

Pricing of Medical Instrument Products for Domestic Production through Investment Feasibility Analysis

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Abstract - Pricing products is an important factor to penetrate the Indonesian market successfully. Since Indonesia's medical device products market has more than 90% import, local production companies must be competitive in price. The current pricing approach relies on the cost of sold goods, profit margin, and cost. Hence, a new pricing model is needed. The price from the new model must be better than the current price from the conventional pricing approach. The research aimed to formulate a pricing model for local medical device products that the market could accept and provide a framework model in local production pricing using investment feasibility analysis. The research used mathematical models, engineering economics, and pricing frameworks to optimize product prices from a local company (PT Enesers Mitra Berkah). The studied object was the domestic production of Anesthesia A8500. The research has several findings. First, the Break-Even Point (BEP) (X_2) is an alternative standpoint to determine the price in a local production investment for medical device products. Second, the production company can consider the market price (X_3). The research develops a simple mathematical model of $X_3 > Y_2 = X_2 + Ct > X_1$ (Y_2 = new price, X_1 = cost of sold goods, Ct = profit and cost). The result provides the pricing framework model as a new approach for developing a medical device product price when the company initiates new local production.

Keywords: medical instrument pricing, medical instrument products, domestic production, investment feasibility analysis

I. INTRODUCTION

The global medical device industry is booming, both technologically and economically. For example, Technavio, a global leading market research institute, said that the market of the medical device industry approximately grew around \$87,65 billion in 2020-2022 (Technavio, 2020). Several leading medical equipment industries, such as Fresenius, GE Healthcare, Johnson & Johnson, Medtronic, Siemens Healthineers, Stryker, and other top sectors, compete to innovate and seize increasingly fierce economic opportunities. The market of global medical device production had a value of \$7 trillion in 2017. The demand will increase to \$115 trillion by 2022 (EMSNOW, 2018). The market grows from year to year over the next period, as shown in Figure 1. The increasing percentage of market value from 2017 to 2028 is about 6% to 12% (see the red line in Figure 1). The percentage is tenderly down-turn, but the economic value increases.

The increasing demand for medical devices in developing countries tends to lead to an increase in the market. Developing countries are currently growing during a slump in the developed countries that are presently economically less attractive. Moreover, the hospital industry requires new technology to improve the quality and accuracy of diagnoses, health services, and operational costs for competitive advantage. Market absorption of medical devices in Indonesia is very promising, but it is dominated by imported medical devices. Hospitals, as the primary markets in the industry of medical equipment products, continue to grow. The growth rate of hospitals represents the market for medical products, as shown in Figure 2.

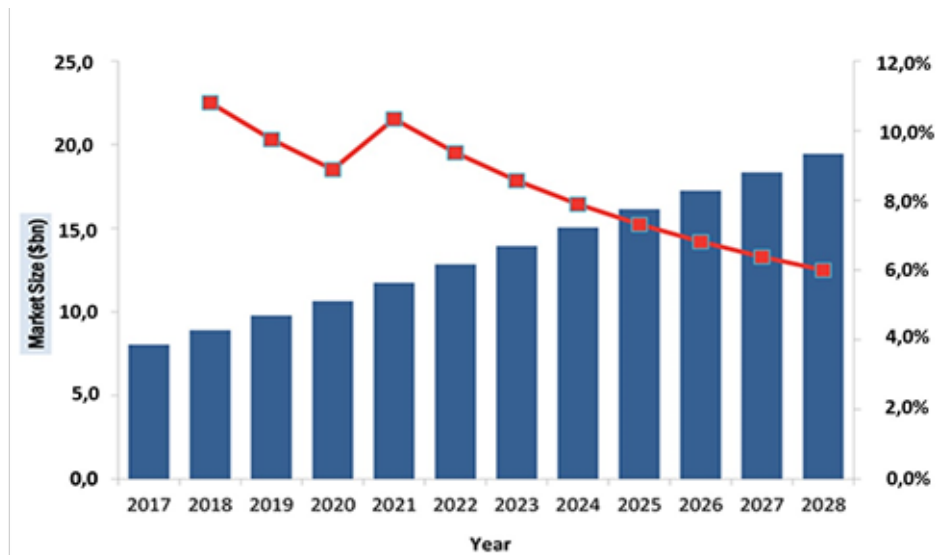


Figure 1 The World Market for Industry of Medical Device Products
(Source: EMSNOW, 2018)

