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Business Opportunity Analysis on Halal Vaccine in the Indonesian Market (Case Study of XYZ Biopharmaceutical Company in Jakarta)

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ABSTRACT: Vaccine hesitancy is defined by the World Health Organization (WHO) as a behavior influenced by several factors, including issues of confidence (do not trust vaccine or provider), complacency (do not perceive a need for a vaccine, do not value the vaccine), and convenience (do not perceive a need for a vaccine, do not value the vaccine) (access). Muslim consumers are becoming increasingly aware of halal medications in addition to food products. They're starting to notice the negative consequences of product development, testing, and production, all of which may deviate from halal standards. As a result of this confusion, the general public is beginning to question the sources of their medicinal items.

Conservative Muslims may refuse vaccinations due to worries that some vaccines were obtained from the contents of pigs or porcine, which Muslims are prohibited from eating. Today, a quarter of the inhabitants of the world are Muslims. This figure is expected to grow by 35% over the next two decades, leaping from 1.6 billion to 2.2 billion by 2030. By 2021, the worldwide halal pharmaceutical industry will be worth USD 132 billion. Based on data from the Directorate General of Population and Civil Registration of the Ministry of Home Affairs, the total population of Indonesia is 272.23 million in June 2021. Of this number, 236.53 million people (86.88%) are Muslims.

To turn this hesitancy into an opportunity, XYZ Pharmaceutical plans to build a manufacturing plant for halal vaccines. In this research, the vaccines that will be produced by XYZ are ACYW135 Meningococcal Polysaccharide Vaccine, ACYW135 Meningococcal Conjugate Vaccine, 13 Valent Pneumococcal Polysaccharide Vaccine, and 23 Valent Pneumococcal Conjugate Vaccine. These vaccines are selected due to their close association with halal vaccines for the use case of Indonesian vaccine hesitancy. The objective of this study is to assess the feasibility of the halal vaccine manufacturing plant project through financial methods emphasizing capital budgeting technique, internal study, and market analysis. The result of this study shows that the development of the XYZ halal vaccine manufacturing plant is financially feasible due to the net present value of (USD 81,141,154), internal rate of return of (31.43%), the payback period of 4 years and six months, and the profitability index of (5.06), which in other scenarios testing are all acceptable for this project.

KEYWORDS: Capital Budgeting, Feasibility Study, Halal Vaccine, Investment, Pharmaceutical.

I. INTRODUCTION

The vaccine market was divided into three groups by the World Health Organization: (1) traditional, (2) innovator (new vaccines), and (3) targeted, regional, and outbreak. Traditional vaccinations drive worldwide market volume, whereas innovator vaccines drive global market value. Vaccine production remains consolidated, with four major companies (GSK, Pfizer, Merck, and Sanofi) holding 90% of worldwide vaccine value and producing 60% of global volume (SII, GSK, Sanofi, BBIL, and Haffkine). Mid-size producers (mainly in Asia) are increasingly diversifying their portfolios to compete in regional and emerging vaccination markets, such as HPV and PCV, by providing more and frequently less expensive options. When considering whether producers export vaccines, product registration, and product differentiation within each vaccination market, the genuine availability of high-quality, inexpensive vaccine choices may be limited. Furthermore, governments, particularly in the Asian regions, prefer to buy from domestic or regional producers, which could limit available options owing to regulatory, legislative, pricing, and political constraints [1]. Based on the vaccine groups already mentioned earlier, the highest volume is in the innovator vaccine group, which outnumbered all of the categories by a huge margin. Currently, in Indonesia, there is no innovative vaccine manufacturer. Most of the innovative vaccines in Indonesia are imported from overseas or partnered with local vaccine manufacturers to create a hybrid vaccine to be marketed in Indonesia. Based on the secondary data collected from WHO and Markets & Markets Report, it is estimated that the global vaccine market in 2019 was USD 33 billion and projected to be USD 74 billion in 2027 with a compounded annual growth rate of 10.2% [2].

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The pharmaceutical market in Indonesia witnessed a 7.4 % loss in 2020 compared to the previous year. The market for ethical medications fell 9.8%, while the market for over-the-counter drugs fell 2%, bringing the overall market to IDR 84.59 trillion. As a result, ethical medications commanded a market share of 68.1%, or IDR 57.57 trillion [3].

II. BUSINESS ISSUES

Muslim consumers are becoming increasingly aware of halal medications in addition to food products. They are beginning to recognize the potential negative consequences of product development, testing, and production, all of which may deviate from halal values. As a result of this confusion, the general public is increasingly questioning the sources of their medicinal items. As a result of these circumstances, the number of children suffering communicable diseases has been on the rise in Indonesia, particularly in the previous few years. As a result, health officials are afraid that some parents may refuse to enroll their children in immunization programs for fear that the vaccines used may violate their stringent religious beliefs. Religious beliefs may be one of the core influences on the refusals. There is an increase in public awareness among Muslims concerning vaccine antigens and excipients of animal origin. Parents are hesitant to vaccinate their children as they are wary of the presence of ritually unclean materials (najs) in vaccines. While the halal vaccine is the biggest issue among Malay Muslim parents (46.1%), vaccine safety is the main concern among Chinese (37.5%) and Indian (36.9%) parents. In 2016, 468 out of 1,815 reported vaccine refusal cases are due to halal and haram concerns. It surpasses the concern on vaccine contents (410 cases), internet influence (217 cases), and choosing homeopathy as a disease prevention method (215 cases) [4].

In Indonesia, religion was found to have a strong and beneficial effect on the inclination to use halal pharmaceutical items. The finding of a positive and significant influence of attitude on intention to consume halal pharmaceutical products suggests that respondents' attitudes toward consuming halal pharmaceutical products are influenced by their positive views or judgments of the benefits of halal pharmaceutical products. To begin with, because mindset and religion are the most important predictors of halal consumption intent, the pharmaceutical business must emphasize the halal characteristics of its goods through proper branding and promotion/advertising efforts. The material/substances of pharmaceutical items, as well as the manufacturing method, are all considered halal. Second, the pharmaceutical sector should contribute to improving halal pharmaceutical product awareness since it has been shown that knowledge of halal goods has a favorable and substantial impact on attitudes and intentions to use halal products [5].

Several studies have shown that there are a high number of vaccine refusals due to religious belief, especially halal related vaccines. These are some findings related to vaccine refusals from several studies across the Muslim majority nations.

