

# Feasibility Analysis of Limestone Industry Development as a Leading Mining Product of Rembang Central Java District

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**Abstract**--- The purpose of this study was to determine the economic feasibility and to determine the strength and opportunities for the development of the limestone processing industry as a superior product in Rembang Regency based on analysis NPV, IRR, ROI, Payback Period, Benefit Cost Ratio and BEP. The results of this study state that the brick mining industry is economically viable and has good strength and opportunities to be developed. SWOT Analysis of internal strength & weakness (IFAS), external opportunity & threat (EFAS) and Factors Analysis Summary (SFAS) strategy factors in the limestone industry that the position of the limestone industry shows that the limestone industry has good strength and opportunity to develop as a product leading.

**Keywords**--- mining industry, net present value, internal rate of return, return on investment, break even point

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## I. INTRODUCTION

Limestone or limestone is many mineral resources in Indonesia [1]. Limestone is scattered in several islands such as in Sumatra, Java, Nusa Tenggara, Sulawesi, Irian Jaya, and other islands. For some people, limestone may not be an ordinary thing that has no value, and is considered not very valuable because it is easy to obtain and the price is relatively cheap. However, for some others, limestone remains a very attractive mineral resource. Limestone is a sedimentary rock with the main composition of minerals calcite ( $\text{CaCO}_3$ ), dolomite  $\text{Ca Mg}(\text{CO}_3)_2$  and aragonite ( $\text{CaCO}_3$ ), formed in several ways, namely organically, mechanically and chemically. In Indonesia, limestone is often referred to as limestone, while the extraordinary term is commonly called "limestone". Limestone contains at least 50% by weight of calcium carbonate in the form of calcite minerals.

Limestone production has been widely used in various industries, the glass industry, fillers in the manufacture of goods from rubber, plastic, cardboard, paint, toothpaste, as an additive in the metal smelting industry both iron and non-iron, fillers and paper coatings; soil conditioners; pH regulators in a number of chemical processes, coagulants in water treatment; the deposition of metal ions in the treatment of liquid waste, neutralizing gas sulfur oxides ( $\text{SO}_x$ ) and nitrogen oxides ( $\text{NO}_x$ ), and others. The process of increasing the added value of limestone called limestone has long been carried out through excavation or mining, followed by breaking up chunks of rock and burning to produce lime and extinguished limestone starting from the use of simple kilns (traditional limestone tobong) in the form of wells known as wells with cubluk furnaces, or rather

capital intensive through upright furnaces and milling machines to produce several types of products, such as flour lime, extinguished lime, and flour limestone (calcium carbonate flour) whose value is quite high.

In the Rembang area, there are sandy limestone, which has a mineral content of up to 30% quartz, large foraminifera, algae, bryozoans and echinoids. This formation was deposited in a shallow marine environment between 50-100 meters. Thickness of this formation reaches 248 meters. Limestone in the area of Rembang Regency allegedly contains minerals in the form of "lithium" Indonesian Institute of Sciences (LIPI).

The potential of limestone in Rembang Regency is very large, but it has not been worked optimally into semi-finished goods that have quite large benefit. Based on data in the Department of Energy and Mineral Resources ESDM [2] in Rembang Regency, the limestone area in Rembang Regency reaches 1.13.91 hectares, spread in Sarang, Sedan, Pamotan, Gunem, Sale, Bulu and Sumber Districts. The most extensive is located in Bulu District. This means that limestone is only sold in the form of chunks of material of very low value, but it has the opportunity to do business processing limestone into semi-finished goods whose value is much higher, in the form of lime flour, lime, extinguished limestone, flour limestone (calcium carbonate flour) and others which is much needed by various industries in the country and abroad.

Tegal Dowo Village, Gunem Sub district, Rembang Regency, Central Java Province has vast potential limestone natural resources, so far the limestone has been sold as chunks for cement, building, fence paint and others with very cheap sales value, to increase added value limestone processing is carried out by building a limestone industry with a business permit for Mining Authority (KP) of the 7.2 hectare limestone industry located in a potential limestone area in Tegal Dowo Village, Rembang Regency. The mining area of Tegal Dowo is about 1 hour from the city center and local road transportation facilities use village and provincial roads. The local environmental conditions that support the limestone mining industry such as residents who own trucks are a means of supporting limestone shipments accompanied by strong government support through Regionally Owned Enterprises (BUMD) to increase the original revenue of Rembang Regency.