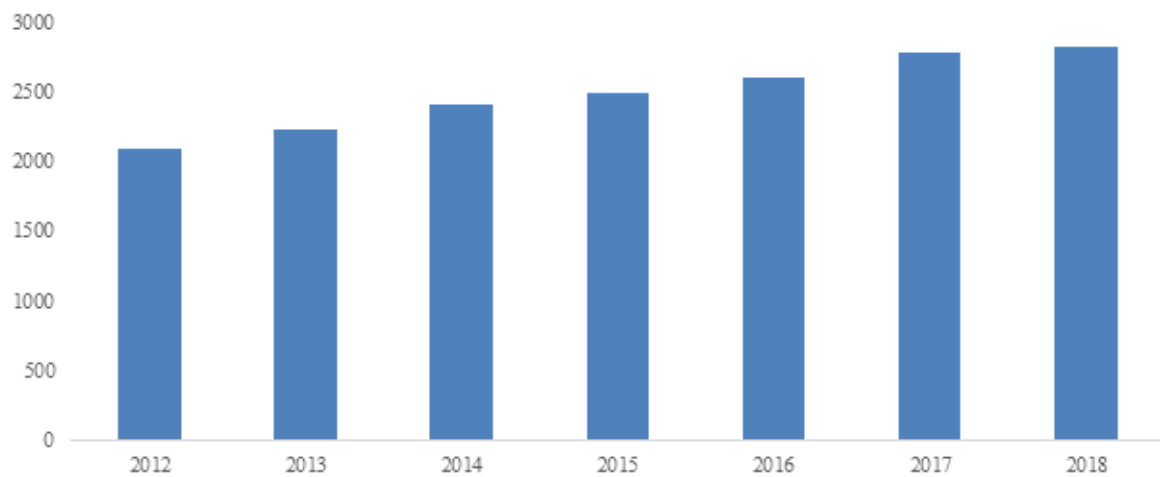


Figure 2 The Hospital Industry Growth in Indonesia
(Source: Indonesian Hospital Association, 2018)

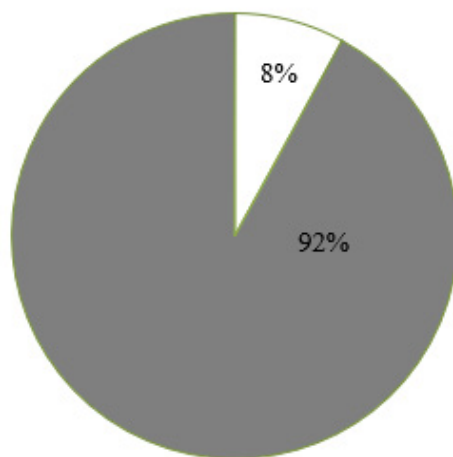


Figure 3 The Structure of Medical Device Market Composition in Indonesia
(Source: Putera, 2018)

The growth of the medical device industry globally has many impacts on Indonesia. Unfortunately, Indonesia is only a market for the medical equipment industry but not a significant player. At present, around 92% of Indonesia's medical devices are from overseas (Bachdar, 2018). The illustration is shown in Figure 3.

The dominance of imported medical equipment is an indisputable fact, as said by Indonesian medical and laboratory equipment associations like *Gabungan Perusahaan Alat-Alat Kesehatan dan Laboratorium (GAKESLAB)*. From around 400 medical and laboratory equipment companies, only 10 produce medical devices in Indonesia. It is also limited to specific medical devices (Putera, 2018). Although imported products dominate the market, the development of Indonesia's medical equipment industry is still promising. However, it is not optimal for domestic production. Medical device products are an essential aspect of medical services in hospitals with various support functions. This industry promises economic contribution in the world, especially Indonesia. Unfortunately, Indonesia's supply of medical equipment needs is still mainly from overseas. Inevitably, Indonesia must begin to develop the domestic medical device industry to reduce imports.

The government has issued Presidential Instruction Number 6 of 2016 concerning the acceleration of the pharmaceutical and medical devices industry development. As the primary stakeholder in health services in Indonesia, the Ministry of Health pledges support to the medical device industry. In 2016, there were 262 types of produced medical devices in Indonesia, increasing in 2017 to 294 varieties. Hence, the domestic medical device industry grew by about 35,23% (Kementerian Kesehatan Republik Indonesia, 2019). However, many factors hamper the growth of Indonesia's medical device industry. Indonesia's market of medical device products has 92% imports. Medical equipment products are provided from North America and Europe with import duties of 5% to 15%. Meanwhile, those from China can reach 0% if the imported goods are part of the ASEAN-China Free Trade Area (ACFTA) (Menteri Keuangan Republik Indonesia, 2016).

Pricing results from complex decisions are related to market and economic considerations (Arrondo, Garcia, & Gonzalez, 2018). Despite intense competition, pricing is a crucial weapon in business strategy among competitors (Liozu, 2019). There are many models and methods in pricing because many factors affect prices and impact the market. Each product has unique features with various effects on prices and markets. Companies must recognize the internal and external attributes that affect market sensitivity. Product attribute is characteristics in the essential functions of a product. It is critical because it determines the factors in most product purchasing decisions (Shamsher, 2012).

