

INVESTMENT ANALYSIS OF HEXAVALENT VACCINE DEVELOPMENT PROJECT

Nabila Safira^a & Maryat Nirwandib^b

^{ab}Institut Teknologi Bandung, Bandung, Indonesia.

Corresponding Email: nabila_safira@sbm-itb.ac.id

Abstract

Combined IPV/OPV vaccination approach in the polio eradication program by WHO requires at least one dose of IPV is introduced in the routine vaccination program in each country. Successful application of IPV in worldwide polio eradication program, particularly in developing countries, will depend on the availability of effective vaccines at affordable price. Hexavalent vaccine represents one of the potential approaches to introduce IPV at a relatively low price through a combination vaccine. Moreover, it can simplify complex routine immunization schedules as well as reduce delivery and injection costs. As a state-owned company that manufacture and supply vaccine needs in the Indonesian mandatory immunization program, Bio Farma intends to develop hexavalent vaccine as an effort to introduce a combination vaccine containing IPV in compulsory immunization program for Indonesian infants and toddlers. The objective of the study is to assess the financial feasibility of hexavalent vaccine development project. External and internal environmental analysis are conducted to picture the business situations in formulating strategies to address the business issue. The study emphasizes capital budgeting techniques to evaluate the investment project. The result of the study shows that the development project of hexavalent vaccine is financially feasible due to its positive NPV (Rp 209,308,155,779), a shorter PP (9.03 years) than the project period (20 years), and a higher IRR (30.60%) than the WACC (18.52%).

Keywords: Biotechnology, Hexavalent Vaccine, Investment & Polio Eradication.

1. Introduction

Since 1988, WHO and other public health organizations have begun efforts to permanently eliminate all cases of poliomyelitis infection worldwide by vaccination. WHO is currently using a combination of Inactivated Polio Vaccine (IPV) and Oral Polio Vaccine (OPV) approaches in the polio eradication program [1]. The combine approach requires that at least one dose of IPV is introduced in the routine vaccination program in each country [2]. Successful application of IPV in worldwide polio eradication program, particularly in developing countries including Indonesia, will depend on the availability of effective vaccines at affordable price [3]. Combination vaccine can address this challenge as it simplifies complex routine immunization schedules as well as reduces delivery and injection costs [3]. Hexavalent vaccine (DTwP-Hib-HB-IPV) containing Diphtheria (D), Tetanus (T), whole-cell Pertussis (wP), Haemophilus Influenza B (Hib), Hepatitis B (HB), and three IPV serotype antigens, represents one of the potential approaches to introduce IPV at a relatively low price through a combination vaccine.

Bio Farma is a state-owned company that produce and also supply vaccine needs in the Indonesian mandatory immunization program. In accordance with the third Sustainable Development Goals (SDGs) objective, which is to ensure healthy lives and promote wellbeing for all at all ages and driven with hexavalent vaccine status as a high priority vaccine in the WHO prequalifications 2018-2020 list [4,5], Bio Farma intends to develop a hexavalent

vaccine as an effort to introduce a combination vaccine containing IPV in the mandatory immunization program for Indonesian infants and toddlers. Hence, thorough investment analysis of hexavalent vaccine development needs to be performed in order to assess the new particular product development project.

2. Business Issue Exploration

The conceptual framework of the study, as shown in Figure 1, consists of four chapters, namely business issue identification, business situation analysis, strategy formulation, and recommendation as well as implementation. The business issue of the study is to assess the financial feasibility of hexavalent vaccine development in order to introduce a combination vaccine containing IPV for the Indonesian children and toddlers mandatory immunization programme.

Business situation analysis, both external and internal, are performed to develop better understanding about business environment and company capacity in executing the project. Factors beyond the control of the firm that influence its choice of direction, action, organizational structure, and internal processes, are referred to external environment. These factors can be divided into three subcategories, which are factors in the remote environment, factors in the industry environment, and factors in the operating environment [6]. Political, economic, sociocultural, technological, ecological, and legal are assessed by PESTEL framework to analyze remote environment factors [7]. In order to analyze industry environment factors, Porter's Five Forces framework is used. This framework emphasizes the analysis on threat of new entrants, rivalry among existing firms, threat of substitute products or services, the bargaining power of buyers, and the bargaining power of suppliers [8,9]. Competitor analysis, as one of tools to assess operating environment factors, is performed to evaluate strengths, weaknesses, and performance of other players as uncontrollable external forces which might affect the company [10]. In combination, these factors create Industry Key Success Factors (IKSFs) as the basis of the opportunities and threats that a firm face in its competitive environment.