The amount of market demand for the products produced by the limestone industry, such as limestone, calcium carbonate flour, lime tohor, limestone extinguished, calcilutit (grabau) and others. The benefits of the products of the limestone industry such as: (1) Limestone: - As Rough Building Materials, - Cement Raw Materials, - Fertilizers, - Hebel (Light Brick), - Mortar (Instant Cement); (2) Calcium Carbonate Flour: - Processing Waste, - Sugar Industry, - Gold Refining Process, - Carbide Industry, - Steel Industry, - Soft Building Materials, - Animal Feed and (3) Tohor lime: - White selcum, - Paper, - Toothpaste, - Cleaning agent, - Gypsum, - Asbestos. From this the research objective is to analyze and determine the economic feasibility of the limestone processing industry and to determine the opportunities and challenges of the limestone processing industry as a superior product to be developed in Rembang Regency.

## **II. EMPIRICAL THEORY AND STUDY**

### **Location of Limestone Mine Physiography**

Geographical location, the research area of Tegal Dowo Village is 16 ° 52'23.6 "S and 111 ° 31'27.5" E with an area of about 7.2 ha. The administrative location of the study area includes the area, Gunem District, Rembang Regency, Central Java Province. Indonesian Stratigraphic Coding Commission [3]. Geomorphological units are divided into three (3) units, namely dendusional plain geomorphological units, sloping structural hill geomorphological units, and steep structural hill geomorphological units. The flowing patterns that develop in

the study area are sub-dendritic, sub-parallel and rectangular patterns [4]. The geological unit in the study area is divided into three (3) units, following the sequence from old to young: the sandstone unit, claystone unit, and limestone unit, it is believed that the process of rock formation has taken place from the Early Miocene-Pliocene, with the depositional environment of the Middle Neritic– Upper Bestiality.

According to [5], physio graphically it can be divided into five regions ranging from north to south namely: Rembang Hills, Randu blatung Zone, Kendeng Hills, Solo Zone and Southern Mountains. The Lembang track is the one that extends west east toward the north coast. The boundary with the Java Sea is separated by shallow sandy beaches. In several places alternating with alluvial plains (Blora, Jojogan, and along Bengawan Solo). The Rembang Trail consists of Anticlinorium-shaped mountain folds that extend west east, from Purwodadi City via Blora, Jatirogo, and Tuban to Madura Island.

The hills, also called the Rembang anticlinorium, widen about 50 km. The highest peak has an elevation of about 500 m above sea level (Ivory 535 m, Mounts 491 m). The ridge has a direction of river flow patterns, which are generally, almost parallel (sub-parallel) and partly patterned branching (dendritic). The ridge with a flat peak is around Tuban and is controlled by reef limestone lithology.

Meanwhile, according to [6], the Rembang zone can be divided into 2, namely the North Rembang Anticlinorium and the Cepu Anticlinorium located in the south. The two anticlinorium's were separated by a Blora-Brow depression. A Kendeng Ridge by a synclinal zone called the Randu blatung-Ngimbang zone until it reaches Wonokromo separates Rembang hills. This depression topography is controlled by tectonic forces from the north that lift the Rembang hills and tectonic forces from the south that lift the Kendeng Hills with the result being a lower topography compared to the two hills above. Division of physiographic zones according to [5].

Near Randu Blatung and Ngimbang, this zone has a width of several kilometers, while between the hills of Rembang this depression is greater. Structurally this area has the direction of movement of the folds to the south and the layer in the Kendeng zone has been subjected to the north force. In the south of the Randu Blatung zone, Kendeng hills are found which is a continuation of the North Serayu Mountains in Central Java. This area stretches along 250 km. In the southern area of Semarang, it has a width of around 40 km, then gradually decreases eastward to around 20 km. hills that are generally low elevation of no more than 500 m. Based on what has been explained above, it can be concluded that the study area is included in the North Rembang anticlinorium.

### **Limestone Market**

Kotler [7], efforts to improve the accuracy of product marketing by knowing the market segment. Market segments consist of large groups that can be identified in a market with similar desires, purchasing power, local geographies, buying behavior and buying habits. Patterns and procedures for classifying markets, namely: (1) Geographic Segmentation grouping is based on areas where sellers discriminate carefully, about which areas can provide different benefits. Small retailers can also differentiate subscriptions from their own region from other regions. National producers classify subscriptions by sales area. In Indonesia, this is difficult, because our area is very large, so in this case it must also be recognized that the cost of sales to distribute goods varies. Large companies, which already have national reputations, adopt policies with uniform prices for all regions in Indonesia and generally the distribution costs are borne by the producers. This is nothing but intended to prevent speculation on their goods; (2) Demographic Segmentation is intended to distinguish various basic groups of conditions of a changing society (demographic variables) such as, grouping in the fields of age, sex, and family

size, income, position of head of family, education, family life cycle (family life circle), grouping in the fields of religion, social, ethnicity and (3) Psychographic Segmentation we try to distinguish the various types of buyer needs or arise because of the fact that the needs of buyers are more different throughout life style or personality life from demographic lives.