Table 1. Vaccine Refusal Studies

Key Takeaways
• It's also been linked to strong religious convictions. In 2011, anti-vaccine propaganda escalated, claiming that vaccines are a Western plot to sterilize Muslim girls and that vaccines are composed of porcine gelatin, which is haram and hence banned in Islam [19].
• Religious convictions might be a major factor in the refusals. Muslims are becoming more conscious of vaccination antigens and excipients derived from animals. Parents are afraid to vaccinate their children because they are concerned about vaccinations containing ritually unclean elements (najs) [4]. • In 2016, halal and haram considerations accounted for 468 of the 1,815 recorded vaccination rejection instances. It outnumbers concerns about vaccine content (410 instances), internet impact (217 cases), and the use of homeopathy as a disease preventative technique (215 cases) [4].
• The high number of hesitancy to use the vaccine due to no halal license from MUI, yet the religious leaders across Yogyakarta can not force the fatwa that suggests the use of the vaccine in a special case (to save lives of many) because of the vaccine is still considered related to porcine [20].

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• The general population is becoming increasingly concerned about the origins of its medicinal items. As a result of these circumstances, the number of children suffering communicable illnesses has been on the rise in Malaysia, particularly in the previous few years. As a result, health officials are afraid that some parents may refuse to enroll their children in immunization programs for fear that the vaccines used may violate their stringent religious beliefs [21].
• The majority of current conspiracy theories are based on religious beliefs. Religious concerns are addressed by integrating educated Islamic experts in COVID-19 health promotion and education. Hence the majority of Pakistani people are Muslim and tend to fall for vaccine hesitancy related to non-halal ingredients of COVID-19 vaccines [22].
• According to the Center for Communication Program at John Hopkins University's COVID19 knowledge, attitude, and practice survey, COVID19 vaccination uptake in Pakistan is 67 percent. In Pakistan, the Vaccine Confidence Project discovered an increase in anti-vaccine attitudes from 2% to 4% as a result of instability and anti-vaccine religious leadership [23].

III. METHODOLOGY

The conceptual framework for this research is applied to give a clearer and more systemized understanding of market analysis for the feasibility study. Relevant variables are included in this conceptual framework to create a hypothetical approach for this research.

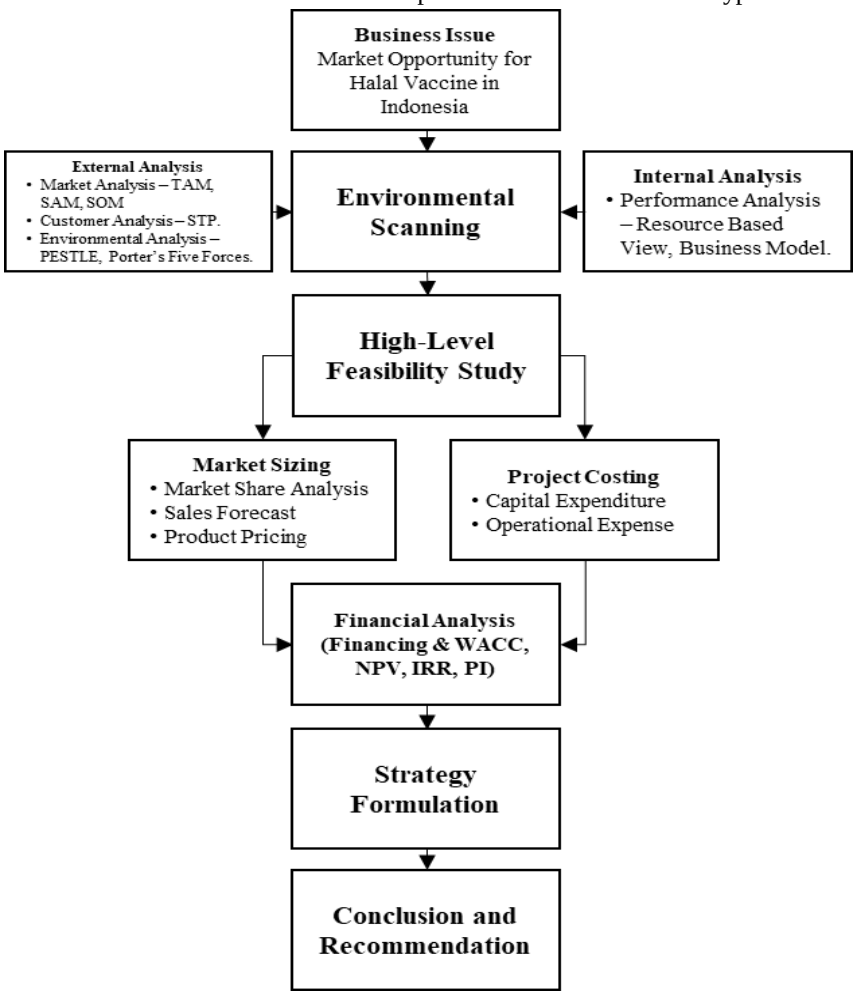

Figure 1. Author's Conceptual Framework

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The diagram above summarizes the research process for this thesis. Firstly, the author will conduct market analysis and preliminary research regarding the business issue that needs to be addressed. After having the preliminary information regarding the business issue, then the author will follow to conduct environmental scanning that covers external analysis and internal analysis through several frameworks available. In external analysis, the author will conduct external analysis using PESTLE for industry analysis and Porter's Five Forces for the related stakeholders and competitors analysis. Moving on to the internal analysis, the author will conduct the analysis using a resource-based view and VRIO Analysis to look deeper into the internal resources of XYZ to thrive in this proposed project.

After having all the necessary information gathered, then the author will conduct the financial feasibility study by calculating the revenue generators from the available market, sales forecast, and then product pricing for XYZ's products. Then the author will calculate project costing for this project by breaking down the capital expenditure and operating expenses needed for this project. In concluding the financial calculation, the author will conduct a financial projection and analysis that include the cost of capital calculation to determine the Weighted Average Cost of Capital (WACC), Net Present Value (NPV), Internal Rate of Return (IRR), and Profitability Index (PI). The results from the financial analysis will determine whether XYZ should open a vaccine manufacturing plant in Indonesia or not, and also the author will give several recommendations regarding the business strategy for this project.

IV. FINDINGS AND DISCUSSION

A. External Analysis

1) PESTLE Analysis

The external environment of a company is made up of all external elements that might influence its ability to obtain and maintain a competitive edge. Strategic executives can manage hazards and capitalize on opportunities by assessing elements in the firm's external environment. Consider the source or closeness of external elements to have a better understanding of how they affect a business [6].

