator = Rp 5.000.000 / month
- Packing & Sort = Rp 4,000,000 / month

Employee salary costs are assumed to increase every year by 10% to the national average of MSE increase annually. The Company provides benefits to employees in the form of an additional 1x basic salary during the holiday (THR) and 2x basic salary at the end of the year (bonus), so the calculation of salary per employee in a year multiplied by 15.

Each alternative selected machine has different employee requirements especially for the number of operators and packing sorting personnel. The machine operates nonstop 24 hours a day so the working hours are divided into 4 shifts. Known employee needs for each machine type as follows:

3.2.10.1 Alternative 1

Using a machine in 2012, it takes 1 manager to handle the overall operation of the machine, it takes 1 supervisor to handle 3 machines each shift so that a total of 4 supervisors, it takes 1 head operator for each machine each shift so that a total of 12 operator heads, it takes 4 the operator for each machine each shift so that a total of 48 operators, and required each of each machine 6 people packing power and 2 people sorting power for each machine and each shift so that a total of 96 packing and sorting power.

3.2.10.2 Alternative 2

Buying a new machine from Switzerland, it takes 1 manager to handle the entire machine operation, it takes 1 supervisor to handle 3 machines per shift so that a total of 4 supervisors takes 1 head operator for each machine each shift so a total of 12 operator heads is required 3 operators for each machine each shift so that a total of 36 operators is more labor-efficient than using the machine in 2012, and it takes each each machine 6 person power packing alone without power sorting for each machine and each shift so that a total of 72 personnel packing and sorting , no manual manually needed anymore because it has done automation sorting through the machine.

3.2.10.3 Alternative 3

Purchased a new machine from France, it takes 1 manager to handle the whole machine operation, it takes 1 supervisor to handle 3 machines per shift so that a total of 4 supervisors takes 1 head operator for each machine each shift so that a total of 12 operator heads is required 3 operators for each machine each shift so that

a total of 36 operators is more labor-efficient than using the machine in 2012, and it takes each machine every 8 people packing power alone without power sorting for each machine and each shift so that a total of 96 packing and sorting power , no manual manually needed anymore because it has done automation sorting through the machine.

3.3 Investment Feasibility Assessment

Assessment of investment feasibility using NPV and IRR criteria. Assessment is done on all possible alternatives for the procurement of production machinery in Karawang branch. Investment can be said to be

eligible to meet the criteria if the value of $NPV > 0$ or positive and $IRR \text{ value} > 6\%$ greater when compared with the current deposit rate. Here are the investment feasibility assessments for each alternative:

3.3.1 Alternative 1 (Moving machine from Surabaya)

Alternative 1 here is just a transfer of machines from Surabaya factory to Karawang. This transfer is intended to utilize idle capacity from the excess number of machines in Surabaya. Because the nature is still in the same division of packaging, this alternative is only the transfer of machinery between the parts there is no cashflow activity in and out which affects the cash flow of the project apart from the cost of moving the machine. From the calculation of the projected income statement and cash flow projection in the attachment section, we can calculate the NPV and IRR values as follows:

Year	Net Cash Flow	DF (6%)	Present Value	DF (900%)	Present Value
(Year 0)	(18,000,000,000)	1	(18,000,000,000)	1	(18,000,000,000)
(Year 1)	140,806,076,800	0.943	132,835,921,509	0.11111111	15,645,119,644
(Year 2)	156,144,799,480	0.890	138,968,315,664	0.01234568	1,927,713,574
(Year 3)	180,853,737,678	0.840	151,848,285,563	0.00137174	248,084,688
(Year 4)	199,464,855,108	0.792	157,994,847,770	0.00015242	30,401,594
(Year 5)	219,963,371,465	0.747	164,369,427,058	0.00001694	3,725,099
(Year 6)	242,539,340,999	0.705	170,980,664,909	0.00000188	456,381
(Year 7)	267,401,889,106	0.665	177,837,528,546	0.00000021	55,907
(Year 8)	294,781,122,725	0.627	184,949,323,235	0.00000002	6,848
Net Present Value			1,261,784,314,255		(144,436,265)