On the other hand, a pricing strategy must anticipate unexpected and uncontrolled external factors, such as supply problems (Gupta, Ivanov, &

Choi, 2021) and market deregulation, inflation, and deflation (Gayretli, Yucekaya, & Bilge, 2019). Even discrimination of price policy with particular goals can affect the pricing strategy (Fontaine, Martin, & Mejean, 2020). Pricing intends to get the exchange rate for the right product for the market to react positively. One of the most popular product designation strategies is the hedonic setting method based on product characteristics about prices (Costanigro & McCluskey, 2011). The product attributes refer to product features that provide benefits to encourage people to buy. For example, the characteristics of the hedonic method in footwear products include pillows that are lightweight, soft, and stable, and have firm footing. The strategy has been concluded in the investigation of goods, prices, and attractiveness (Arrondo *et al.*, 2018). This method can also be applied to medical device products.

The market provides prices by the product quality that depends on market segmentation based on the level of income and price-based quality (Auer, Chaney, & Sauré, 2018). There are times when the market behaves unreasonably to give prices above the actual value of a product. The prices can exceed the substantial amount driven by a particular product with a limited edition or item depending on an individual's satisfaction and privileges. In all contexts, quality becomes a significant factor in setting prices. Meanwhile, other factors are based on market segmentation on purchasing power (Fitzgerald & Haller, 2014). Another critical factor in pricing to capture the market uses the optimal price approach to consider profitability in setting prices (Gan, Pujawan, Suparno, & Widodo, 2018).

The pricing method is related to the product, market, expenditure, and nature of the power in a certain period. Some approaches emphasize future price estimates. One model that considers future prices is the Hull-White method. This method includes the theory of interest rates related to future price estimates (Hinderks & Wagner, 2019). The method can determine or predict the value of shares, bonds, equity, financial trading, goods, and services. The opposite of the Hull-White method in pricing is a behavior-based pricing method. This method emphasizes pricing strategies based on historical price data paid by buyers compared to current prices (Fei & Zhao, 2019). This method widely considers the present era when the big data phenomenon applies to decision-making on extensive, fast, and real-time data analysis. Big data analytics uses various data processing software in providing essential information based on massive, rapid, and real-time data. There are also times when social cultures tend to have the same consumption patterns at the same time and collective decision-making. Those factors can be essential variables in pricing (Razeghian & Weber, 2019). For example, it can happen on holidays and particular events, such as Eid Al-Fitr, Christmas, New Year, and other special days.

Price consists of value, utility, and the amount of the price itself (Alma, 2009). Utility attached to

price becomes an attached attribute to an item. It enables the thing to meet the needs and desires of consumers and satisfy them. Price represents the value of a product to exchange with other products. A value becomes one of the means of swapping in the form of exchanging goods. The barter uses money as a price, so it represents the amount of payment to assess and obtain the products and services needed by consumers. Price considers expenditure components such as costs, tariffs, rents, interests, premiums, commissions, wages, salaries, and other essential factors. The price influences the mechanism of sales. Then, it affects revenue. Hence, price affects its operating profit and financial position. However, price and value are different. Price is an indicator of the obtained benefits by consumers for goods and received services. They are closely related to the value that consumers get on prices. However, the value reflects the ratio between perceived usefulness and price. Price also explains the intended value position of the company's products sold to the market because the right products are sold at a reasonable price and generate massive profits. Pricing is an essential strategy in capturing as many buyers as possible. The buyers or consumers are a crucial factor that is the main target in pricing. They are the recipient of the price of a product offered by a company.

Companies adopt several pricing methods with various approaches, such as judgment method, market-based method, and cost-based pricing. The judgment method uses instincts even though the market and surveys have their prices that usually new or first-time companies use. Meanwhile, the market-based method considers the current market price approach, competitor prices, and adjustments. Then, cost-based pricing is a projected full cost of a particular product, from raw materials to finished products. Another cost-based method is the variable cost approach. It is direct costs in production activities, so product price represents additional costs plus mark-ups for profit. All companies do not have the same model and procedure in determining or setting the price.

Stanton outlined pricing in five stages: estimating the demand for goods, knowing in advance the reaction in competition, comparing prices in the market, using pricing strategy, and considering corporate marketing politics (Stanton, 1984). Meanwhile, Kotler and Keller (2013) mentioned several details in the six-step procedure for setting prices, such as selecting the purpose in pricing, determining the request, estimating costs (fixed, variable, and total costs), analyzing the cost, price, and competitors' offers, choosing a pricing method, and selecting final prices and adjusting prices.