Table 2. Political and Legal Analysis

Political/Legal	1. Some governments support pharmaceutical businesses in order to maintain important pharmaceuticals within reach of the general public. It assists businesses in surviving in a competitive market. a. In Indonesia, the government has begun giving free pharmaceutical packages to self-isolating COVID-19 sufferers. COVID-19 patients who are asymptomatic or OTG, as well as those who are symptomatic, will get one of three drug packages. b. The Indonesian Government provides free vaccination for children under one-year-old of BCG Polio, DPT-HB-Hib, and Measles. c. During COVID-19, all the vaccination related to COVID-19 is free provided by the Indonesian Government. 2. Law No. 19 of 2003 governs SOEs as state-owned corporations. a. To maximize and preserve its role in the development of a more open and competitive global economy. The management and monitoring of SOEs must be based on sound corporate governance standards. 3. Most countries' governments aim to keep a lid on drug prices so that they are affordable to the general public. It may have an impact on pharmaceutical company growth. a. In Indonesia, BPOM Regulation No. 1010/MENKES/PER/XI/2008, as amended by BPOM Regulation No. 1020/MENKES/PER/XII/2008 on Drug Registration, governs the authorization of pharmaceuticals and biologicals. 4. Supreme Court Wins YMKI Material Test Lawsuit, COVID-19 Vaccine Must Be Halal.

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Table 3. Economic Analysis

Economic	1. The GDP of the Non-Oil and Gas Industry Sector is made up of a variety of industrial items. With 1.68 percent, the Chemical, Pharmaceutical, and Traditional Medicine Industries are the Non-Oil and Gas Industry's second-largest contributor. a. As a result, the pharmaceutical industry plays a significant part in Indonesia's economic development. This will also inspire the government to be more supportive of the growth of pharmaceutical businesses. 2. Health expenditure in Indonesia by the Indonesian Government is increasing rapidly mainly due to the COVID-19 pandemic. 3. Healthcare spending will rise 8% to 186 trillion rupiahs, including adding more staff for vaccinations and COVID-19 treatment. 4. Unfortunately, the average spending on Healthcare in Indonesia is very low compared to other nations. Averaging USD 112 per year/capita compared to the OECD average of USD 4,000 in 2019.

The number of middle-income and affluent (MACs) has gradually risen, with Malaysia leading the way with 78 percent of the population in 2017, and Indonesia with 44 percent. By 2030, Indonesia's population will have increased by 8%, from 24 million to 62 million. Meanwhile, the existing middle class will expand by 7% every year, from 26 million to 65 million people. This brings a lot of opportunities for innovative vaccine manufacturers where the number of affluent class people in Indonesia will hugely increase in the future years, the purchasing power for vaccines will also increase added to the huge shock from COVID-19 that will change the vaccine market landscape to a broader scope.

Table 4. Social Analysis

Social	1. The quality of public health in Indonesia is growing rapidly; according to the 2021 Global Health Index, Indonesia ranks 45th out of 195 nations in terms of public health. 2. Vaccination progress for Indonesia is relatively average compared to the global standard. a. The COVID-19 vaccination rate in Indonesia is at 69% in February 2022 compare to the world's vaccination rate of 63.8% in the same period of time. b. In Indonesia there are lots of vaccination and drugs rejection due to "Halal" and religious factors [7].

Table 5. Technological Analysis

Technological	1. The pharmaceutical sector is heavily reliant on technological advancements. Research and biotechnology advancements have led to the manufacture of high-quality medications with reduced production costs. It will enable more people to obtain medicines that they could not previously afford. 2. In the pharmaceutical industry, Indonesia has been designated as a Center of Excellence in Biotechnology and has received funding from OKI to help develop biotechnology. The pharmaceutical sector is projected to increase its capabilities in the research and development of new pharmaceutical products as a result of the benefits of using biotechnology, a. It is feasible that in the application of biotechnology in the pharmaceutical sector, particularly vaccine and anti-sera producers, the R&D or production process can reduce or eliminate the usage of animal origin/ingredients while still producing safe, quality, and efficacy products.

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Table 6. Environmental Analysis

Environmental	1. The R&D process and its production in the pharmaceutical industry will, of course, use materials that contain chemicals that can pollute the environment and endanger the ecosystem around the company, and the company has the potential to produce waste that falls under the category of Toxic and Hazardous Material (B3). a. In Indonesia, by continuing to anticipate waste management, the Government Regulation (PP) No. 85 of 1999 regulating the management of Toxic and Hazardous waste was issued.

2) Porter's Five Forces

A framework that identifies five forces that define a firm's competitive strategy and determine an industry's profit potential. Porter discovered two crucial discoveries that served as the foundation for his groundbreaking five-force model [6]:

Table 7. Porter's Five Forces in Pharmaceutical Industry

Five Forces in Pharmaceutical Industry		**Information**
Bargaining Powers of Supplier	Very High	Because the raw materials used to manufacture vaccines must have proven quality and safety, the selection of good raw materials will be influenced by supplier bargaining power. As a result, locating and selecting suppliers who meet the company's specifications will be tough. As a result, suppliers play a larger role, providing high-quality products in limited quantities.
Threat of Substitute	Low	Since, until now, the vaccination has been the sole pharmaceutical product used as a preventive action against a variety of diseases.
Rivalry Amongst Competitors	High	Because the spread of new disease viruses continues, and people continue to consume vaccines. As a result, all vaccination and bulk manufacturer companies are continuing to develop new products. As a result, product differentiation is limited. What can be distinguished, however, is the efficacy and safety of these products in curing and preventing disease. Then, in order to preserve trust and expand their markets, all vaccine manufacturers must continue to improve the quality of all of their products.
Threat of New Entrants	Very Low	Because of the high barriers to entry, newcomers have difficulties with the economics of scale, product differentiation, capital needs, switching costs, distribution channel access, and government legislation.
Bargaining Power of Buyers	Low	Because vaccines are produced and sold by a small number of corporations in the pharmaceutical industry, both in Indonesia and overseas. As a result, purchasers in some countries can only purchase or use vaccines from businesses with distribution rights in specific locations and customers have few options for treating their ailment, particularly during times of crisis.

B. Internal Analysis

1) Resource-Based View

We can identify the firm's strengths and weaknesses by examining the company to examine its resources, capabilities, and core competencies. Managers can establish their strategic alternatives by linking these findings from a firm's internal analysis to those from the external analysis. Strategic executives ideally seek to use their companies' internal strengths to take advantage of external possibilities while also minimizing internal flaws and external risks (Rothaermel, 2020).