The internal environment is analyzed using two particular frameworks. In order to determine the competitive advantage of the company, VRIO framework is utilized [11]. It analyzes the firm in providing *Value* to customer, competency *Rareness*, competency *Imitability*, and its *Organization* in exploiting resources. Value Chain (VC) framework is used to analyze the overall chain of value-creating activities [12,13]. The objective of this framework is to determine the most valuable activities and the potential activities which could be improved to provide competitive advantage for the firm. It examines each product line's value chain in terms of the various activities involved in producing the product, the linkages within each product line's value chain, and the potential synergies among the value chains of different product lines. The combination of these frameworks analysis provides Company Key Success Factors (CKSFs) as the basis of the critical strengths and weaknesses of the firm which determine whether the firm will be able to take advantage of opportunities while addressing threats.

Strengths, Weakness, Opportunities, and Threats (SWOT) analysis method is generally used for strategic planning by comparing the external (opportunities and threats) and internal (strengths and weakness) forces of the firm [14]. Table 1 shows SWOT analysis of Bio Farma as an output of the business situation analysis.

Critical factors from SWOT analysis are selected and used as the basis of strategy formulation. Two frameworks, Grand Strategy Matrix and TOWS, are used in formulating strategy [14]. The strategy will be used as a reference for creating financial projections. Free Cash Flow to The Firm (FCFF) valuation model is calculated based on the particular financial projections. Capital budgeting parameters, namely Net Present Value (NPV), Payback Period (PP), and Internal Rate of Return (IRR) are obtained by discounting FCFF at Weighted Average Cost of Capital (WACC) [15]. Financial feasibility conclusion will be provided based on these parameters. Sensitivity analysis is also performed to address the uncertainty of

investment decision. Hence, the output of this study are recommendation and implementation plan for the project continuation.