The cost of production is an essential factor in determining prices. Reducing costs and improving quality, delivery time to consumers, and other internal efforts can maximize profit (Hipni & Hasbullah, 2019). However, there is a difference in understanding between production costs and the cost of sold goods. In Standar Akuntansi Keuangan 2019 (financial accounting standards) issued by the Institute of Indonesia Chartered Accountants, the production

costs represent expenses directly or indirectly related to the production process in processing raw materials into finished goods (Ikatan Akuntan Indonesia (IAI), n.d.). Production costs consist of three components: raw material costs, labor costs, and factory overhead.

Meanwhile, the cost of sold goods is the expenditure on production costs by calculating the status of goods in the process (raw, semi-finished, sub-assy). It means the total value of goods and direct materials, labor, and factory to produce goods or services. The determination of the total cost of sold goods includes from the beginning of the process plus the cost of raw materials contained in the production, wage costs, and other costs such as service costs, and facilities in production (factory supervision, indirect wages, use of factory auxiliary materials, patent amortization, lighting, heating, plant generator).

Pricing for a local product with new production needs should consider the investment studies through engineering economic analysis. This approach analyzes the feasibility of investing in the production of Anesthesia A8500 by calculating the value of money. It uses the factors and financial criteria in the assessment of several choices in decision-making. The simple engineering economic analysis is only to confirm the feasibility of producing Anesthesia A8500 before providing a pricing strategy as the focus of the research. First, Net Present Value (NPV) is the amount of spent money and earned income at any time reflecting the current time. The equation can be seen as follows.

$$NPV = \sum_{t=0} At/(1+k)^t \text{ or } \Sigma NPV_{\text{Proceed}} - \Sigma NPV_{\text{outlays}} \quad (1)$$

Description:

k = Discount rate

At = Cash flow in (t) period

n = Period

NPV_{proceed} = On-going Net Present Value (NPV)

NPV_{outlays} = Total investment of Net Present Value (NPV)

Second, it is the Internal Rate of Return (IRR). It calculates the percentage of profits from a project and the ability of the project to return the loan interest until the NPV is equal to zero. If IRR is \geq the Minimum Attractive Rate of Return (MARR), the investment is feasible. However, if IRR is $<$ MARR, the investment is not feasible. The equation is as follows.

$$IRR = I_1 + \frac{NPV^{(+)}(I_2 - I_1)}{NPV^{(+)} - NPV^{(-)}} \quad (2)$$

Third, it is the Payback Period (PP). It is the number of needed periods to recoup investment expenses using proceeds or net cash flows. There are two parameters. First, if PP is faster than the investment period, the investment is feasible. Second, if PP is longer than the investment period, the investment is

not feasible. If cash flow varies annually, the equation is as follows.

$$PP = n + [(a-b)/(c-b)] \times 1 \text{ year} \quad (3)$$

Description:

n = Last year, when the amount of cash flow still cannot cover the initial investment.

a = Number of the first investment

b = Cumulative amount of n-th year cash flows

c = Total cumulative cash flow to the n + 1 year

If the annual cash flow is the same amount, the equation is as follows.

$$PP = (\text{initial investment/cash flow}) \times 1 \text{ year} \quad (4)$$

Fourth, the Benefit-Cost Ratio (BCR) considers the comparison of benefits and costs of a business. If BCR is higher than 1, the investment is feasible. Vice versa, if BCR is smaller than 1, the investment is not feasible. The equation is as follows.

$$BCR = \text{benefit/cost or } \Sigma PV_{\text{Proceed}} / \Sigma PV_{\text{Investment}} \quad (5)$$

Price is critical to consumers' decision-making. Many pricing aspects, such as product attributes, market variables, and operation cost, affect the price and factual condition. It shows the dynamics of price adjustments in the market (Arrondo *et al.*, 2018). Local companies shall overcome barriers, such as price, technology, skills, quality, and other essential factors. They should not rely solely on the government. The local medical device industry must develop the capability and independence of the needed materials to produce a brand following the quality, quality, and price to achieve a competitive advantage. To compete in the medical device market, many domestic companies do not have a pricing strategy to determine product prices, even though they can produce it locally.

The researchers try to conduct an initial survey of 15 medical device companies in DKI Jakarta. Almost 90% of companies use only the conventional method in determining prices. The estimated model traditionally calculates the production cost added to the desired profit margin. The research investigates a traditional pricing approach in PT Enesser Mitra Berkah for Anesthesia A8500. The company just relies on margin and production cost to decide the price of Anesthesia A8500 around IDR 562.000.000 before investing about IDR 6,1 billion for the localization of production. The current conventional method in pricing a medical device in the company is not optimal. The company relies on a limited basis in cost and profit margin without considering important other aspects, especially in assessing the production investment feasibility.