Segment the market to be effective. Kotler & Armstrong [8]: namely; 1. Measurable (Measurability), 2. Accessible (Accessibility), 3. Substantial (Substantiality), 4. Can be distinguished (Differentiability), 5. Can be done certain actions (action ability). The steps to segment the market according to [9] namely: 1) Designing products that are more responsive to market needs 2) Analyzing the market 3) Finding opportunities 4) Mastering superior and competitive positions 5) Determining effective and efficient communication strategies.

### **Theory of Economic Feasibility**

Project Profit Evaluation can be done by using two types of methods, namely the Conventional Method for analysis relating to how quickly the value of the investment can be returned and the Discounted Cash Flow Method is an analysis to determine the benefits in the future [10]. In the Conventional Method, two types of benchmarks are used, namely: Payback period (PB) and Average Rate of return (ARR), while in the Discounted Cash Flow Method three types of profitability benchmarks are used, namely: Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI). In financial analysis 5 assumptions are used namely: (1) Costs that have been incurred in the past are not considered as costs, because the project represents cash flow for the future; (2) Cash flows on projects are not profit based so non-cash flows such as depreciation and amortization are not taken into account; (3) All investments to build factories are assumed self-capital; (4) Tax will be a deduction from benefit calculation (considered as cost) and (5) Interest will be calculated and assumed at the level of bank interest (discount factor).

According to [11] in investing every company generally will try so that the investment can develop in accordance with the company's goals, namely to get the maximum profit. Therefore, to support the construction of the limestone factory in Rembang district, a financial analysis was conducted to determine the economic feasibility of the investment so that the investment was in line with the company's objectives. The financial analysis conducted is to estimate the cash flow of the project each year throughout the project's economic life. The criteria used in the analysis are Net Present Value (NPV), Internal Rate of Return (IRR), Return on Investment (ROI), Pay Back Period (PBP), Net Profit and Gross Profit, Benefit Cost Ratio (B/CR), and Break Even Point (BEP).

### **Industry Opportunities and Challenges**

Strengths, weaknesses, opportunities and threats (SWOT) Analysis is a strategic planning method used to evaluate strengths, weaknesses, opportunities, and threats in a project or business speculation. The four factors that form the acronym SWOT [12]. SWOT will be better discussed using tables made in large paper, so that it can be analyzed properly the relationship from every aspect. This process involves setting specific goals for business or project speculation and identifying internal and external factors that support and which do not achieve these goals. SWOT analysis can be applied by analyzing and sorting out various things that affect the four factors, then applying it in the SWOT matrix image, where the application is how strengths are able to take advantage of the opportunities available, how to overcome weaknesses (weaknesses) that prevent the advantages (advantages) of the opportunities (opportunities) that exist, then how strengths (strengths) are able to deal with

threats (threats) that exist, and finally is how to overcome weaknesses (weaknesses) that can make threats become threats real or create a new threat.

According to [13] research shows that company performance can be determined by a combination of internal and external factors. Next will compare internal environmental factors to the external environment. SWOT analysis is carried out through a series of calculations known as IFAS (internal factor analysis strategy), EFAS (external factor analysis strategy) and SFAS (strategy factor analysis strategy) by calculating the weight and rating values.

