

ASSISTANCE FOR THE STUDY OF POTENTIAL COAL DOWNSTREAMING PROJECTS IN SOUTH SUMATRA

Hendi PRIHANTO^{1*}, R.R. Meitri Hening Chrisna DALUARTI², Prisila DAMAYANTY³, and Yudistira
ADWIMURTI⁴

^{1,4}*Universitas Prof.Dr.Moestopo (Beragama), Jakarta Pusat*

²*Universitas Pendidikan Indonesia Jl. Dr. Setiabudi No.229, Bandung*

³*Institut Bisnis dan Informatika Kosgoro 1957, Jakarta Selatan*

**hendiprihanto@dsn.moestopo.ac.id*

ABSTRACT

Community service aims to provide assistance to the government in conducting academic studies to provide an overview and estimation in various aspects studied such as: planning, technical, legal, economic, financial, social sustainability and so on on objects selected as research or pre-feasibility studies (Pre FS) which are then compiled in the form of reports that will be useful for stakeholders (investors, community, government, private entrepreneurs and others) which aim to improve the investment climate in Indonesia which is getting better especially in the field of coal downstreaming with Mono Ethylene Glycol (MEG) derivative products. The method of implementing this work is carried out using primary data collection techniques (interviews), secondary (data or documents related to the project), surveys and focus group discussions (FGD) on a number of competent parties and related to the business sector. The results of the work are then transformed and presented in the form of a Pre-Feasibility Study report in various forms comprehensively containing all aspects studied in this study, and then promoted in various media, activities and events carried out in various places at home and abroad.

Keyword: pra feasibility study, hilirization, coal, sumatera selatan and mono ethylene glycol

INTRODUCTION

Coal is one of the mining materials that is a favorite commodity in the world because until recently coal was still the flagship of the energy sector that supported the implementation of industry, and all depended on coal. Types of coal are divided into two parts, which are: high and low calories. For high calorie coal utilization is used as electrical energy, fuel and so on, but low calorie coal has not been utilized properly and much is still wasted. This paper discusses the utilization of low-calorie coal in the province of South Sumatra which has very good opportunities and prospects for the development of the coal industry and its downstream (derivative products), besides that there is a lot of potential that can support the place. Coal gasification in South Sumatra is designated as a National Strategic Project (PSN) through the issuance of Presidential Regulation (Perpres) No. 109 of 2020. In addition to coal gasification, the government also established the Industrial Estate in Tanjung Enim as part of the National Strategic Project for the development of the downstream coal industry. Through this research, it can provide an overview, and at the same time become a possible study that the implementation of downstreaming is possible or not for now implemented.

Purpose and objectives

As an academician, providing assistance to the government in doing a study which is carried out to provide a comprehensive and detailed picture (pre-feasibility study) from various aspects to investors and stakeholders regarding the implementation of the feasibility of the coal business and its derivatives in South Sumatra.

METHOD

This work is planned for 6 (six) months starting from the preparation stage in July 2021 to December 2021, taking place in various regions of South Sumatra and DKI Jakarta. The compilation method is carried out in various ways, namely starting from collecting primary and secondary data, focus group discussions (FGDs), surveys, interviews with various parties (government, entrepreneurs, associations, communities and so on) to obtain a level of confidence in the data and validity of the information provided. The end of this activity is to conduct promotions or exposure to the public offering to take part in the investment in the Mono Ethylene Glycol (MEG) coal downstream project.

RESULTS AND DISCUSSION

Description of Project Conditions and Work

The Highest and Best Use (HBU) Analysis approach is used on vacant land or property improvements that are legally permitted, physically possible and financially feasible, and have maximum productivity. (Attakora-Amaniampong, 2016) determine the highest and best use of a vacant plot of land through the following testing steps:

1. Legal Aspect, concerning regulations on Building Height, Building Setback Line, Building Base Coefficient, Building Floor Coefficient and Green Area Coefficient.
2. Physical Aspects concerning the size and shape of the land (length and width of the land), will be an advantage and disadvantage to the value of the land and the appropriate use of the land (Hidayati & Harjanto, 2003) which is a description of where the location of a land is located affects the accessibility factor determining whether it is easy or difficult to reach with the availability of public transportation in addition to water, sewerage, electricity, and telephone services will affect the usefulness and development of a land (Attakora-Amaniampong, 2016).
3. Economic and Financial aspects of project feasibility such as: Supply and Demand, Market, Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR), and Payback Period (PP) as well as funding feasibility with parameters of Debt Coverage Ratio (DCR) and final cash balance (Hidayati & Harjanto, 2003).