This background forms research in pricing strategies and engineering economic analysis for

setting prices for local medical products. The research discusses how to determine the price of local medical device products. The main contribution combines the conventional pricing model and investment feasibility of engineering economics. Determining price does not rely on the attribute, market price, and operation cost, but it also provides an alternative standpoint as a novel approach. The viewpoints are the cost of sold goods and the Break-Even Point (BEP). Moreover, the research explores how PT Enesser Mitra Berkah provides a conventional pricing strategy that relies on production cost and market price. Finally, the research develops a better pricing model through the research result.

II. METHODS

Figure 4 presents the research framework. The first method in the research is a case study to develop a knowledge of the pricing method. It can improve the understanding of the theoretical constructs of new phenomena or systems in question (Koskela-Huotari, Edvardsson, Jonas, Sörhammar, & Witell, 2016). In this case, it is about pricing. The research collects various pricing approaches from journal articles, books, technical reports, news articles, and websites. The case study is carried out based on the literature review approach to understand the pricing of medical device products from a comprehensive perspective. The literature review presents three activities; searching articles, selecting the papers, and extracting data from reports.

The second method is action research. Action means all activities consisting of collecting data, analysis, report and delivering and processing information. The research has chosen one local company, PT Enesser Mitra Berkah, as the sample. It is the manufacturer of medical device products in Indonesia. The studied object is the domestic production of Anesthesia A8500. The research empirically finds out how it carries out the pricing process. There are two research questions in the research: What is the form of pricing in a mathematical model that includes an investment feasibility analysis? What is the form of a framework for modeling it? Both case study and action research methods can develop a model and framework of pricing for the medical device product synergistically.

III. RESULTS AND DISCUSSIONS

From data collection in PT Enesser Mitra Berkah, the developed product pricing is based on top management judgment. In the conventional method, top management relies on the gross cost of sold goods, profit margin, and additional cost in determining the price. Table 1 shows the method in deciding the price of Anesthesia A8500 in Indonesian currency (IDR/Rupiah).