Table 8.NPV & IRR for alternative 1

NPV 1	1,261,784,314,255
NPV 2	(144,436,265)
DF 1	6%
DF 2	900%
IRR	899.90%

The resulting NPV value is positive Rp 1.261.784.314.255, so if based on the investment feasibility criteria where the value of NPV > 0 then alternative 1 is feasible to run. The resulting IRR value is also very high at 899.90% which is well above the IRR feasibility criterion where it requires > 6% only, so the alternative 1 can also be said to be feasible to run.

3.3.2 Alternative 2 (Purchase of new machines from Switzerland)

From the calculation of the projected income statement and cash flow projection in the attachment section, we can calculate the NPV and IRR values as follows:

Year	Net Cash Flow	DF (6%)	Present Value	DF (250%)	Present Value
(Year 0)	(150,000,000,000)	1	(150,000,000,000)	1	(150,000,000,000)
(Year 1)	172,983,789,480	0.943	163,192,254,226	0.40000000	69,193,515,792
(Year 2)	190,229,533,428	0.890	169,303,607,536	0.16000000	30,436,725,348
(Year 3)	209,220,657,521	0.840	175,665,698,463	0.06400000	13,390,122,081
(Year 4)	230,132,740,060	0.792	182,286,685,105	0.02560000	5,891,398,146
(Year 5)	253,158,969,193	0.747	189,175,108,764	0.01024000	2,592,347,845
(Year 6)	278,511,906,496	0.705	196,339,904,122	0.00409600	1,140,784,769
(Year 7)	306,425,427,048	0.665	203,790,410,053	0.00163840	502,047,420
(Year 8)	337,156,853,650	0.627	211,536,381,063	0.00065536	220,959,116
Net Present Value			1,341,290,049,333		(26,632,099,484)

Table 9.NPV & IRR for alternative 2

NPV 1	1,341,290,049,333
NPV 2	(26,632,099,484)
DF 1	6%
DF 2	250%
IRR	245.25%

NPV value generated as positive as Rp 1.341.290.049.333, so if based on the investment feasibility criteria where the value of NPV > 0 then alternative 2 can be said worthy to run because it brings benefits for the company. The IRR value generated is also very high at 245.25% which is far above the IRR feasibility criteria where it requires > 6% only, so alternative 2 can also be considered feasible to run because it brings a higher profit rate than the deposit interest rate in the bank.

3.3.3 Alternative 3 (New machine purchase from France)

From the calculation of the projected income statement and cash flow projection in the attachment section, we can calculate the NPV and IRR values as follows:

Profitability evaluation of capital investment with present value (NPV) and internal rate

Year	Net Cash Flow	DF (6%)	Present Value	DF (300%)	Present Value
(Year 0)	(90,000,000,000)	1	(90,000,000,000)	1	(90,000,000,000)
(Year 1)	139,391,856,739	0.943	131,501,751,640	0.33333333	46,463,952,246
(Year 2)	153,465,907,413	0.890	136,584,111,261	0.11111111	17,051,767,490
(Year 3)	168,968,168,904	0.840	141,868,932,830	0.03703704	6,258,080,330
(Year 4)	186,042,502,582	0.792	147,363,087,388	0.01234568	2,296,821,020
(Year 5)	204,847,207,967	0.747	153,073,750,342	0.00411523	842,992,625
(Year 6)	225,556,469,147	0.705	159,008,410,389	0.00137174	309,405,307
(Year 7)	248,361,945,964	0.665	165,174,878,916	0.00045725	113,562,847
(Year 8)	273,474,524,458	0.627	171,581,299,891	0.00015242	41,681,836
Net Present Value			1,116,156,222,658		(16,621,736,299)

Table 10.NPV & IRR for alternative 3

NPV 1	1,116,156,222,658
NPV 2	(16,621,736,299)
DF 1	6%
DF 2	300%
IRR	295,69%

NPV value generated as positive as Rp 1.116.156.222.658, so if based on the investment feasibility criteria where the value of NPV > 0 then alternative 3 can be said worthy to run because it brings benefits for the company. The resulting IRR value is also very high at 295.69% which is far above the IRR feasibility criteria which requires > 6% only, so alternative 3 can also be said to be feasible to run because it brings a higher profit rate than deposit interest in the bank.

