FEASIBILITY STUDY DOWNSTREAM FACILITY FOR BACILLUS CALMETTE GUERIN (BCG) PROJECT OF PT. BFM

Anisa Adiningrum and Subiakto Soekarno
School of Business and Management
Institut Teknologi Bandung, Indonesia
anisa.adiningrum@sbm-itb.ac.id

Abstract. BFM has been constantly striving to discover new vaccines for more than 123 years, in order to eradicate communicable diseases that continue to grow and threaten the humans' health. Therefore, this research has the objective to conduct a conclusion whether the replacement production line of Bacillus Calmette Guerin (BCG) is feasible or not. Bacillus Calmette Guerin (BCG) is known as freeze-dried vaccine which contains live attenuated of Mycobacterium Bovis, Paris strain. Nowadays the process of production BCG will replace by new technology because of increased demand. Theories and methods in this research are cash flow, Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP), and sensitivity analysis. The result of this project indicates the feasibility of the project and the benefit of the project for PT. BFM. Based on the positive NPV, greater IRR when compared with WACC, and shorter payback period when compared with the project economical life, this project is economically feasible.

Keywords: Cash Flow, NPV, IRR, Payback Period, Sensitivity Analysis

Introduction

BCG one of the products from PT. BFM is known as freeze-dried vaccine which contains live attenuated of Mycobacterium bovis (Bacillus Calmette Guerin), Paris strain. Nowadays the process of production BCG will replace by new technology. This technology will need billions rupiah to invest. PT. BFM change the production line because the demand of this vaccine getting higher so the company need the new technology that can produce more quantity. This project will discuss about the feasibility of new investment in new technology of BCG's production. This feasibility study will consider the economic side of the project is feasible or not by calculated NPV, IRR, Payback Period and Sensitivity Analysis.

Literature Review

Feasibility Study
A feasibility study can be defined as a controlled process for identifying problems and opportunities, determining objectives, describing situations, defining successful outcomes and assessing the range of cost and benefits associates with several alternatives for solving a problem. The feasibility study is used to support the decisions making process based on as cost benefit analysis of the actual business or project viability. A feasibility study enables the writer to take a realistic look at both the positive and negative aspects of the opportunity. The feasibility study is conducted during the deliberation phase of business development cycle prior to commencement of a formal business plan. It is an analytical tool that includes recommendations and limitations, which are utilized to assist the decision-makers when determining if the business concept is viable (Drucker 1985: Hoagland & Williamson 2000: Thompson 2003a: Thompson 2003c).

Capital Budgeting

Capital budgeting is "The process evaluating and selecting long-term investments that are consistent with the firm's goal maximizing owners wealth" (Gitman:2009:380). Capital budgeting can be determine as company list opportunity to estimate capital cost needed to gain positive NPV with looking for right investment. Type of this investment is long term and fixed asset, include for land (property), plant, and equipment.

Initial Investment

"The relevant cash outflow for a proposed project at time zero" (Gitman:2009:384). Initial investment used to financing investment from the start and happened in zero years. The initial of the project include with installation cost for new asset, construction, proceed (if exist) from the old asset and tax (if exist).

Cash Flow

Cash flow is a revenue or expense stream that changes a cash account over a given period. Cash inflows usually arise from one of three activities - financing, operations or investing - although this also occurs as a result of donations or gifts in the case of personal finance. Cash outflows result from expenses or investments. This holds true for both business and personal finance. An accounting statement called the "statement of cash flows", which shows the amount of cash generated and used by a company in a given period. It is calculated by adding noncash charges (such as depreciation) to net income after taxes. Cash flow can be attributed to a specific project, or to a business as a whole. Cash flow can be used as an indication of a company's financial strength. (http://www.investopedia.com/terms/c/cashflow.asp).