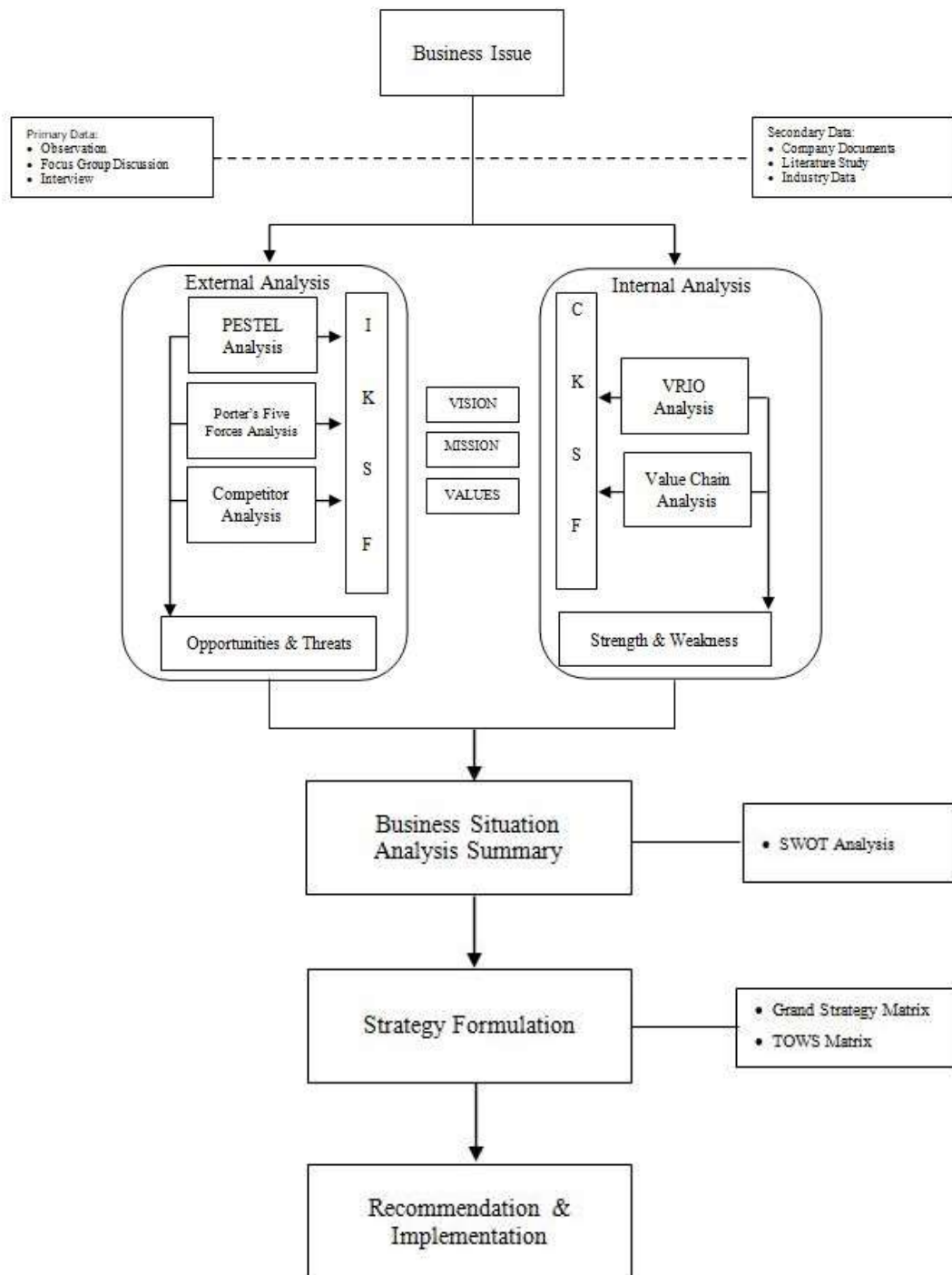


Figure 1: Conceptual Framework

Source: Author's analysis

3. Business Solution

3.1. Analysis of Industry and Company Key Success Factor

In order to evaluate the external and internal environment of the firm, external and internal factor evaluation matrices are used [16]. Factors, both external and internal, are generated

from SWOT analysis. Each factor will be weighted by determining the percentage of its degree of importance's value. The total value of the degree must be 1. The response of the firm to the factor will be rated ranging from 1 for very poor response to 4 for superior response by FGD in the management meeting. The value is generated from multiplying the weight and the rating of each factor. Total score of opportunity, threat, strength, and weakness are obtained from the sum of each factor's value. Table 2 and 3 show External Factor Evaluation (EFE) and Internal Factor Evaluation (IFE) matrices of Bio Farma respectively.

The total score of EFE (0.755) and IFE (-1.2) are combined and used to determine the strategic position of the firm. Based on the total score, the position of the firm is in the second quadrant of the grand strategy matrix, as shown in Figure 2. It indicates a weak competitive position in a rapid market growth. Product development, market development, market penetration, horizontal or vertical integration, and liquidation are several strategic action suggestions that a company in the second quadrant can take into consideration [17]. In order to address the polio eradication program challenge, Bio Farma chooses product development as its strategic action. Specifically, Bio Farma chooses to develop hexavalent vaccine as an effort to introduce a combination vaccine containing IPV in mandatory immunization program for Indonesian infants and toddlers.

3.2. Functional Strategy Formulation

Functional level strategy is a daily strategy that is going to keep the organization moving in the right direction by involving cooperation from various departments. TOWS matrix, as an extension from SWOT analysis, can be used to formulate functional strategy [18]. TOWS matrix of Bio Farma is shown in Table 4.

3.3. Project Financial Feasibility Analysis

The free cash flow, as portrayed in Table 5, is generated from the project scheme with a total investment of Rp 1,467,355,090,429, a WACC of 18.52% and 100% equity financing. It reveals that the project has a NPV of Rp 209,308,155,779, an IRR of 30.60%, and a PP of 9.03 years.

3.4. Sensitivity Analysis

Sensitivity analysis determines the effect of input variable changes in target variables [19]. The purpose of the analysis is to establish the sensitivity of the NPV as target variable to key parameters of assumptions. Six key parameters, which are sales price, sales price growth, COGS price, COGS price growth, vaccination coverage, and WACC, are estimated to have greatest influence on project NPV. Upside and downside cases are set for each parameter as shown in Table 6. Tornado chart, as shown in Figure 3, are used in this study to rank the key parameters based on the significance of changes in target parameters. It unveils that the order of parameters that most influences NPV are sales price, WACC, vaccination coverage, COGS price, COGS growth, and sales price growth respectively. Moreover, the analysis shows that 5% change of sales price, as the most influential parameter on NPV, might change NPV up to 56.36%. Accordingly, decision makers should be more aware in determining the initial selling price of the product before offering it to the government.