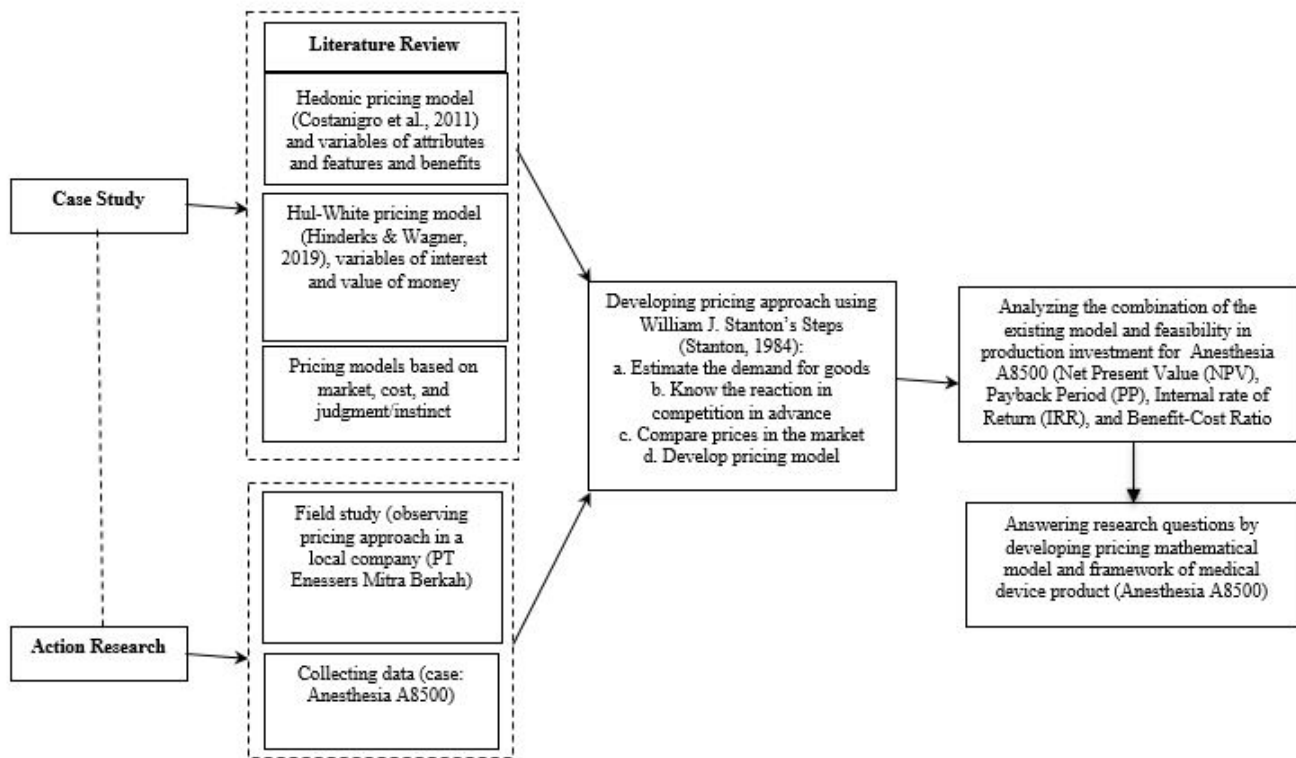


Figure 4 The Research Framework

Table 1 The Current Conventional Pricing Approach of Anesthesia A8500

Indicators	Price
Cost of sold goods per unit (X_1)	IDR 437.606.997
Gross margin of 20% (C_1)	IDR 87.521.399
Others (license, promotion, and cost after production) 8,2% (C_2)	IDR 36.871.604
Price of Anesthesia A8500 (Y_1)	IDR 562.000.000
Current existing model	$Y_1 = X_1 + C_1 + C_2$

Table 2 Data Analysis of Stanton's Steps

Stanton's Steps	Data and Information
Estimating the demand for Anesthesia A8500	The confirmed order in the next three years is 45 pcs. In 10 years, it is about 267 pcs (based on considering the capacity and historical demand).
Knowing in advance the reaction in competition	A positive reaction is shown when the company gets offering and commitments regarding the orders of 45 pcs in three years by presenting the product prototype and sample after obtaining a license.
Comparing prices in the market	The research collects 27 models (mostly imported products). The products have a similar and nearly equal classification. Then, the price range from IDR 298.650.435 to IDR 2.030.770.000 with an average price of IDR 631.657.758.
Pricing strategy through the framework model improvement of Anesthesia A8500	The research provides this step.

The price (Y_1) (IDR 562.000.000) is the sum of X_1 (IDR 437.606.997), C_1 (IDR 87.521.399), and C_2 (IDR 36.871.604). Then, the estimation of the demand for Anesthesia A8500 has a positive response (see Table 2). This pricing uses an existing method in PT Enesser Mitra Berkah. It is a fact and condition in developing a new pricing approach in the research. Table 2 shows Stanton's approach in determining price. It consists of estimating the demand for goods, knowing in advance the reaction in competition, comparing prices in the market, and pricing strategy (Stanton, 1984).

Although the first step shows a positive response, the research analyzes whether this local production investment is feasible through the engineering economic analysis. Besides, the objective of engineering economic analysis is to determine product feasibility and get a price in the BEP. Comparing prices in the market is about collecting and analyzing prices from the market or competitor. It also carries out the benchmarking to the closest competitor in product feature, price, and pricing strategy characteristics (Holtorf, Gialama, Wijaya, & Kaló, 2019).

The standpoints and assumptions by Focus Group Discussion in this engineering economic analysis are as follows. First, five years are the period of useful utility for equipment, jigs, and machines with moderate depreciation. Second, five years

or more product model changes occur because of technology advancing, the additional feature, and others. However, the emergence of new models in the market is not too much in this industry, especially in developing countries. Third, in five years, the rate of increase in product prices due to raw materials, production costs, and overheads in each year are not too drastic. Hence, the company can anticipate it. Fourth, the used interest rate ($i = 5\%$) is the average in five years between 2016 to 2020 (4,0% to 6%) so that $i = 5\%$ is a reasonable midpoint. Fifth, the current price of Anesthesia A8500 is IDR 562.000.000 for the initial analysis of engineering economics. The result of the engineering economic analysis is shown in Table 3.

Table 3 shows the result of the engineering economic analysis. All results in all methods reflect that local production investment for Anesthesia A8500 is feasible. NPV is positive (+, IDR 3.435.963.690). Meanwhile, BCR is more than 1 (1,086659). PP obtains less than five years, and it is $IRR > MARR$. The engineering economic analysis also finds that the price at IDR 517.181.798 is a BEP in five years. This finding is a breakthrough as an alternative to the existing standpoint of the price at IDR 437.606.997 as the cost of sold goods. Then, Table 4 presents the standpoints which are considered in setting the price for Anesthesia A8500.

Table 3 The Results of Engineering Economic Analysis

Method	Result	Remarks
NPV	$SPV_{\text{Proceed}} - SPV_{\text{outlays}} = \text{IDR } 3.435.963.690$ (Table P/F, 5%, 5)	NPV is positive value in 5 years. It means feasible investment.
BCR	$SPV_{\text{Proceed}} / SPV_{\text{Investment}} = 1,086659$	1,086659 > 1 means feasible investment.
PP	The payback period is on 17 Sept in the fourth year,	The BEP is in 4 years (less than five years). It means feasible investment.
IRR	IRR is 22,38%. This company has a MARR.	$IRR > MARR$ means feasible investment.
The ratio of existing price and cost of sold goods in (n) = 5 years and (i) =5%	Price in BEP is IDR 517.181.798.	There are three standpoints to determine price product: cost of sold goods (IDR 437.606.997), BEP (IDR 517.181.798), and the average price of 27 product in the market (competitors with similar products) (IDR 631.657.758).