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Table 8. XYZ Resources Analysis

XYZ Resources	
Tangible	**Intangible**
1. One of the biggest pharmaceutical holding in China and the world. 2. Engaged with 350+ pharmaceutical and medical device suppliers. 3. 108,316 total employees worldwide. 4. The company has the largest supply chain network covering 31 provinces and 241 logistics centers. Also, it owns the largest number of retail drug stores in major cities in China. 5. Over 5,000 scientists, two Chinese Academy of Engineering Academicians, 11 national R&D institutes, 44 provincial-level technological hubs 6. XYZ, the world's sixth-biggest vaccine maker, can produce all of the vaccines in the National Vaccination Program and supplies over 80% of the vaccinations used in China's Expanded Immunization Program. 7. XYZ expands its global collaboration by forming 26 joint ventures with world-renowned pharmaceutical businesses and trade with over 120 nations and regions, including 60 Belt and Road countries. 8. 9,000+ domestic retail stores and worldwide connection of sales channel through joint-ventures. 9. For biological medications, narcotic and psychotropic drugs, anti-infectious drugs, cancer drugs, cardio-vascular drugs, and respiratory drugs, XYZ has established production and medicinal materials facilities.	1. The wide business line to support each other. a. R&D of natural sciences, development of biotech. b. Pharmaceutical material industry and pharmaceutical products. c. Medical device business. d. Wholesale for healthcare-related products. e. Clinics and laboratories. 2. Strong financial position in recent years, especially in 2020 FY. a. Sales reached RMB 456 billion, an increase of 7.32 percent from 2019. 3. XYZ has established a TCM industry chain that includes planting, research, and development, decoction pieces, formulated instant granules, and preparations. It can make over 900 medications and has 15 China Time-honored Brands and four medicines from the National Intangible Cultural Heritage. 4. The US FDA and EU authorities have authorized some of the XYZ production lines, and WHO has prequalified them. 5. Innovative company. a. Various information systems and platforms have played an important role in assuring the distribution and supply of medications. In 31 provinces and towns across the country, XYZ's "Saifei" supply-chain management cloud service platform encompasses 184 warehouses, 606 pharmaceutical and medical device production and operation firms, and 78,655 pharmaceutical product regulations. 6. The various highest standards for operation, manufacturing, and R&D. a. Good Manufacturing Practices (GMP) from National Agency of Drug and Food Control and Good Manufacturing Practices (cGMP) from the World Health Organization (WHO). b. Good Laboratory Practices (GLP), Good Clinical Practices (GCP), Good Distribution Practices (GDP), integrated management system ISO 9001:2015, ISO 14001:2015, and OHSAS 18001:2007, as well as world-class standard guidelines, including ISO 26000 guidance for CSR, Enterprise Risk Management ISO 31000, International Financial Reporting Standard (IFRS) and Information Technology 27000. c. Green Logistics.

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2) VRIO Analysis

XYZ's competitive advantage can favor its business to grow even bigger exceeding Indonesia's demand for vaccines. All of those XYZ's resources can be broken down into several categories for VRIO analysis.

Table 9. XYZ VRIO Analysis

	Resource/Capability	**Reasoning**
Valuable	1. XYZ's huge production facility produces 5 billion vaccines annually. 2. The high number of licensed products by WHO. 3. Global sales channel to cover more than 150 countries. 4. Strong partnership position and fully backed by the Chinese government as the main vaccine provider. 5. Innovative vaccine manufacturer to create new vaccines every year. 6. High standard for production, research, operation, and marketing to create high-quality and affordable vaccines.	1. XYZ can fulfill national demand and international demand with that level of production capacity. 2. Increase the perception of the high quality of XYZ's products. 3. Expand the sales for XYZ beyond the regional market. 4. Contracts for exclusive procurement from partners (including the Chinese government) to increase sales. 5. Keep up with the market demand to compete against international big players. 6. Lower the cost of production while maintaining high-quality vaccines.
Rare	1. XYZ's huge production facility produces 5 billion vaccines annually. 2. The high number of licensed products by WHO. 3. Global sales channel to cover more than 150 countries. 4. Strong partnership position and fully backed by the Chinese government as the vaccine provider. 5. High standard for production, research, operation, and marketing to create high-quality and affordable vaccines.	1. Few vaccine manufacturers with that capacity in the world. 2. Few vaccine manufacturers with more than 10 licensed products by WHO. 3. Accumulated from years of experience in the pharmaceutical industry. 4. Exclusive contracts for COVID-19 vaccine procurement in China, and worldwide governments. 5. Only a few pharmaceutical companies are licensed with cGMP standards from WHO.
Costly to Imitate	1. XYZ's huge production facility produces 5 billion vaccines annually. 2. The high number of licensed products by WHO. 3. Global sales channel to cover more than 150 countries. 4. Strong partnership position and fully backed by the Chinese government as the vaccine provider.	1. Requires more than RMB 311 billion in total assets to produce that level of production. 2. Requires a lot of steps and took years for a product to get licensed by WHO. 3. Requires high investment in the distribution channel, especially in foreign markets. 4. The company needs to have strong core resources, capabilities, and core competencies in order to be exclusive partners with the government.

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	5. High standard for production, research, operation, and marketing to create high-quality and affordable vaccines.	5. Cost lots of time and investment to get approval for the highest standard.
Organized	1. Global sales channel to cover more than 150 countries. 2. Strong partnership position and fully backed by the Chinese government as the vaccine provider. 3. High standard for production, research, operation, and marketing to create high-quality and affordable vaccines.	1. Can not be done in the short time-variant, the company needs to be structured end-to-end and fully supported and aligned with their corporate strategy. 2. Need a high level of stakeholders management and be trusted to deliver the best result. Aligning the company with its company objectives for a long period of time. 3. Most of the international standards requires participation from all of the department to deliver the best results in order to gain the golden standards.

C. External and Internal Factor Analysis

A SWOT analysis is a straightforward and successful method for determining a company's strengths, weaknesses, opportunities, and threats. It's critical to capitalize on strengths, reduce dangers, and seize available chances. Conducting a SWOT analysis is beneficial for strategic planning and identifying a company's goals [8]. Using the SWOT analysis, we combine insights from an internal examination of XYZ's strengths and weaknesses with those from an analysis of external opportunities and threats. Internal resources, capacities, and competencies are the focus of internal strengths (S) and weaknesses (W). The VRIO framework may be used to assess if they are strengths or weaknesses.