Table 1: SWOT Analysis of Bio Farma

		Opportunities	Threats
External Environment Analysis	Remote Environment	1. International trade agreements, such as ASEAN-Australia and New Zealand Free Trade Agreement, ASEAN-People's Republic of China Comprehensive Economic Cooperation Agreement, ASEAN Free Trade Area, Pakistan-Indonesia Preferential Trade Agreement, Preferential Tariff Arrangement – Group of Eight Developing Countries, and ASEAN-India Comprehensive Economic Cooperation Agreement, might drive sales through tariff reduction, tariff preference, and tariff elimination.	-
		2. Pharmaceutical state-owned holding enterprise establishment benefits the firm through market expansion, product portfolio enrichment, and supply chain reinforcement.	-
		3. -	Economic instability due to coronavirus global outbreak.
		4. -	Negative views of Indonesian society towards vaccination.
		5. Automation might increase production capacity and efficiency.	-
		6. Internet of things might increase the efficiency and effectiveness of business activities.	-
		7. Global outbreak of coronavirus might change negative perceptions and provide an understanding of vaccine and immunization importance to the public, especially in Indonesia.	-
		8. -	Polio virus eradication policy leads to the needs to introduce IPV.
		9. Vaccine prequalification priority policy by WHO induces innovation and acceleration of new products development.	-
		10. Domestic market for vaccine is available through Indonesian government vaccination program.	-
		11. -	Indonesian government regulation number 33 of 2014 regarding guarantee of halal products drives new raw materials selection and product optimizations based on halal status.
	12. Threat of new entrants is low due to high product differentiation, high capital requirement and also high fixed cost in the industry.	-	
	Industry Environment	13. -	Bargaining power of suppliers is moderate due to the uniqueness of the supplier's goods, limited availability of substitute goods, and the ability of several suppliers to compete with the customer.
		14. -	Bargaining power of buyers is moderate due to large purchase proportion of buyers and several buyers have the ability to produce the product.
		15. Threat of substitute product is low due to specific characteristic of the product.	-
		16. The rivalry among competitors is low due to varies size of competitors, differentiated products, high fixed cost, and high exit barrier.	-
	Operating Environment	17. Limited competitors due to the uniqueness of the product	-
Internal Environment Analysis	Strength		Weakness
	Resources Analysis	18. Strong financial resources.	-
		19. Well managed organizational resources.	-
		20. -	Inadequate physical resource, especially CT 3 facilities.
		21. Adequate technological resources.	-
		22. Strong brand and reputation for years.	-
		23. -	Human resources are not properly managed. Often employees work outside of their employment status.
	24. High tendency for innovation.	-	
	Value Chain Analysis	25. -	Lack of priority scale on high number of product development projects.
		26. -	High price of raw material.
		27. -	Insufficient number of researcher, tools, and facilities for the development project.
28. -		80% of raw materials are imported.	
29. -		Poor work efficiency.	

Source: Author's analysis

Table 2: External Factor Evaluation of Bio Farma

No.	External Factors	Weight	Rating	Value
O1	International trade agreements might drive sales through tariff reduction, tariff preference, and tariff elimination.	0.025	3	0.075
O2	Pharmaceutical state-owned holding enterprise establishment benefits the firm through market expansion, product portfolio enrichment, and supply chain reinforcement.	0.050	2	0.100
O3	Automation might increase production capacity and efficiency.	0.050	2	0.100
O4	Internet of things might increase the efficiency and effectiveness of business activities.	0.050	2	0.100
O5	Global outbreak of coronavirus might change negative perceptions and provide an understanding of vaccine and immunization importance to the public, especially in Indonesia.	0.100	3	0.300
O6	Vaccine prequalification priority policy by WHO induces innovation and acceleration of new products development.	0.150	4	0.600
O7	Domestic market for vaccine is available through Indonesian government vaccination program.	0.100	4	0.400
O8	Threat of new entrants is low due to high product differentiation, high capital requirement and also high fixed cost in the industry.	0.025	2	0.050
O9	Threat of substitute product is low due to specific characteristic of the product.	0.025	2	0.050
O10	The rivalry among competitors is low due to varies size of competitors, differentiated products, high fixed cost, and high exit barrier.	0.050	2	0.100
Total Opportunity Score				1.875
T1	Economic instability.	0.100	3	0.300
T2	Negative views of Indonesian society towards vaccination.	0.050	3	0.150
T3	Polio virus eradication policy leads to the needs to introduce IPV.	0.100	3	0.300
T4	Government regulation number 33 of 2014 regarding guarantee of halal products drives new raw materials selection and product optimizations based on halal status.	0.025	2	0.050
T5	Bargaining power of suppliers is moderate due to the uniqueness of the supplier's goods, limited availability of substitute goods, and supplier's ability to compete with the customer.	0.050	3	0.150
T6	Bargaining power of buyers is moderate due to large purchase proportion of buyers and several buyers have the ability to produce the product.	0.050	3	0.150
Total Threat Score				1.100
Total External Factors Score				0.755