Yudha & Haryono [14] in study of Dissolved  $\text{CaCO}_3$  Variability to Know the Level of Dissolution and Absorption of Atmospheric Carbon in the Certification Process of Rembang Karst Area. High or low content of dissolved calcium carbonate ( $\text{CaCO}_3$ ) value indicates the level of dissolution that occurs in limestone. Overall, the content of dissolved calcium carbonate ( $\text{CaCO}_3$ ) in each spring during the highest research was in the Gondang Well with an average value of 315.68 mg/l, but the peak value was found in the Kajar spring, which was 340.14 mg/l. The high content of dissolved calcium carbonate ( $\text{CaCO}_3$ ) values in the Gondang Well shows that the rate of dissolution process is inversely proportional to the flow rate. The carbon concentration will be diluted at a large flow volume while the carbon content will be concentrated at a small flow volume, making the aggressiveness higher in dissolving limestone. The amount of flow discharge is one of the factors that influence the aggressiveness of carbon dioxide ( $\text{CO}_2$ ) absorption, the greater the flowrate, the greater the carbon dioxide ( $\text{CO}_2$ ) that can be absorbed. The karst area of Rembang with an area of about 30.2 km<sup>2</sup> has a carbon dioxide ( $\text{CO}_2$ ) absorption rate of 19.45 Gg  $\text{CO}_2$ / year. The rate of carbon dioxide ( $\text{CO}_2$ ) absorption is 19.45 Gg  $\text{CO}_2$ /year, not more than 1 percent of the rate of carbon dioxide ( $\text{CO}_2$ ) absorption in Indonesia, which is 13,482 Gg  $\text{CO}_2$ /year. Then, the results of the calculation of the dissolution rate in the study area produce a value of 94.45 m<sup>3</sup>/year/km<sup>2</sup>. This value is quite high when compared with previous research in the karst area of Gunung Sewu, which amounted to 50.91 m<sup>3</sup>/year/km<sup>2</sup>. The amount of rainfall and the value of the concentration of calcium carbonate ( $\text{CaCO}_3$ ) are factors that influence the level of dissolution in the karst region.

Laraebi [15], characterization of mineral content and limestone constituent elements at PT. Semen Tonasa. Minerals contained in limestone in Limestone Quarry PT Semen Tonasa based on the height of the place by using X-Ray Diffraction tool obtained mineral content from limestone, namely  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{CaO}$ ,  $\text{MgO}$ ,  $\text{K}_2\text{O}$ ,  $\text{SO}_3$  and  $\text{Na}_2\text{O}$ , while the elements contained in limestone are  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{CaO}$ ,  $\text{MgO}$ ,  $\text{K}_2\text{O}$ ,  $\text{SO}_3$  and  $\text{Na}_2\text{O}$ , while the elements contained in limestone by using X-Ray Fluorescence tools namely Calcium (Ca), Magnesium (Mg), Iron (Fe), Silicon (Si), Aluminum (Al) as the major elements of limestone and its minor elements namely Potassium (K), Sulfur (S), and Sodium (Na). Physical characteristics of limestone based on the height of the place obtained by observations on each block where in block 4 obtained a fresh white color, weathered brownish-white color, rock texture easily weathered and hollow, there is a fossil content and has an HGI value of 64. In block 5 with physical characteristics, i.e. it has a fresh white color, a grayish weathered white color, an easy weathered rocky texture, is slightly hollow, there is a fossil content, and has an HGI value of 60. In block 7 it has, a fresh gray color, a grayish weathered white color, a hard and non-hollow rock texture, there is a fossil content and has an HGI value of 61. In block 8 has a fresh white color, weathered brownish white color, rock texture is not easily weathered and hollow, there is a fossil content and has an HGI value of 73. In block 9 with physical characteristics of color fresh white, weathered brownish white color, rocky texture that is not easily weathered and not hollow, there is no content f oscillating and has an HGI value of 77.

Aziz [16] limestone and increase in benefit and specifications for the industry. For lime and lime outages, the manufacturing process requires combustion, the cost of fuel reaches 60% of the production cost, so the process of adding value (although 19 times) is directly affected by high fuel prices, and this is the biggest obstacle in efforts to increase the benefit of both products them. PCC is a limestone product that has better future prospects than GCC, even of all limestone products, because the benefit is very high reaching 99 times that of limestone (GCC is only 19 times). With this high benefit, the PCC industry can exist against the pressure of rising fuel prices, even though the process requires combustion and drying. However, the PCC investment industry is quite large because it requires a lot of equipment. Likewise, human resources who have expertise for product development are needed to meet market demands. Indonesia's enormous limestone resources need to be increased in benefit through collaboration with mineral processing and utilization research institutions, so that the results can contribute more to the prosperity of the nation's life.