Weighted Average Cost of Capital (WACC)

Weighted average cost of capital (WACC) reflects the expected average future cost of capital over the long run. It is found by weighting the cost of each specific type of capital by its proportion in the firm's capital structure.

$$r_a = (w_i \times r_i) + (w_p \times r_p) + (w_s \times r_{r \, or \, n})$$

w_i	= proportion of long-term debt in capital structure
w_p	= proportion of preferred stock in capital structure
w_s	= proportion of common stock equity in capital structure
$w_i + w_p + w_s$	= 1.0

Capital Asset Pricing Model (CAPM)

Capital asset pricing model is classic theory that link risk and return for all asset, the CAPM used to understand the basic risk-return tradeoffs involved in all types of financial decisions.

$$r_j = R_F + [b_i \times (r_m - R_F)]$$

r_j	= required return on asset j
R_F	= risk-free rate of return, commonly measured by the return on a U.S. Treasure bill
b_i	= beta coefficient or index of non-diversifiable risk for asset j
r_m	= market return; return on the market portfolio of assets

Net Present Value

"*The Net Present Value (NPV) is capital budgeting technique by subtracting a project's initial investment from the present value of its cash inflows discounted at a rate equal to the firm's cost of capita*" (Gitman:2009 :429). It is the difference between the present value of the expected cash flows from an

investment and the amount of investment. Present value of the expected cash flows is computed by discounting them at the required rate of return. NPV is used in capital budgeting to analyze the profitability of required rate of return. NPV is used in capital budgeting to analyze the profitability of an investment or project. NPV analysis is sensitive to the reliability of future cash inflows that an investment or project will yield.

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} - CF_0$$

$\frac{CF_t}{(1+r)^t} = Present\ value\ of\ Cash\ Inflows$
$CF_0 = Initial\ Investment$

Internal Rate of Return
"The internal rate of return (IRR) is the discount rate that equates the NPV of an investment opportunity with $0" (Gitman: 2009: 431) . It is the rate of return that would make the present value of future cash flows plus the final market value of an investment or business opportunity equals the current market price of the investment or opportunity. Internal rate of return is an important calculation used frequently to determine if a given investment is worthwhile. An investment is generally considered worthwhile if the internal rate of return is greater than the return of an average similar investment opportunity, or if it is greater than the cost of capital of the opportunity.

Payback Period
"*The payback period is commonly used to evaluate proposed investment. The payback period is the amount of time required for the form to recover its initial investment in a project, as calculated from cash inflows*" (Gitman: 2001: 425) .

$$Payback\ Period = Y + \frac{A}{B}$$

Y = The Number of Years Before Final Payback Years
A = Total remaining to be paid back at the start of the payback year, to bring cumulative cash flow to zero
B = Total (net) paid back in the entire payback year

Profitability Index
A variation of NPV rule is called the profitability index (PI) (Gitman, 2012:399). For a project that has initial cash outflow followed by cash inflow, the profitability indes is equal to the present value of cash inflows divided by the initial cash outflow.

$$PI = \frac{\sum_{t=1}^{n} \frac{CFt}{(1+r)^t}}{CF_0}$$

When a company evaluate investment using PI, the decision rule they follow is to invest in the projet when the index is greater than 1.0. When the PI is greater than one, that means that the present value of cash inflows is greater than the absolute value of initial cash outflow, so when profitability index is greater than one corresponds to a net present value greater than zero. In other words, net present value and profitability index will always come to the same conclusion regarding whether the investment is worth or not.

Depreciation
Allocation of historical cost over time is called depreciation. Depreciations deduction, like any other business expenses, reduce the income that a firm reports on its income statement and therefore reduce the taxes that the firm must pay. However, depreciation deductions are not associated with any cash

outlay. That is, when a firm deducts depreciation expense, it is allocating a portion of an asset's original cost (that the firm has already paid for) as a charge against that year's income. The net effect is that depreciation deductions increase a firm's cash flow because they reduce a firm's tax bill.

"*Depreciation is the decrease in value of physical properties with the passage of time and use. More specifically, depreciation is an accounting concept that establishes an annual deduction against before-tax income such that the effect of time and use on an asset's value can be reflected in a firm's financial statement*" (Sullivan :2011 :321)

Author use the Straight-Line Method to calculate depreciation in this final project. Straight-Line depreciation is the simplest depreciation method. It assumes that a constant amount is depreciated each year over depreciable (useful) life of the asset.