Source: Author's analysis

Table 3: Internal Factor Evaluation of Bio Farma

No.	Internal Factors	Weight	Rating	Value
S1	Strong financial resources	0.10	3	0.30
S2	Well managed organizational resources	0.05	4	0.20
S3	Adequate technological resources	0.05	3	0.15
S4	Strong brand and reputation for years	0.05	4	0.20
S5	High tendency for innovation	0.05	3	0.15
Total Strength Score				1.00
W1	Human resources are not properly managed. Often employees work outside of their employment status.	0.15	3	0.45
W2	Lack of priority scale on high number of product development projects	0.10	4	0.40
W3	High price of raw material	0.10	2	0.20
W4	Insufficient number of researcher, tools, and facilities for the development project	0.15	3	0.45
W5	80% of raw materials are imported	0.05	2	0.10
W6	Poor work efficiency	0.15	4	0.60
Total Weakness Score				2.20
Total Internal Factors Score				(1.20)

Source: Author's analysis

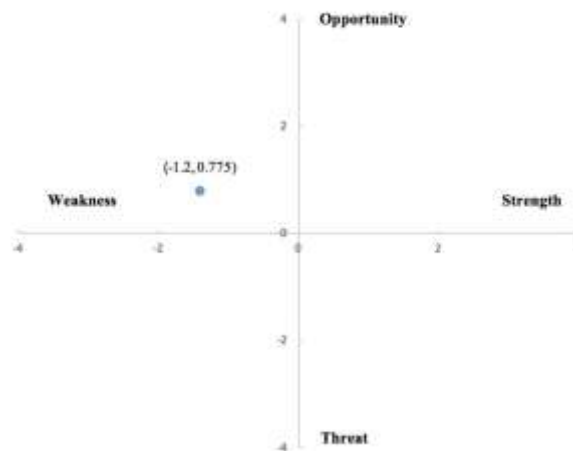


Figure 2: Grand Strategy Matrix of Bio Farma

Source: Author's analysis

Table 4: TOWS Matrix of Bio Farma

		Strength		Weakness								
		S1	S2	S3	S4	S5	W1	W2	W3	W4	W5	W6
IFE		S1	Strong financial resources			W1	Human resources are not properly managed. Often employees work outside of their employment status.					
		S2	Well managed organizational resources			W2	Lack of priority scale on high number of product development projects					
		S3	Adequate technological resources			W3	High price of raw material					
		S4	Strong brand and reputation for years			W4	Insufficient number of researcher, tools, and facilities for the development project					
		S5	High tendency for innovation			W5	80% of raw materials are imported					
						W6	Poor work efficiency					
		Opportunity		SO Strategies		WO Strategies						
O1	International trade agreements might drive sales through tariff reduction, tariff preference, and tariff elimination.			<ul style="list-style-type: none"> • Increase automation and internet of things utilization by using financial resources 		<ul style="list-style-type: none"> • Set priorities for project activities 						
O2	Pharmaceutical state-owned holding enterprise establishment benefits the firm through market expansion, product portfolio enrichment, and supply chain reinforcement.			<ul style="list-style-type: none"> • Choose new products based on the WHO prequalification list to be developed 		<ul style="list-style-type: none"> • Analysis the resource needs based on priorities 						
O3	Automation might increase production capacity and efficiency.			<ul style="list-style-type: none"> • Secure domestic market and increase profits by reducing production costs through efficiency enhancement 		<ul style="list-style-type: none"> • Equalize similar raw materials to simplify the procurement process and reduce its costs 						
O4	Internet of things might increase the efficiency and effectiveness of business activities.			<ul style="list-style-type: none"> • Enhance product innovation and improve product time to market 		<ul style="list-style-type: none"> • Regulate centralized procurement of raw materials for parent company and subsidiaries 						
O5	Global outbreak of coronavirus might change negative perceptions and provide an understanding of vaccine and immunization importance to the public, especially in Indonesia.					<ul style="list-style-type: none"> • Conduct personnel training and increase the use of automation as well as internet of things in order to improve work efficiency 						
O6	Vaccine prequalification priority policy by WHO induces innovation and acceleration of new products development.											
O7	Domestic market for vaccine is available through Indonesian government vaccination program.											
O8	Threat of new entrants is low due to high product differentiation, high capital requirement and also high fixed cost in the industry.											
O9	Threat of substitute product is low due to specific characteristic of the product.											
O10	The rivalry among competitors is low due to varies size of competitors, differentiated products, high fixed cost, and high exit barrier.											
		Threat		ST Strategies		WT Strategies						
T1	Economic instability.			<ul style="list-style-type: none"> • Develop a vaccine containing IPV that is supported by strong financial resources and high tendency for innovation 		<ul style="list-style-type: none"> • Utilize resources for the top priority of business activities 						
T2	Negative views of Indonesian society towards vaccination.			<ul style="list-style-type: none"> • Choose halal products for new raw materials 		<ul style="list-style-type: none"> • Increase work efficiency 						
T3	Polio virus eradication policy leads to the needs to introduce IPV.			<ul style="list-style-type: none"> • Conduct optimization studies related to the replacement of raw materials that have not been declared halal on existing products 								
T4	Government regulation number 33 of 2014 regarding guarantee of halal products drives new raw materials selection and product optimizations based on halal status.											
T5	Bargaining power of suppliers is moderate due to the uniqueness of the supplier's goods, limited availability of substitute goods, and supplier's ability to compete with the customer.											
T6	Bargaining power of buyers is moderate due to large purchase proportion of buyers and several buyers have the ability to produce the product.											