UGM Faculty of Engineering [17] in study of the potential of the northern kendeng karst area in the Rembang Madura Mountains, Rembang Regency, Central Java. Based on the results of studies and facts on the ground, the Watuputih Mountains area or Watuputih CAT area are karst landscape areas having surface morphology (evokers) in the form of elongated karst hills, elongated fault cliffs, valleys resulting from dissolution (dolina) and karst springs (karina springs). Subsurface morphology (endocarps) found structural systems and underground rivers that develop following fracture patterns. Watuputih CAT area is undergoing an active certification process; this can be shown from the distribution of springs at any elevation level that comes out through fractures between rocks, and the development of the karst hydrological system, which is shown, by the development of the subsurface system and river surface following the fracture and flow patterns due to dissolution. Springs and underground rivers in the Watuputih CAT Area are parental/flowing throughout the season. The hydrological function in the Watuputih CAT Area is the main controller of the ecological system which includes the relationship between abiotic components (soil, rocks, rivers, water, etc.), biotic (cave biota as well as flora and fauna in the karst area), and culture (social environment, society, culture, and customs) that interact with one another form an ecosystem where kars is the main control. Watuputih Mountains is an area that functions as a Watuputih CAT water catchment area that stores water for springs that are around the Watuputih Mountains Region. Based on image analysis and topographical maps, activities that cause morphological changes due to mining will potentially lose water absorption which will become surface runoff and will provide water supply to K. Bengawan Solo, K. Lusi, K. Tuyuhan so that, the potential for flooding that always occurs in every year will be higher because of the increase.

### **III. METHODOLOGY**

To assess the economic feasibility of investment profitability using the Discounted Cash Flow Cash Flow calculation method, namely the calculation of cash flow time value of money with profitability analysis Net Present Value (NPV), Internal Rate of Return (IRR), Return on Investment (ROI), Pay Back Period (PBP), Benefit Cost Ratio (BCR), Net Profit and Gross Profit, and Break Even Point (BEP). To assess strengths and opportunities with a combination of SWOT analysis methods (Strength, Weakness, Opportunity, Threat) with the AHP (Analytical Hierarchy Process) method. In this analysis, to obtain primary data, observation and interview methods were used with the Department of Energy and Mineral Resources of Rembang Regency and Central Java Province and several mining companies. Secondary data were obtained through literature studies

from various research journals, proceedings, and papers from the Directorate General of Minerals and Coal, the Center for Geological Resources, the Central Statistics Agency and other relevant agencies.

Analysis of Strength and Opportunity of the Limestone Industry SWOT analysis is carried out through a series of IFAS (internal factor analysis strategy), EFAS (external factor analysis strategy) and SFAS (strategy factor analysis strategy) calculations by calculating the weight and rating values [13].

#### IV. RESEARCH RESULTS AND DISCUSSION

##### Calculation of Net Present Value (NPV)

From the cash flow data, we get investment, revenue and expenditure data every year. Each value of revenue and expenditure is obtained by an annual profit and loss, which is calculated by the value of the present value. The rate is 10%. From the total present value minus the investment, value of the 0 year the Net Present Value is obtained. From the calculation of the total present value minus the initial investment, the NPV figure is obtained. NPV after 4 years is still negative. NPV after 5 years of Rp. 4,400,917,625 > 0, so this investment is considered profitable after the company operates 5 years. The results of the Present Value and Net Present Value calculations are shown in table 1.

Table 1. Calculations Results of Net Present Value

Years	Income	Outcome	Profit-Loss	Present Value
0	0	10,000,000,000	-10,000,000,000	-10,000,000,000
1	21,423,750,000	38,343,300,000	-16,919,550,000	-15,381,409,091
2	32,565,000,000	22,230,000,000	10,335,000,000	8,541,322,314
3	32,565,000,000	22,230,000,000	10,335,000,000	7,764,838,467
4	32,565,000,000	22,230,000,000	10,335,000,000	7,058,944,061
5	32,565,000,000	22,230,000,000	10,335,000,000	6,417,221,874
In Rupiah (Rp)			NPV	4,400,917,625

##### Calculation of Internal Rate of Return (IRR)

Data on annual income and expenditure differences in table 1, can be searched for its IRR value by using excel = IRR (initial investment, difference in years 1 to 5, guess). The guess rate is entered at 10%. IRR obtained 17% for 5 years. This 17% IRR exceeds current bank interest, so the investment in the limestone industry is worth developing.

##### Calculation of Return on Investment (ROI)

From the cash flow data obtained total investment, total sales, total expenditure and profit. For simplification of investment, interest and depreciation are not included in the calculation. ROI calculation results are shown in table 2.

Table 2. Calculation results of Return on Investment

	ROI for five years	ROI for four years	ROI for three years
Total Investment (I)	25,455,000,000	25,455,000,000	25,455,000,001
Total Sales	151,683,750,000	119,118,750,000	86,553,750,000
Total Expenditures	127,263,300,000	105,033,300,000	82,803,300,000

Profit (P)	24,420,450,000	14,085,450,000	3,750,450,000
ROI=P/I * 100%	96%	55%	15%

Return on Investment is 96% for a 5-year projection. This is already greater than the benefits obtained if investment funds are deposited to the bank. Deposit interest is estimated at around 4% per year. Deposit yield for 5 years =  $(1 + 4\%)^5 = 22\%$  is still lower than ROI 96%. When compared to 10% bank interest =  $(1 + 10\%)^5 = 61\%$ , 96% ROI is also still good. If the projection is only 3 years, where the 10% interest is calculated for 3 years to 33%, then the 3-year ROI is only 15%. If the projection is only 3 years, then this project is not interesting. However, the comparison is only deposit interest, where the 4% deposit rate for 3 years is calculated to be 12%, and then the 15% ROI is still better.