Method

Research Design
The feasibility study of BCG project by PT. BFM is going to be main focus as an investment. Author applies the process with several research steps to conduct this final project. The steps are shown in the diagram below:

Problem Identification
The first step for doing the research is identifying main the problems for the research, which will be developed to create the objectives of this research itself. Objective of the final project is to analyze the feasibility study of the replacement production line of BCG by PT. BFM. Author will evaluate and calculate the data gathered from the company, to know whether the project is feasible or not to be invested due to some scope of limitation.

Literature Review
To performing the final project author uses theoretical foundation that will be used as references to attain the objectives of this research. Calculations, definitions, and explanations are gained from the sources of the literatures. Literature reviews in this paper were gathered from several books, internet, and journals as a handy guide for the authors to understand deeply about topics that related to the feasibility study analysis.

Data Collection
The further analyzing process of the project is gathering specific necessary data. The data used in the analysis is gathered from both primary and secondary data. Primary data is gathered from PT. BFM with several ways. The primary data consist of the project overview, location and background of the project, project components, initial investment cost, capital expenditures, revenue projections, operating, and maintenance expenses. Secondary data is about the supportive data for the BCG project analysis,

mostly generated from web surfing. Foundation theories gained from literature books of feasibility study analysis for analyzing the financial project aim, which are NPV, IRR, and Payback Period. There are two ways in collecting secondary data first is to conduct literature books research and web surfing research for supporting the project analysis.

Data Analysis
After gathering the data the next step is to analyze the final project to process data to find its feasibility. The processes of data analysis are first primary and secondary data analysis. After both is analyzed, next step is combining each analysis to create a synergy between data for an output to NPV, IRR, and Payback Period analysis.

Conclusion and Recommendation
Conclusion of the research is based on the result of the analysis that had been made from the chapter before. Conclusion will consist of summary of the whole analysis process of replacement production line of BCG that includes the financial feasibility analysis result. The result will be the answer for the problem that occur in this project, and also used as a consideration for author in generating recommendation to PT. BFM about the development project.

Data Analysis

Cost Calculation
The cost calculation process is to calculate the costs that appear during the project holding period. This project consists of two main costs that are going to be calculated, there are the initial investment and operational cost.

Weighted Average Cost of capital
Number of WACC is intended to find Present Value Interest Factor for NPV calculation of PT. BFM BCG Vaccines. The PVIF will be a multiplier to the annual After-Tax Cash Flow to find NPV per year. In this project the number of WACC is 10.93%. The calculation showed below

$$Cost\ of\ Equity = 8.65\% + [0.68 \times (12\% - 8.65\%)]$$
$$Cost\ of\ Equity = 10.93\%$$

$$WACC = (1 \times 10.93\%)$$
$$WACC = 10.93\ \%$$

Depreciation
Depreciation in the financial aspects becomes an important element in the calculation of income and statement of cash flow report as a basis for eligibility decisions. Depreciation is calculated as cost elements in the calculation of income that can be used to reduce the tax burden on profits. The calculation of depreciation cash flow is calculated as cash inflows. Depreciation calculated for all types of fixed assets (excluding land) as mill inventory, machinery, utilities, and buildings. As has been stated above, that one of the purposes of this capital expenditure is to complete production equipment, thus affecting cGMP requirements. BFM management considerations, capital expenditure facility aims to meet the requirements of cGMP with a weight of 40%, so the commercial weight of 60%.

Investment	Total (In Rupiah)	Economic Years	Depreciation/Year (In Rupiah)	Depreciation Accumulation (10 years)	Book Value 2028 (In Rupiah)
Machine	85,772,400,000	16	5,360,775,000	53,607,750,000	32,164,650,000

Utilities	1,050,000,000	16	65,625,000	656,250,000	393,750,000
Building	15,813,000,000	20	790,650,000	7,906,500,000	7,906,500,000
Total	102,635,400,000		6,217,050,000	62,170,500,000	40,464,900,000

NPV

Net Present Value (NPV) is used in capital budgeting to analyze the profitability of an investment or project. In this project if the NPV shows positive number so we can accept the project. First thing to know is the discount rate. The discount rate for this project is 10.93% from WACC number. NPV is the main factor for the viability calculation, because the number will be the basis for the project to be accepted or not.