To support mining and industrial natural resource areas in growth corridors and equity, priority strategic areas are developed. One of these strategic areas is in South Sumatra, Tanjung Enim. The policy of downstreaming superior commodities, strengthening connectivity infrastructure between regions is the key to accelerating the growth of Sumatra Island with the following description:



Figure 1. Description of project conditions and work

The geographical condition of South Sumatra is an area that is included in the classification of lowland areas with an average altitude of ±79 mdpl (meters above sea level) with a relatively flat topography. Slope conditions in South Sumatra Province are as follows:

Klasifikasi	Luas (Ha)	Persentase Luas (%)
Datar	6.390.222,46	73,52
Landai	938.837,83	10,80
Agak Curam	549.161,20	6,32
Curam	186.423,96	2,14
Sangat Curam	626.953,27	7,21
Jumlah	8.691.598,72	100,00

Sumber: Olahan dari Geoportal Tematik Sumatera Selatan, 2021

Figure 2. Slope conditions in South Sumatra Province

An overview of the population and its growth rate in 2016 - 2020 is as follows:

No	Kabupaten/Kota	Jumlah Penduduk (Jiwa)					Laju Pertumbuhan Penduduk (%)			
		2016	2017	2018	2019	2020	2016-2017	2017-2018	2018-2019	2019-2020
1	Ogan Komering Ulu	354.488	359.092	364.260	368.756	367.603	1,30	1,44	1,23	-0,31
2	Ogan Komering Ilir	798.482	809.203	821.528	832.151	769.348	1,34	1,52	1,29	-7,55
3	Muara Enim	609.607	618.762	628.661	637.556	612.900	1,50	1,60	1,41	-3,87
4	Lahat	397.424	401.494	405.605	409.348	430.071	1,02	1,02	0,92	5,06
5	Musi Rawas	389.239	394.384	400.239	405.175	395.570	1,32	1,48	1,23	-2,37
6	Musi Banyuasin	620.738	629.791	640.065	649.085	622.206	1,46	1,63	1,41	-4,14
7	Banyuasin	822.575	833.625	846.269	857.097	836.914	1,34	1,52	1,28	-2,35
8	Oku Selatan	348.574	352.926	358.510	363.004	408.981	1,25	1,58	1,25	12,67
9	Oku Timur	656.568	663.481	670.653	677.080	649.853	1,05	1,08	0,96	-4,02
10	Ogan Ilir	414.504	419.773	424.774	429.595	416.549	1,27	1,19	1,13	-3,04
11	Empat Lawang	241.336	244.312	247.544	250.465	333.622	1,23	1,32	1,18	33,20
12	Penukal Abab Lematang Ilir	182.219	184.671	187.554	190.062	194.900	1,35	1,56	1,34	2,55
13	Musi Rawas Utara	185.315	187.635	190.222	192.540	188.861	1,25	1,38	1,22	-1,91
14	Palembang	1.602.071	1.623.099	1.651.857	1.674.243	1.668.848	1,31	1,77	1,36	-0,32
15	Prabumulih	179.563	182.128	185.895	188.669	193.196	1,43	2,07	1,49	2,40
16	Pagar Alam	135.328	136.605	137.964	139.192	143.844	0,94	0,99	0,89	3,34
17	Lubuk Linggau	222.870	226.002	229.889	233.178	234.166	1,41	1,72	1,43	0,42
Jumlah/Rata-Rata		8.160.901	8.266.983	8.391.489	8.497.196	8.467.432	1,30	1,51	1,26	-0,35

Sumber: BPS Provinsi Sumatera Selatan, Provinsi Sumatera Selatan Dalam Angka Tahun 2021

Figure 3. Overview of the population and its growth rate in 2016 - 2020

The GRDP of one district at constant prices with oil and gas in 2019 reached Rp. 41.58 trillion and Rp. 41.59 trillion in 2020. In the structure without oil and gas, the added value in 2020 reached Rp. 37.64 trillion, from Rp. 37.52 trillion in 2019. In this case, the mining sector has a strategic role as a provider of employment for the people of South Sumatra, as well as contributing to GRDP, especially Muara Enim Regency. Coal is the dominant commodity in South Sumatra in the form of the highest mining and quarrying in South Sumatra. This dominant sector is due to its geographical location which has many excavation and mining points that form of petroleum, coal and natural gas compared to other districts/cities in South Sumatra Province.