Table 10. SWOT Analysis of XYZ

Strengths	**Weaknesses**
• Global sales and distribution channel. • Strong product proposition and price offerings for the Indonesian market. • The gold standard of production, R&D, and sales/distribution. • High level of intellectual property licensed by WHO. • One of the biggest vaccines production capacities in the world, years of professional experience in the pharmaceutical field.	• Limited product offerings for Indonesian market. • The newness of the Indonesian market to penetrate. • High cost for production. • Lack of major Indonesian governmental partnership. • Lower human capital competitiveness for the pharmaceutical field in Indonesia.
Opportunities	**Threats**
• Supreme Court Wins YMKI Material Test Lawsuit, COVID-19 Vaccine Must Be Halal. • Low level of competitive field in Indonesia for domestic vaccine producers. Only Bio Farma is the main player in the vaccine manufacturer business.	• High penetration from big International players on halal vaccine initiatives. • Unclear local regulation regarding new pharmaceutical products. • Long process for halal licensing from the BPOM and MUI.

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• Low bargaining power of customers, especially in vaccine products. • Increase in health awareness level due to pandemic. • Active national vaccination program from the Indonesian government.	• Emergences of a local manufacturing company (Bio Farma) to create their own halal vaccine. • Lower Purchasing Power Index of the Indonesian customers compared to the Chinese market (Numbeo, 2021).

D. Market Potential and Market Share Target

The study by the Ministry of Health of Indonesia and WHO in 2020 [9] which surveyed more than 115,000 respondents from all 34 provinces in Indonesia found that respondents indicated considerable worries regarding vaccine safety and effectiveness, expressed a lack of faith in vaccination and voiced reservations about the vaccine's haram-halal classification. Concerns regarding vaccination safety (30%), doubt about the vaccine's efficacy (22%), lack of faith in the vaccine (13%), fear of side effects such as fever and discomfort (12%), and religious views (8 %) were the most prevalent reasons for not adopting COVID-19 vaccine.

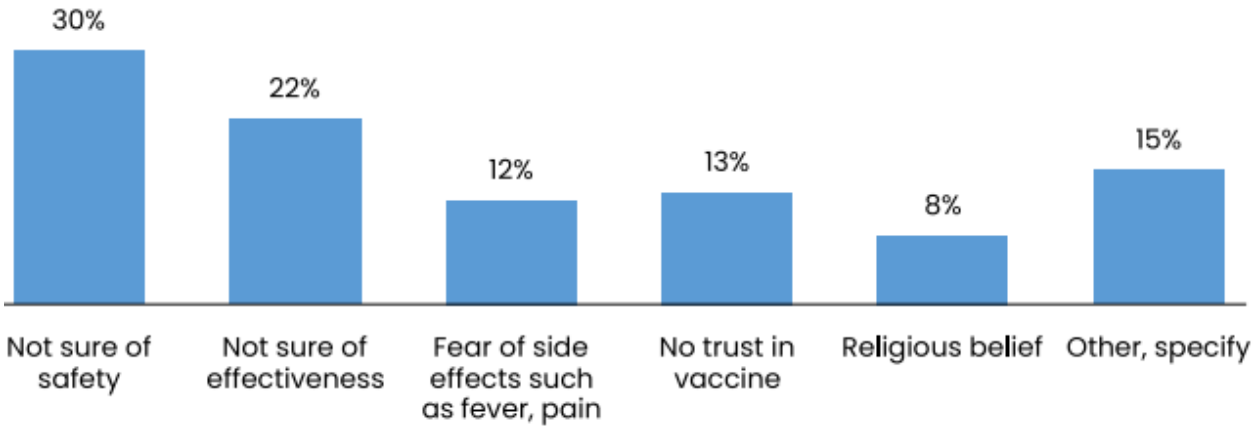

Figure 2. Common Reasons for Not Accepting Vaccination [9]

Assuming that halal vaccines produced by XYZ can eliminate the haram-halal vaccination hesitancy to increase the market size of the vaccine in Indonesia, with base calculation as follows:

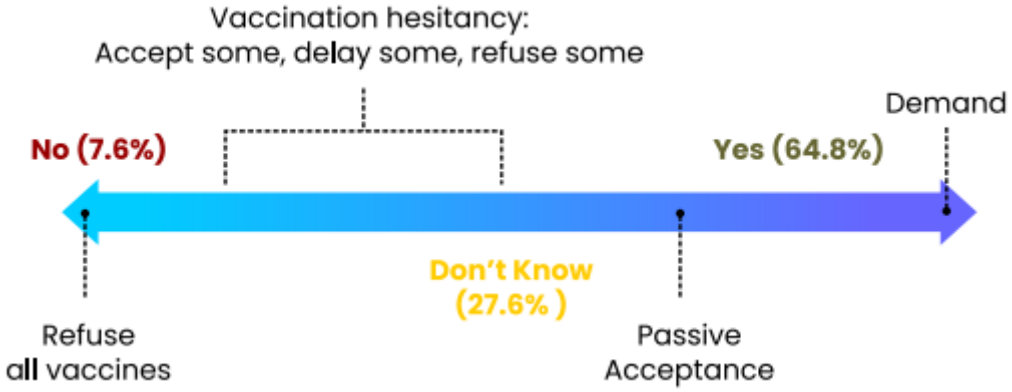

Figure 3. Vaccine Acceptance Status in Indonesia [9]

It can be extrapolated from the current market size of the vaccine from USD 256.5 million to USD 267.65 million or the exclusive market size for halal vaccine of USD 11.15 million added from the religious belief refusal of vaccines.

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1) ACYW135 Vaccines

Meningitis is an inflammatory disease of the membrane system that protects the central nervous system (meninges). This disease occurs when there is an infection in the membrane that lines the brain. Meningitis has spread in various countries. Meningitis sufferers who died in Indonesia in 2016 reached 4,313 people from 78,018 cases [10]. This figure makes Indonesia the country with the highest case and death rate in Southeast Asia due to meningitis. Also, the main demand for ACYW135 vaccines comes from the Muslims who are going for Hajj and Umrah. The government of Saudi Arabia requires that all people who will come to their country, including Umrah and Hajj, need to be injected with the meningitis vaccine.