Source: Author's analysis

Table 5: The Projection of Free Cash Flow

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	0	1	2	3	4	5	6	7	8	9	10
Earning Before Interest and Tax (EBIT)	-	(1,935,542,772)	(3,753,458,983)	(5,644,083,504)	(9,153,763,699)	(9,163,323,699)	297,471,938,933	306,826,742,959	337,242,297,667	358,740,371,555	381,333,286,911
Tax for EBIT	-	-	-	-	-	-	74,367,759,728	79,206,685,740	84,310,574,417	89,685,092,889	95,328,304,228
Net Operating Profit After Tax (NOPAT) / EAT	-	(1,935,542,772)	(3,753,458,983)	(5,644,083,504)	(9,153,763,699)	(9,163,323,699)	223,103,279,185	237,620,057,220	252,931,723,251	269,055,278,666	285,984,912,683
Depreciation Expense	-	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810
Amortization	-	1,646,824,962	3,444,741,173	5,335,365,694	9,120,504,589	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890
Operating Cash Flow	-	-	-	-	-	-	314,735,792,883	329,232,570,919	344,564,236,950	360,687,792,365	377,617,426,383
Changes in Net Fixed Asset	1,467,355,090,429	(308,777,810)	(3,753,458,983)	(5,644,083,504)	(9,153,763,699)	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)
Depreciation Expense	-	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810
Amortization	-	1,646,824,962	3,444,741,173	5,335,365,694	9,120,504,589	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890
Net Fixed Asset Investment	1,467,355,090,429	1,646,824,962	1,797,916,211	1,890,624,321	83,869,686,196	118,750,000	-	-	-	-	-
Changes in Current Asset	-	-	-	-	-	-	974,502,153,233	46,428,538,270	49,526,473,506	53,870,616,591	57,695,208,398
Changes in Current Liabilities	1,461,180,734,237	-	(1,646,824,962)	(3,444,741,173)	(5,335,365,694)	(9,120,504,589)	89,455,864,764	(75,598,879,828)	(77,027,061,250)	(75,84,806,322)	(74,497,060,030)
Net Current Asset Investment	(1,461,180,734,237)	-	1,646,824,962	3,444,741,173	5,335,365,694	91,205,045,890	780,246,988,468	122,187,418,198	126,553,534,756	129,655,422,913	132,102,268,327
Free Cash Flow	(6,174,356,192)	(1,646,824,962)	(3,444,741,173)	(5,335,365,694)	(91,205,045,890)	(91,323,795,890)	(465,511,195,584)	207,065,152,721	218,010,702,194	231,032,369,452	245,515,158,055