The development for coal focuses on its derivative product, Mono Ethylene Glycol (MEG), which is a derivative compound of Ethylene that is generally produced from petroleum processing. Mono Ethylene Glycol (MEG) is used as a chemical intermediate for resins, antifreeze, humectants, and other chemical intermediates. This material/application is highly important for the production of various products, including resins, deicing fluids, heat transfer fluids, automotive antifreeze and coolants, water-based adhesives, latex paints, asphalt emulsions, electrolytic capacitors, textile fibers, paper, and leather. In the textile industry, MEG is used as a raw material along with purified terephthalic acid (PTA) to produce Polyethylene Terephthalate (PET), also known as polyester.

Tanjung Enim Industrial Estate as the South Sumatra project site is divided into three blocks and each block is allocated to a specific type of industry, such as:

- North Block: 185.43 ha earmarked for MEG production Industry
- Central Block: 100.68 ha for power plant industry
- South Block: 299.29 ha for the gasification industry, CPO and its derivatives

Then the development phasing plan will be carried out:

- Phase 1 includes the southern block (gasification industry blocks J1, J2)
- Phase 2 includes the southern block (CPO industry and CPO downstream blocks Q1, Q2)
- Phase 3 covers the northern block (MEG production industry blocks A1, A2)

Analysis of the area's raw water sources comes from the Enim River, the intake is located in the Enim River which is about 900 m west of the land. Water will be treated at the WTP (Water Treatment Plant) which is located in the south block support facility area, before being distributed to the area both to industrial lots and to the following (non-industrial) support facilities:

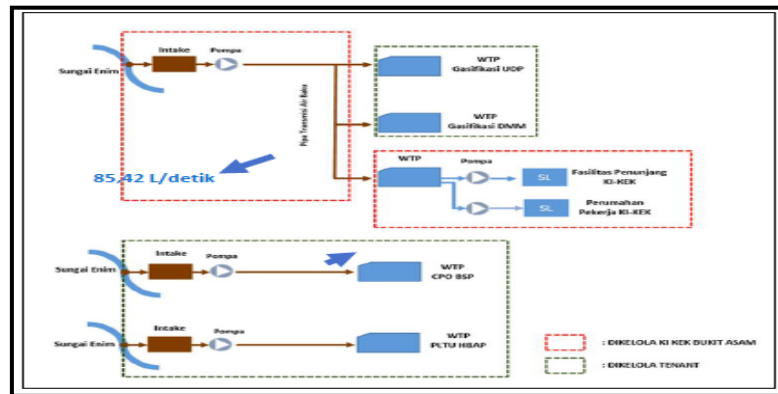


Figure 4. WTP (Water Treatment Plant)

Based on industrial estate regulations the main infrastructure is electricity, water, telecommunications and logistics.

1. Electricity needs for Tanjung Enim Industrial Estate using PLTU Bukit Asam (existing) flowed with SUTET 150 KVA and PLTU Sumsel 8 that has been built.
2. The main water source is from the Enim River, the existing infrastructure is the water intake of PLTU Sumsel 8 and PT BSP (CPO factory). Planned one (1) additional water intake with an area of 1 ha with water source from Enim River.
3. Existing telecommunications there is a telecommunications network to and through Tanjung Enim Industrial Estate non-wired transmission with BTS. While for the plan is an optical cable network from special to Tanjung Enim Industrial Estate.
4. Industrial area supporting infrastructure such as hotel facilities, education, health, sports, tourism already exist.

Accessibility based on existing conditions, Tanjung Enim Industrial Estate is reached by using land routes (highways and railways), river routes (River Pier) and sea (Tarahan Port) and air (airport). The plan to improve accessibility in the Tanjung Enim Industrial Estate is:

1. The planned exit toll ring road to Tanjung Agung crosses the Tanjung Agung Special Economic Zone, part of the land has been acquired.
2. Construction of the Indralaya-Muara Enim toll road
3. Double track railroad
4. New railway line
5. Construction of a new pier
6. Upgrading the capacity of the Kertapati-Palembang and Tarahan Port-Lampung docks

Raw Material Availability

The source of raw materials comes from PT Bukit Asam's mines, i.e. IUP PT Bukit Asam Block Banko Pengah A with an area of 2,423 ha and Banko Tengah B with an area of 22,937 ha. The total amount of PT Bukit Asam coal production in Tanjung Enim is 24,234,371 tons in 2020 with a special West and Central Banko Block of 11,710,244 tons. The need for raw materials will be different from previous production because it will require low grade coal. The total coal reserves of PT BA in Tanjung Enim are 2.3 billion tons.