Table 4 Four Standpoints of Pricing for Anesthesia A8500

Standpoints	Label	Value
Cost of sold goods	X_1	IDR 437.606.997
Price in BEP	X_2	IDR 517.181.798
Average price from the market	X_3	IDR 631.657.758
Current price in the conventional method	Y_1	IDR 562.000.000

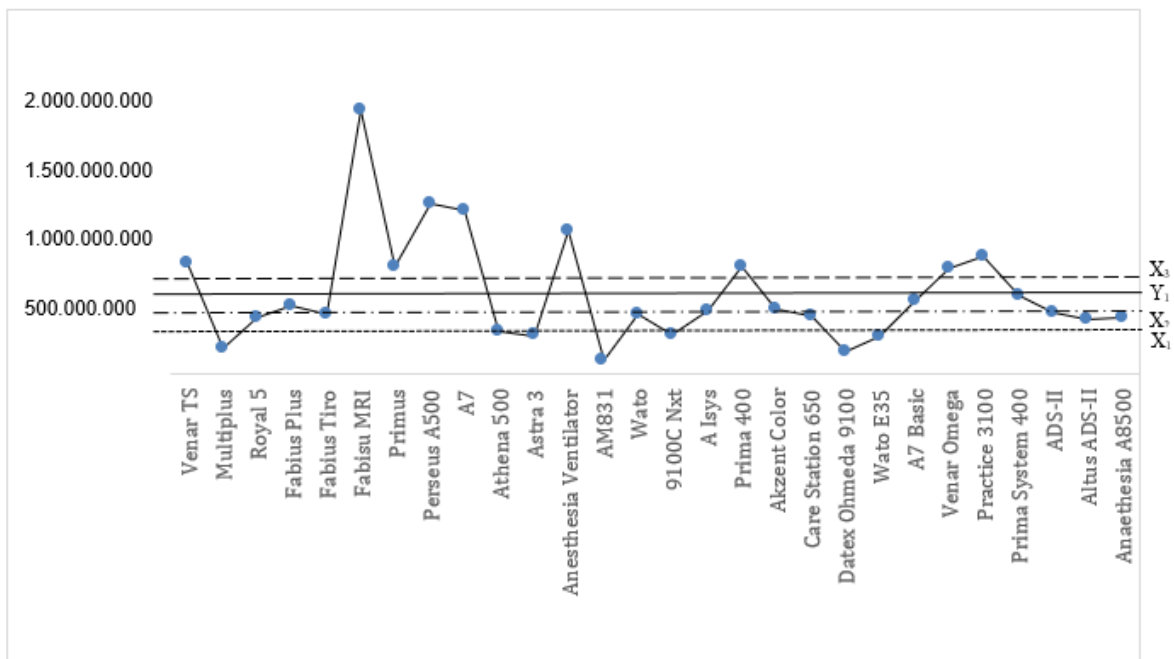


Figure 5 Four Standpoints of Price for Anesthesia A8500

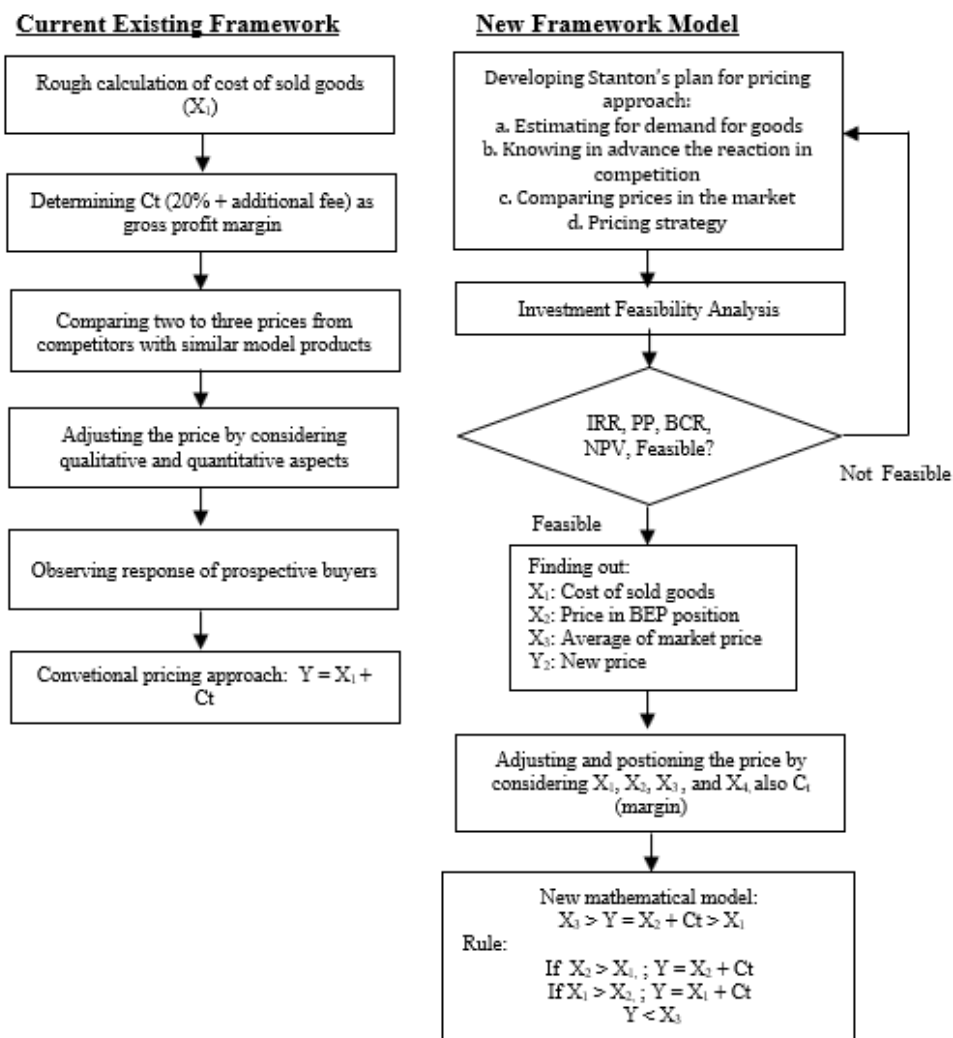


Figure 6 The Framework Model Improvement in Pricing of Anesthesia A8500

There are four standpoints in determining a price, as shown in Table 4. The evaluation of the current price (Y_1) of IDR 562.000.000 is done by comparing four standpoints of X_1 (IDR 437.606.997), X_2 (IDR 517.181.798), and X_3 (IDR 631.657.758). Figure 5 shows the position of X_1 , X_2 , X_3 , and Y_1 . The existing pricing method, as shown in Table 1, $Y = X_1 + Ct$, is revised in the research. In Figure 5, there are other standpoints besides X_1 for optimizing the price by considering X_2 and X_3 . There is an available "space" between the current price (IDR 562.000.000) and X_3 as the average market price (IDR 631.657.758). The company can increase its margin higher or less than X_3 (average market price). The new bottom line of this pricing approach is not X_1 (cost of sold goods) but X_2 (price in BEP). The research offers a new pricing model from current existing models ($Y = X_1 + Ct$) as $X_3 \geq X_2 + Ct \geq X_1$. The framework model for this new pricing approach is shown in Figure 6.

Figure 6 is the pricing framework model. It is a new approach for developing a medical product price when the company initiates local production. This model requires a combination of several approaches to ensure that the investment in local production is feasible and gets a price in the BEP. All engineering economic approaches through methods, such as NPV, BCR, PP, and IRR, show that the investment is feasible. This model contributes academically and practically to providing a pricing approach, especially in Indonesia's medical product. This approach implies that a new pricing approach in the product shall involve investment feasibility analysis to determine whether local production is feasible and gets a price in the BEP.