Year		After Tax Cash flow	PVIF (10.93%)	Discounted After Cash Flow	Cumulated Discounted After Cash Flow
		(1)	$(2)=1/(1+10.93\%)^{year}$	$(3)=(1)*(2)$	Cumulated (3)
0	2016	Rp(173,459,000,000.00)	1.0000	Rp(173,459,000,000.00)	Rp(173,459,000,000.00)
1	2017	Rp42,258,270,371.45	0.9015	Rp38,094,537,430.32	Rp(135,364,462,569.68)
2	2018	Rp44,572,116,719.30	0.8126	Rp36,221,400,070.22	Rp(99,143,062,499.46)
3	2019	Rp47,034,512,002.68	0.7326	Rp34,456,376,438.52	Rp(64,686,686,060.94)
4	2020	Rp49,654,993,063.25	0.6604	Rp32,791,922,099.56	Rp(31,894,763,961.37)
5	2021	Rp52,443,709,007.91	0.5953	Rp31,221,109,612.77	Rp(673,654,348.60)
6	2022	Rp55,411,460,516.22	0.5367	Rp29,737,572,877.15	Rp29,063,918,528.55
7	2023	Rp58,569,741,671.36	0.4838	Rp28,335,456,750.75	Rp57,399,375,279.29
8	2024	Rp61,930,784,476.66	0.4361	Rp27,009,371,433.74	Rp84,408,746,713.03
9	2025	Rp65,507,606,230.06	0.3932	Rp25,754,351,153.94	Rp110,163,097,866.97
10	2026	Rp108,474,687,881.21	0.3544	Rp38,444,859,608.25	Rp148,607,957,475.22
			NPV	Rp148,607,957,475.22	

IRR

Internal Rate of Return (IRR) used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. If the IRR more bigger than dF so we can decide that the project feasible for company. To calculate IRR, author will use trial and error of NPV method to find two numbers of discount rate. One of the trial numbers must make the NPV minus, and the other slightly above zero for gaining a precise calculation of IRR the aim IRR number calculation is to make the NPV zero. Based on the calculation the IRR number is 26.35%.

Payback Period

The length of time required to recover the cost of an investment. The payback period of a given investment or project is an important determinant of whether to undertake the position or project, as longer payback period are typically not desirable for investment positions. From sales projection the cash flow always shows positive numbers and the project will take 3.9 years to cover initial investment.

	Year	Cumulated Discounted After Cash Flow
		Cumulated
0	2016	Rp(173,459,000,000.00)
1	2017	Rp(135,364,462,569.68)
2	2018	Rp(99,143,062,499.46)
3	2019	Rp(64,686,686,060.94)
4	2020	Rp(31,894,763,961.37)
5	2021	Rp(673,654,348.60)
6	2022	Rp29,063,918,528.55
7	2023	Rp57,399,375,279.29
8	2024	Rp84,408,746,713.03
9	2025	Rp110,163,097,866.97
10	2026	Rp148,607,957,475.22

The last deficit of the cumulated discounted after-tax cash flow is on year 2020, which is the 5th year. While in year 2021, which is 6th the cumulated discounted after-tax cash flow achieve surplus. So payback period of this project is between year 2020 and 2021. The calculation of payback period is:

$$PBP = 5 + \frac{673,654,348.60}{29,063,918,528.5 + 673,654,348.60}$$
$$= 5 \ years$$

The payback period shown above is in 5 years.

Sensitivity Analysis

To conduct sensitivity analysis, take a certain variable involved in a potential investment and change it in order to see how that change would affect the overall investment. In this case author will increase cost of goods sold, decrease price, and decrease sales, from these three category which factor that change the NPV, IRR, and PI dramatically so that factor will be the very sensitive factor in this project. In this sensitivity analysis author try to assumed if cost of goods sold rise 2% to 10% and assumed if sales and price fall 2% to 10%.