### Calculation of Pay Back Period (PBP)

After making cash flow, what needs to be seen is the time needed to return the investment (PBP). In cash flow can be seen from the time, where the balance is equal to zero. When the balance = zero, means that the incoming and outgoing funds are balanced. At the same time a break-even point can be found, Break Event Point (BEP). Based on cash flow in table 6, the balance is still minus in the 31st month and starts to be positive in the 32nd month. That means the investment has reached the breakeven point (BEP) in the 32nd month or Pay Back Period (PBP) within 2 years 8 months. Investment is considered feasible because the payback period is shorter than the life of the project, the remaining life of the project produces a profit in the production process and cash flow.

### B/C Ratio

B/C ratio can be seen from Table 8. After 3 years, in this case the Benefit is taken from the total sales value of Rp. 86,553,750,000, Cost is taken from the total expenditure of Rp. 82,803,300,000.  $B / C \text{ Ratio} = 1,045 > 1$ . The B / C ratio is more than one so that this project can be considered profitable. After 5 years the B / C ratio is better  $151,683,750,000 / 127,263,300,000 = 1,19 > 1$ .

## Opportunities and Challenges of the Limestone Industry

### IFAS Analysis of Limestone Industry

The following external factors such strengths and weaknesses are as table 3. Below this:

Table 3. Internal Factors Strength and Weakness of the Limestone Industry of Rembang Regency

No		Weight	Ranging	Weighted	Information
A	<b>Strengths</b>				
1	It is the limestone source area with the second largest reserve in Central Java	0,163	4	0,652	Having the largest limestone reserve area, being a force can attract investors to invest
2	Open mining land	0,096	3	0,288	Open Mining Land Becomes the Power of Operational Production
3	One of the best quality limestone in Indonesia	0,124	4	0,496	Having Good Quality in Indonesia Becomes Strength Can Attract Consumer Interests To Buy Limestone Products
4	Availability of Electricity and Road	0,055	2	0,110	The availability of Electricity and Road Infrastructure is a supporting force in investing
5	Supporting Infrastructure Resources Demand for limestone is high in the market	0,062	2	0,124	The demand for limestone in the high market becomes a strength in producing limestone
	<b>Total Number</b>	<b>0,5</b>		<b>1,546</b>	
B	<b>Weakness</b>				



1	Still need a more in-depth research approach,	0,078	2	0,156	There is still a need for a more in-depth research approach to determine the quantity and quality of reserves for certainty is a weakness in investing
2	The quality of white limestone has not been seen as a whole	0,083	2	0,166	The quality of the white limestone has not been seen as a whole, making investors have to do research in determining potential mining sites
3	The Government Filed Requirements that are quite heavy and Old Process to Open a Business	0,092	2	0,184	The process of managing a business open legality is quite heavy and long and the bureaucracy is a long weakness in investing
4	Expensive Production Equipment Prices	0,145	4	0,580	Equipment for the Production of Expensive Prices, making investors take a long time to Brick Even Pointe (BEP)
5	Road damage occurred	0,102	3	0,306	The process of transporting transportation with tronton loads in mining causes damage to the road
<b>Total Number</b>		<b>1,000</b>	<b>3</b>	<b>1,392</b>	

In IFAS, analysis data above the dominant strength is the limestone source area with the second largest reserve in Central Java with a weight (0.163) rating (4) and total weighting (0.652). The reason for the high weighting is the large reserves of limestone causing a lot of desire to open the limestone mining industry, besides the strength factor is the best quality limestone in Indonesia with a score (0.124) and a total branch (0.496). The high weakness is Expensive Price Production Equipment, with weight (0.145) and total rating (0.580). The reason is that the Production Equipment Expensive Price will raise the cost of the product so that it takes a long time for Brick Even Pointe (BEP), so the next weakness factor is the damage to the road due to heavy equipment and heavy truck cargo.