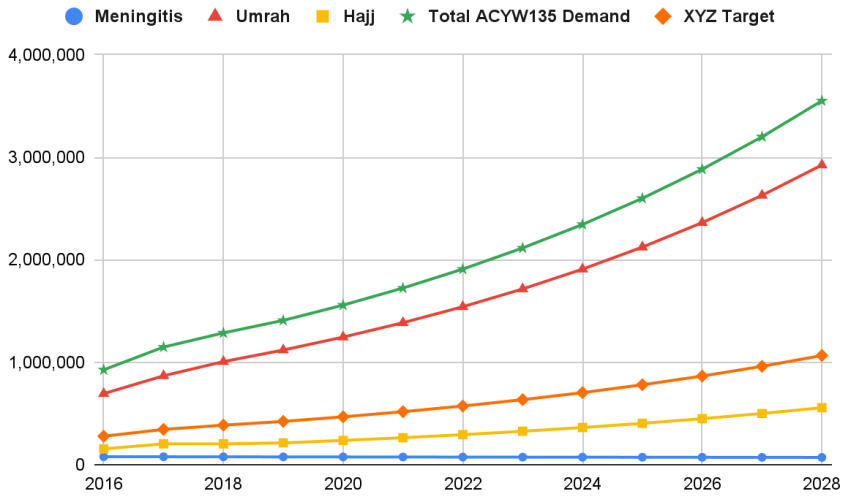

Figure 4. ACYW135 Market Projection [11][12][13]

The number of Indonesian pilgrims for Umroh and Hajj in 2018 was 1,209,507 people, and from the historical data growth, we forecasted an 11.3% growth year-over-year until 2028. By totaling the meningitis population and pilgrims, the base year of 2022 consists of 1,908,863 people for the ACYW135 vaccines demand. XYZ's target market for this vaccine is 30% realistically come from the product offering of halal vaccine and the limited supplier for this kind of vaccine. Hence, we got 865,069 doses of ACYW135 for the base year of 2026 for XYZ.

2) Pneumococcal Vaccines

The pneumococcal vaccination protects against pneumococcal infections that can be severe and even deadly. The pneumonia vaccination is another name for it. Streptococcus pneumoniae causes pneumococcal infections, which can result in pneumonia, blood poisoning (sepsis), and meningitis [14]. Your age and health will determine the type of pneumococcal vaccination you receive. Pneumococcal conjugate vaccine (PCV) is used to vaccinate children under the age of two, whereas Pneumococcal polysaccharide vaccine (PPV) is used to vaccinate persons aged 65 and above, as well as those at high risk due to long-term health issues.

Pneumococcal conjugate vaccine (PCV) is usually given to children in 4 doses, namely 1 dose at 2 months of age, 1 dose at 4 months of age, 1 dose at 6 months of age, and 1 dose at 12-15 months of age [15]. While the Pneumococcal polysaccharide vaccine (PPV) only needs to be administered for a single dose usually for people aged 65 and over, or in a special case of long-term health condition you may only need a single every 5 years [14].

There are 4,180,548 newborns in Indonesia in 2021 [16], this number will be the base number for PCV vaccine market size calculation, while the elderly population aged 65 and over is 17,581,000 in 2021 [16]. The vaccines that XYZ will develop consist of innovative mainstream vaccines to boost the body's immune. XYZ's target market will be established emerging middle-class, middle-class, and affluent people in Indonesia, due to the halal license and cheaper product prices that will be the main selling point of XYZ's vaccines, XYZ believes that the conservative target for their vaccines is 30% of the total emerging middle-class, middle-class and affluent people in Indonesia that lies on PCV and PPV target category. Below are the market projection for future

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innovative vaccines. This calculation also considers the population growth of Indonesia for the past twenty years from 2001 to 2021 of 1.28% annually [17].

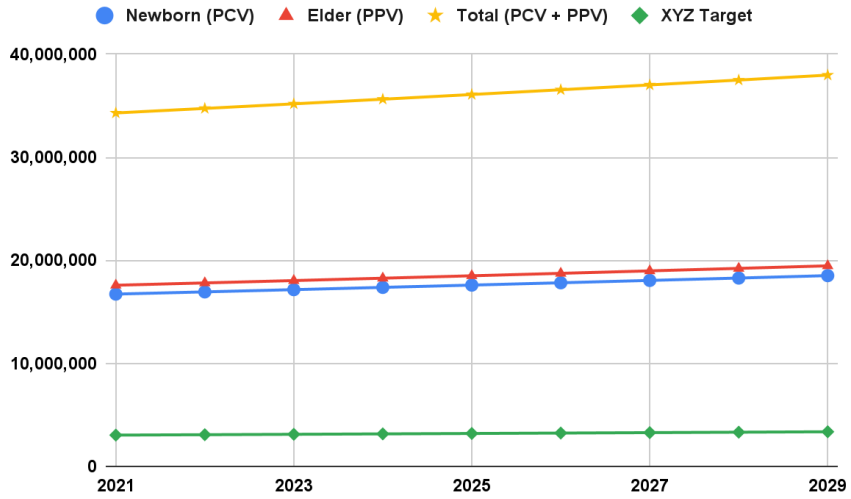

Figure 5. Pneumococcal Vaccine Market Projection
Source: (World Bank, 2021; BCG, 2020; BPS, 2020; Author's Analysis)

E. Product Pricing

The pricing for the goods produced will be set at 75% of the circulating market price to enable market penetration and aid the government in achieving its aim of delivering vaccinations at reasonable costs for the population. In a year, XYZ will raise the price of its vaccine by 5% to cover the inflation rate assumption of 5%.

Table 11. Price for XYZ Innovative Halal Vaccine [1]

Vaccine	Indonesian Market Price in 2022 (IDR)	XYZ Price Target in 2022 (IDR)	XYZ Price Target in 2026 (IDR)
ACYW135 Meningococcal Polysaccharide Vaccine	184,423	119,875	145,709
ACYW135 Meningococcal Conjugate Vaccine	446,699	290,354	352,927
13 Valent Pneumococcal Polysaccharide Vaccine	267,476	173,859	211,327
23 Valent Pneumococcal Conjugate Vaccine	788,974	512,833	623,352

F. Revenue Forecast

By multiplying the demand forecast (doses) from the future XYZ's vaccines and the pricing for the products, we can estimate the revenue for XYZ's products from 2026 onwards.

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Table 12. Revenue Forecast for XYZ Halal Innovative Vaccines

No	Product	Forecast Revenue (USD) in Year - Scenario 1				
		2026	2027	2028	2029	2030
1	ACYW135 Meningococcal Polysaccharide Vaccine	4,346,479	5,064,147	5,902,010	6,880,271	8,022,530
2	ACYW135 Meningococcal Conjugate Vaccine	10,527,804	12,266,099	14,295,525	16,665,015	19,431,735
3	13 Valent Pneumococcal Polysaccharide Vaccine	24,154,387	25,686,741	27,316,308	29,049,254	30,892,139
4	23 Valent Pneumococcal Conjugate Vaccine	67,767,886	72,067,081	76,639,016	81,500,996	86,671,419
Total		**106,796,556**	**115,084,068**	**124,152,859**	**134,095,536**	**145,017,823**

G. Defining Project Assumptions

Any project element that is assumed to be true, actual, or certain without empirical proof or demonstration is referred to as a project assumption. It's hard to plan a project without making some assumptions. Knowing how to recognize such assumptions and having controls in place to ensure that if any assumption turns out to be erroneous, the impact on project execution is limited is the key [18]. The following are other assumptions used in this financial simulation:

1. Exchange rate use for the calculation is USD $1 = IDR 14,500.
2. The inflation rate is 5%, rounded from the average actual inflation rate in Indonesia from 2010 to 2021.
3. Debt proportion of 40% from bank and 60% from owner's equity.
4. The loan interest rate of 10% (rounded past three years average).
5. The assumption from the product price increase is 5% annually.
6. Corporate tax of 25%.
7. The project starts in May 2022 and will be completed to start selling the vaccines in January 2026.