3.4 Selection of Investment

From the investment feasibility assessment for several alternatives that have been done before it can be taken a summary of the results as follows

Period	Alternative 1	Alternative 2	Alternative 3
NPV	1.261.784.314.255	1.341.290.049.333	1.116.156.222.658
IRR	899,90%	245,25%	295,69%

Table 11.NPV & IRR for 3 alternatives

Based on the above table if each alternative has a positive IRR value then the selection of investments made is taken from the alternative that has the highest NPV value, with the consideration that the alternative with the highest NPV most can provide maximum benefits for the company. In this case means alternative 2 is a purchase of a new machine from Switzerland that is most feasible by the company. If the three alternative options are independent projects which allow it to be run simultaneously as long as it is still in the investment grade category then the priority sequence implemented is alternative 2, alternative 1, and alternative 3.

If from the calculation of the financial aspect chosen alternative 2 then from the operational aspect can also be obtained a strong reason for the selection of alternative 2. Through the purchase of new machines from Switzerland then the company gets the advantage of larger machine capacity, more power efficient, and more efficient labor. Though the company spent a considerable initial investment expense but the excess that can be earned over the long term will bring huge profits to the company. Although the alternative 1 is cheaper cost at the beginning but the machine still uses the old technology where manual power is still manual, this will potentially cause high industrial problems because if still using human power then sorting results will not be able to match consistency when compared to automated sorting machine alternative 2, so that from technical reason of machine and financial calculation above then PT GGG is suggested to choose alternative 2 in fulfillment of production capacity requirement of factory in Karawang.

3.5 Sensitivity Analysis

Sensitivity analysis is a risk analysis technique where NPV projects are calculated based on assumptions if the worst and best conditions are to occur. This analysis is conducted to anticipate the state of the company in the future due to instability of input variables associated with the calculation of feasibility analysis of an investment. Sensitivity analysis uses three scenarios where the condition is pessimistic, normal, and optimistic. Pessimistic condition where sales quantity decrease 5% every year, the normal condition where the quantity of sales is assumed conservatively every year there is no increase, and optimistic condition where the sales quantity increase 5% every year. Calculation of sensitivity analysis using alternative 2 in accordance with the selected and will be implemented by the company.

3.5.1 Pessimistic Condition (Sales decrease 5% every year)

From recalculation to projected income statement and cash flow projection in the attachment section we can calculate the value of NPV and IRR for pessimistic conditions as follows:

Year	Net Cash Flow	DF (6%)	Present Value	DF (250%)	Present Value
(Year 0)	(150,000,000,000)	1	(150,000,000,000)	1	(150,000,000,000)
(Year 1)	172,983,789,480	0.943	163,192,254,226	0.40000000	69,193,515,792
(Year 2)	180,121,367,257	0.890	160,307,375,629	0.16000000	28,819,418,761
(Year 3)	187,538,641,083	0.840	157,461,059,367	0.06400000	12,002,473,029
(Year 4)	195,244,151,816	0.792	154,651,655,437	0.02560000	4,998,250,286
(Year 5)	203,246,425,303	0.747	151,877,552,414	0.01024000	2,081,243,395
(Year 6)	211,553,932,039	0.705	149,137,174,263	0.00409600	866,524,906
(Year 7)	220,175,041,040	0.665	146,428,977,286	0.00163840	360,734,787
(Year 8)	229,117,967,301	0.627	143,751,447,181	0.00065536	150,154,751
Net Present Value			1,076,807,495,803		(31,527,684,292)