#### EFAS Analysis of the Limestone Industry

The following factors are opportunities and threats are as shown in table 4. Below this:

Table 4. External factors Opportunities and Threats of Limestone Industry in Rembang Regency

No	External Strategic Factors,	Weight	Ranging	Weighted	Information
<b>C</b>					
<i>Opportunity,</i>					
1	Opened the market for export	0,132	4	0,528	Limestone much needed in the international market has the opportunity to open it for export
2	Establishment of BUMD	0,161	4	0,644	With the existence of Limestone production has the opportunity for the formation of BUMD,
3	Recruitment of Manpower	0,061	3	0,183	With the construction of limestone mining becoming an opportunity for recruitment,
4	Addition of Transport Truck Fleet for the Community,	0,082	3	0,246	With the limestone mining development becoming an opportunity for the community in the procurement of the Transport Truck Fleet
5	Opening of Businesses for Communities in their Environment	0,064	2	0,128	With the construction of limestone mining, it becomes an opportunity for the community to get additional income by opening various businesses
<b>Amount</b>		<b>0,5</b>		<b>1,729</b>	
<b>D</b>					
<i>Threat</i>					
1	Free market	0,072	2	0,144	With the existence of the Free Market, foreign products are free to enter without tax at a lower price which is a threat to the price of domestic limestone
2	Technology, HR and Capital from the outside world,	0,082	2	0,164	Outside industry uses sophisticated technology, proportional human resources and large capital with better product quality, a threat to domestic limestone products.
3	Raw materials cannot be renewed	0,053	2	0,106	Limestone quarry raw materials cannot be renewed, threatened to gradually diminish and run out
4	Mining is bad for the environment,	0,172	4	0,688	By limestone mining openly having a bad impact on the air, erosion and so on, threatening the environment,
5	Mining Areas Are Most Indigenous Land,	0,121	4	0,363	The mining area is a Customary Land, a threat to the company because many people who cannot be traded

own customary land.

Total Number	1,000	1,465
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The EFAS data analysis shows that the dominant opportunity in the limestone industry is the Establishment of a Regional-Owned Enterprise (BUMD) with a weight (0.161) and a total weighting (0.644). The reason for the high weighting is due to the limestone mining industry in the area of Rembang Regency, opening a big opportunity for the government to open up BUMD to increase local revenue (PAD) in order to increase regional economic growth, then the opportunity factor that is quota is: Opening of markets for exports with weight scores (0.132) and the total branch score (0.528). The highest threat to the Rembang Regency Limestone Industry is mining which has a negative impact on the environment with a weight (0.172) and a total rating (0.668). The reason for the weighting of the threat is high that the limestone industry's raw material from the results of open mining in the limestone hills has a negative impact on air pollution from mining dust, erosion and river water pollution. Besides that, the strongest threat factor is the Mining Area Most of the Customary Land with a weight (0.121) and total branch weight (0.363)

Table 5. Strategy Factors Analysis Summary (SFAS)

Strategic Factor (1)	Weight (2)	Rating (3)	Scoring (4)	Duration (5)			Information (6)
				S	M	L	
It is the limestone source area with the second largest reserve in Central Java (S)	0,163	4	0,652	X	X	X	Having the largest limestone reserve area, becoming a regional natural resource asset can attract investors to invest
Expensive Production Equipment (W)	0,145	4	0,580	X	X		Equipment for high-priced production, raising selling prices, takes a long time to Brick Even Pointe (BEP)
Establishment of BUMD (O)	0,161	4	0,644		X	X	With the existence of Limestone production has the opportunity for the formation of BUMD
Mining has a negative impact on the environment (T)	0,172	4	0,688		X	X	With limestone mining openly has a bad impact on life and the environment
SFAS Total	1,00		2,564				

Of the various decision strategies that might be applied, respondents chose 4 (four) alternative strategies for managing the limestone mining industry in Rembang Regency. The four alternative strategies are: (1) Rembang Regency has the largest limestone reserve area in Central Java, is an asset of regional natural resources that can attract interest in investing; (2) Establishment of BUMD limestone industry is the biggest opportunity because besides the government regions have the ability of capital and human resources, government revenue will increase because additional revenues aside from taxes and obligations of mining companies; (3) Expensive Production Equipment Prices and (4) Mining with a negative impact on the environment requires an AMDAL process in formal studies to estimate the environmental impact issues might occur because of mining activities.