This plant will focus on downstream processes, according to the initial proposal (formulation, filling & packaging). If the downstream process is broken down further, the filling and packaging process will come first, followed by the formulation process, keeping time-to-market in mind. The next stage is to transmit the vaccine to be sold to customers once it has been appropriately packaged. The first stage in constructing a factory, as depicted in the diagram below, is to establish a legal corporation. After that, the industrial building may commence. Various steps must be completed before the factory may begin operations and obtain a permit to sell its products to the general public. The first phase is to complete the concept of design (CoD) and basic of design (BoD) processes, which will take three months, followed by the detailed engineering design (DED) process, and finally, the building of industrial facilities, which will take around 18 months.

Qualification and validation of the rooms and equipment will be carried out when the production facilities are completed. This procedure takes roughly 6 months to complete. The next stage is to apply for GMP certification (GMP), which takes roughly 6 months after the validation and qualification procedure is completed. After then, a six-month-long stability study is required. The next stage is to obtain a vaccination distribution permit, which will take around four months. The vaccination product can be marketed to customers after receiving distribution permission for the vaccine. As indicated in the diagram below, it takes around 43 months from the commencement of construction to the point when the product may be offered to the general public.

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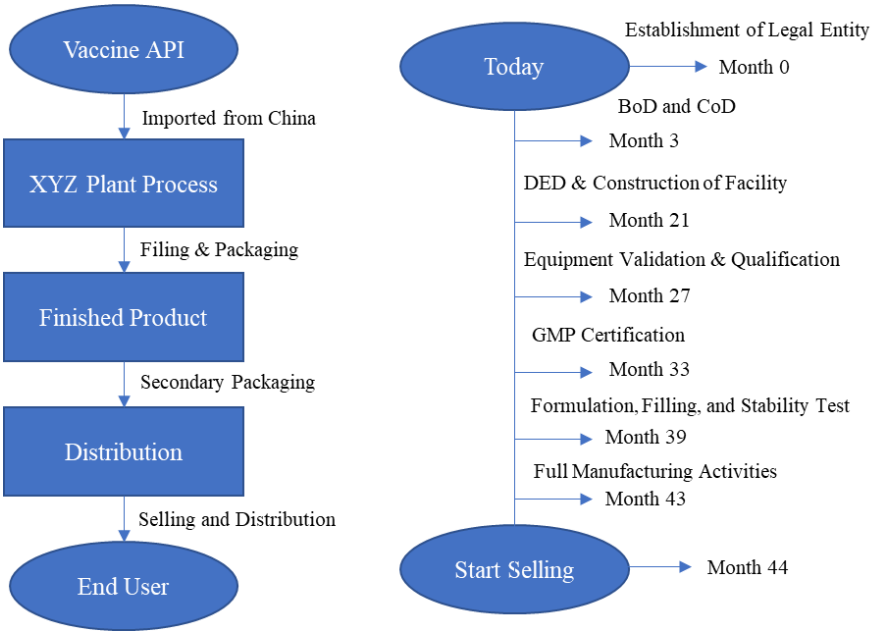

Figure 6. Plant Process and Project Timeline

H. Capital Expenditure

1) Land and Facilities

The available land is determined to fit the criteria to be utilized for the building of a biopharmaceutical plant based on the results of inspections and observations. The rationale for this is that this area is close to toll highways, has strong infrastructure, and fits qualifying requirements (road conditions, road width). One of the benefits of this property is its square shape, which makes it easier to plan the manufacturing. Furthermore, the presence of property in this industrial region might be advantageous, such as the simplicity with which company permissions and factory development permits can be obtained.

Table 13. Land Project Information

Land Project Information		
Location	Industrial Estate, West Java - Indonesia	
Usage	Pharmaceutical, Warehouse, and Distribution	
Land Area (sqm)	15000	
Price/sqm	IDR 2,000,000	
Total Price	IDR 30,000,000,000	~ USD 2,000,000
Zoning	Industry	
Building Coverage (sqm)	9000	
Building Ground Floor (sqm) - Phase 1	Office	800
	Production	1600
	Warehouse	640
	Electrical	580
	Central Utility	560

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	Power House	30
	Guard House	170
	Total	4380
Building Ground Floor (sqm) - Phase 2	Future Development	2000

The proposed structure must comply with the most recent GMP and biosafety regulations. The structure will include facilities for the formulation, filling, and finishing, as well as secondary packaging and storage, Quality Control (QC), and Quality Assurance (QA). Apart from these general amenities, the building should additionally incorporate the following supporting areas:

1. Cleaning, laundry, sterilization, and other support services are available in this section.
2. HVAC, electric power supply, industrial raw water treatment, wastewater treatment, and other technical domains.
3. The storage compartment for vaccines is cold (2-8 C) and at room temperature.

Figure 7. Factory Layout

2) Total Capital Expenditure

The initial investment will happen in the first month of the project to purchase the land for the manufacturing plant, XYZ needs to invest a total of USD 19,883,668 in May 2022. The base calculation is for the capital investment to come from 40% of bank loans and 60% of equity.

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Table 14. Project Investment

CAPEX	**Investment Outflow (USD)**
Item	**Year (May 2022)**
Land	2,068,966
CoD & BoD	200,000
Facility	10,457,875
Equipment	7,156,827
Total	**19,883,668**

I. Financial Feasibility Result and Scenario Analysis

The most crucial stage in starting a new business is the financial feasibility study, which evaluates if the business concept is worth pursuing or should be abandoned. In this study, the author analyzes several parameters of financial feasibility study such as cost of capital, IRR, NPV, PI, and payback period. The calculation of this project is using discounted cash flow (DCF) method with 10 years of the project lifetime. At the end of the calculation, there will be tested against three different scenarios to determine the feasibility of this project.