Criteria	Cost of Goods Sold Increase				
	2%	4%	6%	8%	10%
NPV	Rp 134,537,117,033.80	Rp 118,845,356,319.42	Rp 103,153,595,605.04	Rp 87,461,834,890.66	Rp 71,770,074,176.28
IRR	25.02%	23.51%	21.97%	20.40%	18.80%
Profitibality Index	1.775613356	1.685149553	1.594685751	1.504221948	1.41
	Price Decrease				
	2%	4%	6%	8%	10%
NPV	Rp 149,578,848,463.18	Rp 148,928,819,178.19	Rp 148,278,789,893.20	Rp 147,628,760,608.21	Rp 146,978,731,323.21
IRR	26.41%	26.31%	26.22%	26.12%	26.02%
Profitibality Index	1.86	1.86	1.85	1.85	1.85
	Sales Decrease				
	2%	4%	6%	8%	10%
NPV	Rp 144,799,546,813.63	Rp 139,370,215,879.08	Rp 133,940,884,944.53	Rp 128,511,554,009.99	Rp 123,082,223,075.44
IRR	26.00%	25.48%	24.96%	24.44%	23.92%
Profitibality Index	1.83	1.80	1.77	1.74	1.71

Conclusion and Recommendation

The final chapter of this project analysis will answer all of the problem identification questions in the chapter I. The answer is generated from the result of all data analysis of the previous chapter, which will be summarized and presented as conclusion of this project analysis. Recommendation that will be given to PT. BFM is also based on the internet research and the financial feasibility study of BCG vaccine production downstream facility project.

Conclusion
Based on the previous chapter of data analysis, the result of the financial feasibility analysis of BCG vaccine production downstream facility project is based on three factors that are Net Present Value, Internal Rate of Return, and Payback Period calculations, and also other factors that support the three factors calculation.

Revenue and Capital Structure
Based on the revenue data, the quantity of BCG Vaccine produce can cover all the cash outflow gained from operation cost, which is good because it makes profitability for the investment. For the proportion of capital structure PT. BFM will use all equity. Cash flow of the project is in good performance, because the cash inflow still could counterbalance the cash outflow even though the revenue is fixed stagnant and the cash outflow is increasing per year.

Net Present Value Analysis
According to NPV calculation at previous chapter, the NPV is greater than zero, it makes that NPV has fulfilled the success criteria. NPV calculation of BCG vaccine production downstream facility project generates a good number, which is Rp. 148,607,475.22. As the NPV analysis fulfilled the criteria, the project is feasible.

Internal Rate of Return Analysis
The IRR calculation generates a number of 26.35%, which is over numbered the WACC number PT. BFM (WACC = 10.93%). Therefore, the IRR calculation of of BCG vaccine production downstream facility project is compatible with the success criteria that is must overcome the discount rate. As the IRR analysis fulfilled the criteria, the project is feasible.

Payback Period
The payback period of BCG vaccine production downstream facility project is 5 years from the date the project started. This number shows a good result considering the economic value of the project that is 10 years. As the payback period is sooner than the economic value for operating period is a success criterion, the project is feasible.

The Project Analysis
From the four aspects above of Revenue and Capital Structure, Net Present Value, Internal Rate of Return, and Payback Period, the BCG vaccine production downstream facility project is feasible, and suggested to be conducted.

Recommendation

From the conclusion above, the BCG vaccine production downstream facility project is economically feasible and suggested to be conducted by PT. BFM. So the BCG vaccine production downstream facility project can contributed for company in generate profit and fulfill the demand.

References

Drucker, P.F., 1985. *Innovaton & Entreprenership,* New York: Harper Traade

Gitman, Lawrance. J., 2009, *Principal of Managerial Finance* (12th ed), Boston: Pearson Education

Ross, Stephen A., 2008, *Corporate Finance Fundamentals* (8th ed), New York: Mc Graw Hill

Sullivan, W. G., Wicks, E. M. & Koelling, C. P., 2009, *Engineering Economy,* New Jersey: Pearson Education

Investopedia (2015) Cash Flow, [online] Available at: http://www.investopedia.com/terms/c/cashflowstatement.asp [Accesed: March 23, 2015]