### Strategy Explanation and Direction

Total strength score: 1,546; Total weakness score: -1,392

Total chance score: 1,729; Total threat score: -1,465

Based on the total score above, the determination of company position can be drawn as the following SWOT matrix: In addition, the determination of the coordinates of the image is as follows: (1) Internal Analysis Coordinates:  $(\text{Total strength score} - \text{Total weakness score}) / 2 = (1,546 - 1,392) / 2 = 0.077$  and (2) Coordinates of External Analysis:  $(\text{Total chance score} - \text{Total threat score}) / 2 = (1,729 - 1,465) / 2 = 0.132$ . The coordinates are located at (0.077; 0.132) as shown in Chart 1 below:

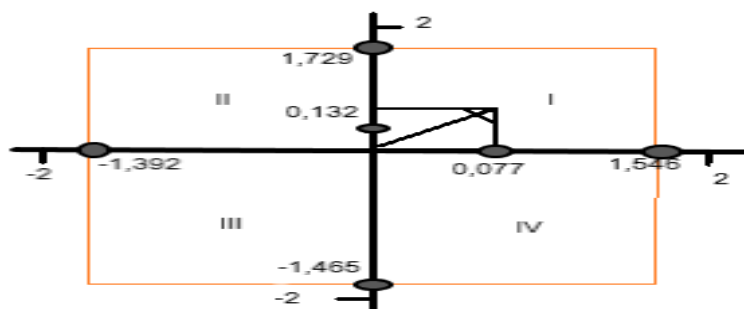


Chart 1. SWOT matrix

The results of calculations for each quadrant can be illustrated in table 6 below:

Table 6. Calculations results of Limestone industry Position

Quadrant	Matrix position	Matrix area	Ranging	Strategy priority
I	(1,546 ; 1,729)	2,673	1	Growth
II	(-1,392 ; 1,729)	-2,407	3	Stability
III	(-1,392;-1,465)	2,039	2	Combination
IV	(1,546;-1,465)	-2,265	4	Collapse

The position of the Limestone Industry as the Leading Product of Rembang Regency is in quadrant 1, p this shows that the superior limestone industry product has strength and has great opportunity so it is very good to be developed using the general strategy on table 7 as follows:

Table 7. General strategy position

<i>High Growth</i>			
<i>Low competition</i>	<b>Quadrant II</b> 1. Market Influence 2. Market Penetration 3. Product Influence 4. Horizontal Integration 5. Business Downsizing 6. Reduction	<b>Quadrant I</b> 1. Featured Products 2. Development & Market Penetration 3. Product Development 4. Forward integration 5. Backward Integration 6. Horizontal Integration 7. Concentric Diversification	<i>Strength Competition</i>
	<b>Quadrant III</b> 1. Business Downsizing 2. Liquidation 3. Concentric Divers 4. Horizontal Diversity 5. Diversity of Conglomerates 6. Reduction	<b>Quadrant IV</b> 1. Concentric Divers 2. Divers Horizontal 3. Diversity of Conglomerates 4. Joint Ventures 5. Outsourcing 6. Benchmarking	
<i>Low Growth</i>			

## V. CONCLUSION

The limestone industry in Tegal Gowo Village, Rembang Regency is economically feasible for developed with the reasons: (1) The total present value minus the initial investment, the NPV figure after 5 years is Rp. 4,400,917,625 > 0, so this investment is profitable after 5 years of operation; (2) Internal Rate of Return (IRR) is obtained 17% for 5 years. IRR 17% > Bank interest rate guess 10%. (Currently in effect, so that the investment in the limestone industry is feasible and feasible provide benefits; (3) Calculation of Return on Investment (ROI) obtained 96%, for a 5-year projection. Interest deposit interest bank 10% =  $(1 + 10\%)^5 = 61\%$ , <ROI

96%, so that investment in the limestone industry is feasible implemented; (4) Calculation of Pay Back Period (PBP). Break Event Point (BEP), positive in the 32nd month. or deep takes 2 years 8 months to return the investment and (5) B/C Ratio. Of the total sales value of Rp. 86,553,750,000. Total Cost of expenditure of Rp. 82,803,300,000. B/C Ratio = 1,045 > 1. So that the limestone industry is profitable.

SWOT Analysis of internal strength & weakness strategy factors (IFAS), external strategy factors opportunity & threat (EFAS) and Strategy Factors Analysis Summary (SFAS). Total strength score: 1,546, Total weakness score: -1,392, total chance score: 1,729, Total threat score: -1,465 (coordinate of Internal Analysis = 0.077 and coordinate of External Analysis = 0.132). The coordinate point is located at (0.077; 0.132) located in quadrant 1, hence the position of the industry limestone shows good strength and opportunity. From the economic analysis and SWOT analysis, it shows that the limestone industry in the village of Tegal Gowu Rembang regency as a superior mining product is very good and profitable for developed.

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