Table 15. Sensitivity Scenarios

Variables	**Scenario**		
	Pessimistic	**Most Likely**	**Optimistic**
Price	60%	65%	70%
Sales Target	85%	100%	110%
Debt Financing	30%	40%	50%
Capital Financing	70%	60%	50%

1) Scenario 1 – Most Likely

On the basis case of this project calculation, the project will use the source of funds for the investment from 40% of bank loan and 60% of equity. For the calculation of the cost of debt, the author will use 10% of the bank interest rate for nine years of interest paid annually from the outstanding value. In this scenario, the selling price of the products is 65% of the average market price for similar products in Indonesia, and the sales target is 100% of the projected sales forecast. The levered beta is adjusted based on the debt and equity ratio for this calculation, where in this scenario the WACC is 9.56%.

The amount of initial investment is USD 19,883,668 and resulted in a positive result in the below table. In conclusion, the economic feasibility of Scenario 1 is feasible since the NPV, IRR, PP, and PI showed positive results.

Table 16. Scenario 1 Economic Feasibility Result

Scenario - Most Likely			**Remarks**
IRR	31.43%		Accept
NPV	81,141,514	USD	Accept
Payback Period	4.53	Years	Accept
Discounted Payback Period	4.75	Years	Accept
Profitability Index	5.06		Accept

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2) Scenario 2 – Pessimistic

On the basis case of this project calculation, the project will use the source of funds for the investment from 30% of bank loan and 70% of equity. For the calculation of the cost of debt, the author will use 10% of the bank interest rate for nine years of interest paid annually from the outstanding value. In this scenario, the selling price of the products is 60% of the average market price for similar products in Indonesia, and the sales target is 85% of the projected sales forecast.

The levered beta is adjusted based on the debt and equity ratio for this calculation, where in this scenario the WACC is 9.53%. The amount of initial investment is USD 19,883,668 for this scenario calculation which resulted in positive IRR, NPV, PP, and PI.

Table 17. Scenario 2 Economic Feasibility Result

Scenario - Pessimistic			**Remarks**
IRR	26.14%		Accept
NPV	55,984,429	USD	Accept
Payback Period	4.71	Years	Accept
Discounted Payback Period	5.02	Years	Accept
Profitability Index	3.79		Accept

3) Scenario 3 – Optimistic

On the basis case of this project calculation, the project will use the source of funds for the investment from 50% of bank loan and 50% of equity. For the calculation of the cost of debt, the author will use 10% of the bank interest rate for nine years of interest paid annually from the outstanding value. In this scenario, the selling price of the products is 70% of the average market price for similar products in Indonesia, and the sales target is 110% of the projected sales forecast.

The last scenario in this research consists of the best possibility possible for the forecasted calculation, with the WACC of 9.58% due to a higher portion of debt ratio on financing alternatives. The initial investment is still at USD 19,883,668 split equally between equity and bank loan. This scenario resulted in the best output of calculation compared to the other two scenarios shown earlier. This scenario has the highest NPV of USD 102,610,407 and IRR of 35.52%. Here are the full calculations for the financial feasibility result:

Table 18. Scenario 3 Economic Feasibility Result

Scenario - Optimistic			**Remarks**
IRR	35.52%		Accept
NPV	102,610,407	USD	Accept
Payback Period	4.43	Years	Accept
Discounted Payback Period	4.60	Years	Accept
Profitability Index	6.14		Accept

V. CONCLUSION AND RECOMMENDATION

A. Conclusion

The main objective of this study is to assess the feasibility of the XYZ Halal Vaccine Manufacturing project which is state-of-the-art for this industry. The conclusions that can be drawn from this study are as follows:

1. The initial investment for this project is USD 19,883,668 which consists of investment in land, facility, equipment, and intangibles. The financial model that is built on this research using the capital budgeting method can mirror the national demand and projection for the halal vaccine market in Indonesia.

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2. Based on the quantitative analysis study, the Halal Vaccine Manufacturing project is feasible. The most-likely scenario resulted in an NPV of USD 81,141,154 and IRR of 31.43% with a payback period of 4 years and six months. The profitability index is 5.06, which in other scenarios testing are all acceptable for this project.
3. This project can also sustain a pessimistic scenario with a huge margin of positive parameters on IRR, NPV, PP, and PI. Here is the summary of the results:

Table 19. Summary of Project Result

Scenarios Summary				Remarks
	Pessimistic	Most Likely	Optimistic	
IRR	26.14%	31.43%	35.52%	Accept
NPV	55,984,429	81,141,514	102,610,407	Accept
Payback Period	4.71	4.53	4.43	Accept
Discounted Payback Period	5.02	4.75	4.60	Accept
Profitability Index	3.79	5.06	6.14	Accept

B. Recommendation

Based on the study, there are still many things that can be maximized to capture more beneficial results. The following items are recommended to be implemented on this project:

1. **Partnering with Local Vaccine Player**
   The innovative vaccine market in Indonesia is currently very scattered among international pharmaceutical companies, while in Indonesia the sole vaccine manufacturer is Bio Farma which only manufactures generic vaccines. This kind of collaboration can bring mutual benefit for both parties, XYZ can benefit from the current Bio Farma's sales channel and government relationship. While Bio Farma can also benefit from the lower cost of raw materials and product partnership, especially with pneumococcal vaccines which is on the main recommendation list from the Indonesian Pediatrician Association (PDAI) to fulfill the PCV demand.
2. **Low Cost Active Pharmaceutical Ingredients**
   In addition to ensuring the company's growth and sustainability, XYZ must be able to provide economic raw material pricing, allowing companies to provide cheap rates for the community as a support for government initiatives aimed at improving the welfare and health of the larger community. This also can break barriers to the innovative vaccines market were currently held by big pharmaceutical companies which offer more expensive prices in the market.
3. **Immediate Project Implementation**
   Carry out this Biopharmaceutical plant construction project as quickly as feasible to win the competition and close the door to other enterprises working in the same market. Currently, the halal licensed vaccines in Indonesia are still very limited. XYZ can maximize this benefit to obtain halal licenses as the vaccines are produced nationally and can be assessed thoroughly by the Indonesian governing bodies.

VI. LIMITATIONS

Due to the limitation of information and resources to conduct this research, there are several limitations of this research which are listed below:

1. On account of the limited information available for vaccines study, the author uses assumptions based on available secondary data to estimate the feasibility study.
2. High-level feasibility studies conducted in this research do not precisely mirror the technical requirements of vaccine manufacturing due to the secretive nature of the industry.
3. The market assessed in this study is limited to only the Indonesian market, specifically on the traditional and innovator vaccines.

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4. Specific external factors such as licensing method, manufacturing practices, political condition, and raw materials pricing are adjusted based on available information and assumptions.

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