IV. CONCLUSIONS

This pricing approach is a simple model that refers to the several used literature review by other researchers with some modification. The research combines several models partially. For example, product attribute in pricing is used by grouping products based on similarity to get the average market price (X_3). The pricing model is also based on product characteristics in the hedonic model, which is directly and indirectly used. The research also involves the Hul-White model, which considers the interest rate theory related to future price estimates (X_3).

The findings show an alternative standpoint besides the cost of sold goods (X_1) to determine the price. It is BEP (X_2). Another alternative in this pricing model is the market price (X_3). Finally, the research results in a simple mathematical model ($X_3 > Y_2 = X_2 + Ct > X_1$). The C_1 and C_2 are the situationally defined profit margin.

The current price of Anaesthesia A8500 is IDR 562.000.000 (Y_1). It just relies on the cost of sold goods (X_1) and profit margin (C_1), and other costs (C_2). This existing approach, $Y_1 = X_1 + C_1 + C_2$, is a judgment model for top management to decide the price. The existing price of IDR 562.000.000 is still lower than

the average market price of IDR 631.657.758 (X_3). However, it is higher than the break-even position of IDR 517.181.798. It means there is a potential chance to optimize a price gap by increasing the price between IDR 562.000.000 to IDR 631.657.758.

Other issues and important variables affecting price need to be explored more to complete the research. The research requires more exploration from future researchers to solve the deficiency, incompleteness, and loophole and make the research better. It is limited in certain aspects. In the future, it requires a more comprehensive and combination of several pricing models, methods, and variables. All aspects that affect prices and their impact on the market shall be explored more, even though they depend on the context of the case study and characteristics.

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