Source: Author's analysis

Year	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
	11	12	13	14	15	16	17	18	19	20
Earning Before Interest and Tax (EBIT)	494,090,645,517	429,719,631,992	455,796,296,028	483,281,333,549	519,924,333,785	542,090,359,262	575,423,439,291	610,495,003,254	647,323,571,285	709,871,380,263
Tax for EBIT	101,226,661,329	107,429,697,998	113,649,674,607	120,795,283,385	127,981,033,446	135,522,289,640	143,855,784,823	152,623,759,814	161,830,439,296	192,467,825,041
Net Operating Profit After Tax (NOPAT) / EAT	393,679,984,138	322,289,723,994	341,847,222,021	362,385,850,155	383,943,100,339	406,567,769,821	431,567,354,468	457,871,232,441	485,491,317,889	577,403,475,122
Depreciation Expense	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810
Amortization	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	89,676,970,927	87,879,054,717	85,988,430,396	128,750,000
Operating Cash Flow	395,312,497,838	413,922,237,694	433,479,735,720	454,018,363,854	475,575,614,938	498,200,283,521	521,533,043,205	546,059,024,967	571,788,465,894	577,830,942,932
Changes in Net Fixed Asset	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)	(9,163,323,699)	(89,985,688,737)	(88,187,772,526)	(86,297,148,005)
Depreciation Expense	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810	308,777,810
Amortization	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	9,132,795,890	89,676,970,927	87,879,054,717	85,988,430,396	128,750,000
Net Fixed Asset Investment	-	-	-	-	-	-	(1,646,824,962)	(1,797,916,211)	(1,890,624,321)	(83,869,686,196)
Changes in Current Asset	58,292,688,392	61,771,899,633	65,305,052,670	68,570,836,438	71,625,936,601	75,322,129,335	79,395,099,615	83,222,702,792	87,224,029,437	91,620,912,059
Changes in Current Liabilities	(73,791,417,925)	(73,262,337,641)	(72,162,462,000)	(71,188,807,140)	(70,171,656,006)	(69,178,475,369)	(68,013,677,743)	(65,391,549,688)	(62,187,435,914)	(59,019,263,093)
Net Current Asset Investment	132,084,096,317	135,013,537,274	137,467,455,571	139,689,643,598	141,797,592,607	144,510,604,904	147,208,777,337	148,314,232,480	149,411,485,351	150,640,175,143
Free Cash Flow	263,228,401,521	278,998,700,420	296,012,280,149	314,328,720,256	333,778,021,431	353,689,678,617	375,991,090,810	399,542,688,698	424,267,605,064	513,060,447,985

Source: Author's analysis

Table 6: Sensitivity Analysis of Net Present Value

Variables	Input Variables				Abs. Result Change	NPV		
	Change	Downside Case	Base Case	Upside Case		Downside Case	Base Case	Upside Case
Sales Price (% of COGS)	5%	135%	140%	145%	56.36%	91,334,054,589	209,308,115,779	327,282,176,968
Sales Price Growth (%)	0.1%	0.4%	0.5%	0.6%	1.57%	206,021,276,263	209,308,115,779	212,594,955,295
COGS (IDR/dose)	10%	197,570	246,962	271,658	10.30%	183,297,460,010	209,308,115,779	230,857,560,042
COGS Growth (%)	0.5%	4.5%	5%	5.5%	9.03%	191,470,430,770	209,308,115,779	228,216,069,967
Vaccination Coverage (%)	5%	75%	80%	85%	13.46%	181,130,867,619	209,308,115,779	237,485,363,939
WACC (%)	1%	19.52%	18.52%	17.52%	15.88%	176,069,053,964	209,308,115,779	247,534,154,748