Table 12.Pessimistic Condition

NPV 1	1,076,807,495,803
NPV 2	(31,527,684,292)
DF 1	6%
DF 2	250%
IRR	243.06%

Although the condition of sales is assumed to decrease by 5% annually the value of NPV generated is still positive at Rp 1,076,807,495,803, so if based on the investment feasibility criteria where the value of NPV > 0 then in the pessimistic condition this investment proposal can be said is still feasible to run for profit for the company. The resulting IRR value is also very high at 243.06% which is far above the IRR feasibility criterion where it requires > 6% only, so in pessimistic conditions this investment alternative also still can be said to be feasible to run because it bring a higher profit rate than the deposit interest deposits in the bank.

3.5.2 Optimistic Condition (Sales increase 5% every year)

From recalculation to projected income statement and cash flow projection in the attachment section, we can calculate the NPV and IRR values for optimistic conditions as follows:

Profitability evaluation of capital investment with present value (NPV) and internal rate

Year	Net Cash Flow	DF (6%)	Present Value	DF (250%)	Present Value
(Year 0)	(150,000,000,000)	1	(150,000,000,000)	1	(150,000,000,000)
(Year 1)	172,983,789,480	0.943	163,192,254,226	0.40000000	69,193,515,792
(Year 2)	200,337,699,599	0.890	178,299,839,444	0.16000000	32,054,031,936
(Year 3)	232,014,572,237	0.840	194,803,908,795	0.06400000	14,848,932,623
(Year 4)	268,690,592,625	0.792	212,828,115,790	0.02560000	6,878,479,171
(Year 5)	311,147,258,080	0.747	232,507,331,565	0.01024000	3,186,147,923
(Year 6)	360,287,746,251	0.705	253,988,644,311	0.00409600	1,475,738,609
(Year 7)	417,155,824,666	0.665	277,432,448,683	0.00163840	683,468,103
(Year 8)	482,957,695,870	0.627	303,013,633,224	0.00065536	316,511,156
Net Present Value			1,666,066,176,039		(21,363,174,688)

Table 13. Optimist Condition

NPV 1	1,666,066,176,039
NPV 2	(21,363,174,688)
DF 1	6%
DF 2	250%
IRR	246,91%

Sales condition is assumed to increase 5% every year and the value of NPV generated is still positive Rp 1.666.066.176.039, so if based on the investment feasibility criteria where the value of $NPV > 0$ then in optimistic condition this investment proposal can be said still feasible to run because profit for the company. The value of IRR generated is also very high that is 246,91% which is far above the criteria of IRR feasibility

where it requires $> 6\%$ only, so in optimistic condition this investment alternatives also still can be said is feasible to run because bring profit rate greater than deposit interest deposits in the bank.

IV. Conclusion

After the calculation of investment feasibility criteria on several alternative options available then it can be concluded the results of this study as follows:

- The most feasible investment option chosen by PT GGG to increase the packaging production capacity by 30% at the new plant in Karawang West Java is the second alternative is the purchase of a new machine from Switzerland. The alternative is chosen because it can produce the greatest NPV value when compared to other alternatives. Although at the beginning the company had to pay a large enough cost for machine investment of Rp 150 billion, but the company benefited from a larger machine production capacity of 10% than the old machine, saving the amount of labor costs due to fewer operator needs, and more efficient power consumption 15%. Profitability of this investment proposal is also very high that is equal to 245.25% so that allows the company although it should come out big investment in front but already will return capital in the first year.
- After the sensitivity analysis is done for pessimistic and optimistic condition, alternative proposal 2 can also be said still feasible to be implemented because it has positive NPV. This means that this investment proposal has a very small risk of loss if it will be run because of high profitability and not easily affected by changes in economic conditions

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