Source: Author's analysis

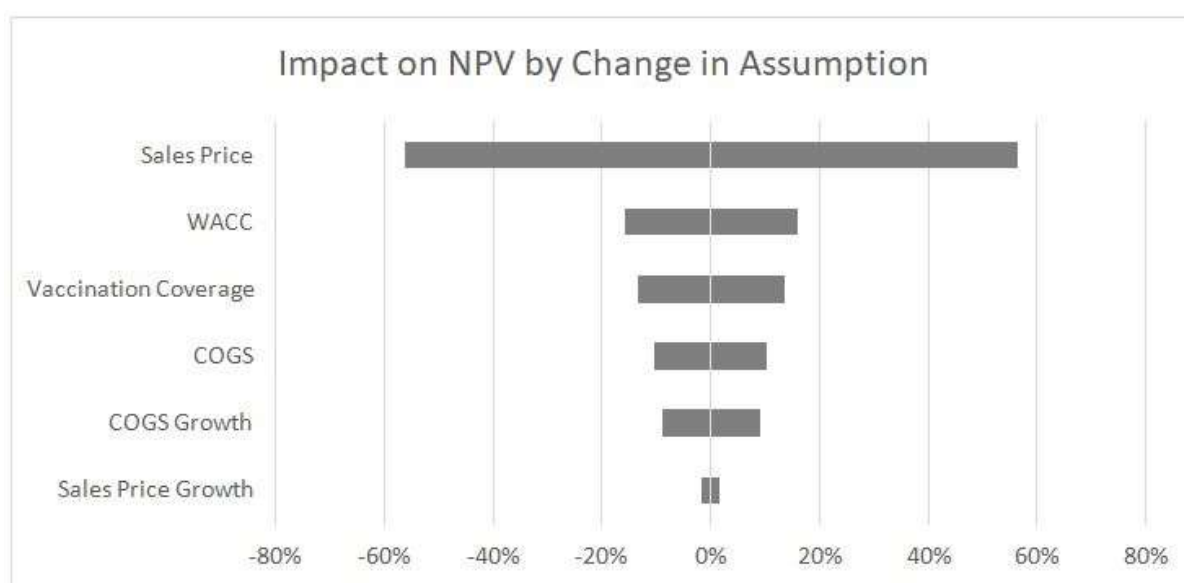


Figure 3: Tornado Chart of Net Present Value
Source: Author's analysis

4. Conclusions and Implementation Plan

The study discloses that the development of hexavalent vaccine, which might cost the company Rp 1,467,355,090,429 approximately, is financially feasible due to its positive NPV (Rp 209,308,155,779), a shorter payback period (9.03 years) than the project period (20 years), and an IRR (30.60%) that is higher than the WACC (18.52%).

Project implementation consists of the investment approval process and the timeline of the project. The approval process of a business project starts from the business situation analysis performed by Business Planning and Strategy Division. The source of the project proposal can be derived from the internal parties, in this case the market research or market intelligent of Business Planning and Strategy Division, or external parties, such as Marketing and Sales Division, CEO, or other partners. A feasibility study is then carried out on the project proposal by Business Planning and Strategy Division. If the project proposal is feasible, then it will be proposed to the CEO. The project proposal which is approved by the CEO, will be classified based on business collaboration type. Business Planning and Strategy Division then will coordinate with related divisions to conduct the project. For new product development project, Business Planning and Strategy Division will coordinate with Research and Development Division. The product development process is conducted by the Research and Development Division. The transition process from developed product to routine

product is carried out with the coordination of various divisions. Throughout the process, Business Planning and Strategy Division monitors the project.

The business project approval process is expected to be completed in mid-2020. If the project gets the approval to be executed, the product development process will begin at the end of 2020 and is expected to be completed in 2025. The new product will be registered to the Food and Drug Regulatory Agency as Indonesian National Regulatory Authorities (NRA) in the end of 2025 until early 2026. Commercial scale production of the new product is expected to start in the second quarter of 2026. The prospective product will be launched in the fourth quarter of 2026.

Four recommendations can be given for the project. First, the management should be more aware in determining the hexavalent vaccine sales price because it is the most influential parameter on the project NPV. Moreover, there is a high possibility that the government would lower the offered prices due to the economic recession caused by current Covid-19 pandemic. It would be better if the company tries various ways to reduce the COGS to anticipate it, such as improving work efficiency and selecting raw materials that are more cost effective. Second, it would be better if other feasibility study aspects, such as social, economical, environmental, and legal, are thoroughly studied to maximize existing opportunities as well as minimize business risks that might occur during the project. Third, the project feasibility analysis will produce more comprehensive analysis results when domestic and global markets are taken into consideration. Therefore, it would be better for future studies to focus more on the global market aspects to enhance current study analysis. Last but not least, Covid-19 pandemic unfortunately changes investment priorities and delays the development of projects in the company. Knowing the hexavalent vaccine domestic market will still be available and guaranteed by the government through its policies for the company, it is still possible to postpone the project in order to support other project activities related to Covid-19 pandemic mitigation if needed.

The hexavalent vaccine development project is not only financially profitable for the company. Considering that the wP-based hexavalent vaccine is not yet available in the global market, the reputation of the company will rise both globally and domestically if the project is successful. It will certainly increase business collaboration opportunities in the future. In addition, by developing a wP-based hexavalent vaccine, Indonesia actively participates in the polio eradication program more effectively and efficiently because it produces its own vaccine as well as improves its compliance to WHO policies.

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