Types of Technology used for the MEG Industry

Coal gasification technology has long been developed with varied product derivatives. This technology can produce electricity through steam and gas, fuel, and other downstream chemical products that describe a multi-product gasification. Mono Ethylene Glycol (MEG or Ethylene Glycol) is a coal gasification product produced from syngas or methanol. MEG is widely used in the polyesters (polyethylene terephthalate or PET) industry as fibers, films, solid-state resins, and anti-freeze agents. MEG can be produced from coal through the gasification process, which is a type of ethylene glycol that has uses:

- Production material for polyester fibers and poly ethylene terephthalate (PET) resins.
- Anti-freezing agent and vehicle coolant.
- Industrial raw materials e.g. for heat transfer, engine anti-freeze in general..

In terms of coal to MEG technology, it has been developed since the 1970s through the process of processing coal into syngas and methanol and then processed into MEG through the MEG processing unit.

Supporting Infrastructure Facilities in Industrial Areas

Related to the supporting facilities of road infrastructure can be calculated with the following assumptions:

- From the above population assumptions, it is assumed that those who will generate traffic with interregional travel are from the manager level with the use of private vehicles and staff using buses (capacity 40 people), then the traffic generation is 300 private vehicles + (2000/40=50 buses) = 300 smp + 50x3 smp = 450 smp/day.
- Freight transportation 100 x 3 TEUS = 300 TEUS per month (1200 smp/month = 40 smp/day) and export 100x3.5 TEUS=350 TEUS/month = 57 smp/day. Therefore, the total freight transportation is close to 100 smp/day. The total generation of labor and goods transportation becomes 450 + 100 = 550 smp/day. If returned to the generation effect of per hectare of industrial area is 5.5 smp/day/hectare.
- If the types of industries that will be located in the industrial estate have the potential to produce liquid waste, then it must be equipped with an integrated WWTP which usually treats four (4) key parameters, namely: BOD, COD, pH, and TSS. In connection with the integrated WWTP, the management is obliged to set the influent standard that can be entered into the integrated WWTP, and other effluent parameters or the quality of the four key parameters are far above the influent standard, so they must be pre-treated by each factory. In planning an integrated WWTP system that is only able to treat four key parameters (BOD, COD, TSS and pH), it is determined by two main factors, which are:
 - a. The maximum investment that can be provided by the area manager to build an integrated WWTP system is related to the size of the industrial area.
 - b. The designation of the receiving water body (stream) whether it is a class I, II, III or IV water body in accordance with PP 82/2001 on Water Quality Management and Water Pollution Control.

Based on the above two considerations, in planning an industrial estate the influent standards for four parameters are as follows:

- BOD: 400 - 600 mg/l;
- COD: 600 - 800 mg/l;
- TSS: 400 - 600 mg/l; and
- pH: 4 - 10

In detail, the processing of syngas from coal into MEG can be seen in the following flow.

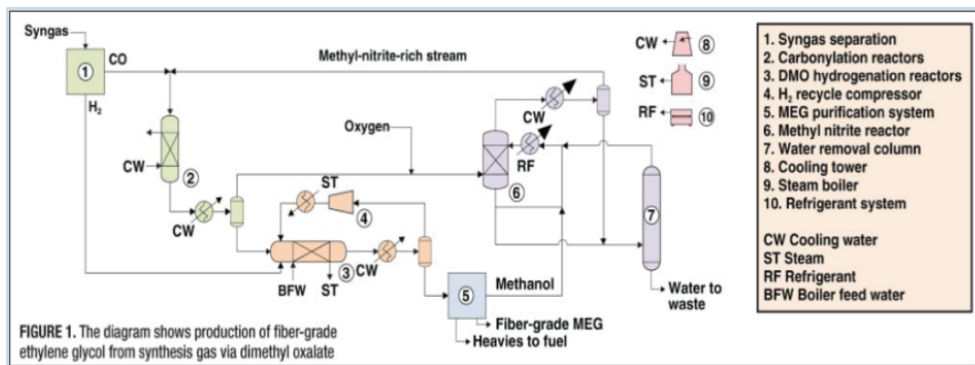


Figure 5. Processing of syngas from coal into MEG
 Source: PolyesterTime, 2017

From the flow above, it is mentioned that the MEG processing unit is an additional unit from a series of gasification processes. One of the processing technologies into MEG, for example, was developed by the company Eastman and JM, which for a decade developed this technology in the UK. One of the units that can be seen is carried out in Jiutai on a large scale with a capacity of 1 million tons (benchmark).

Market Aspects

One of the products produced through the coal synthesis process is Monoethylene Glycol (MEG), which is an important feedstock for industrial applications and can be gasified. The use of MEG is in the manufacture of polyester (PET). Monoethylene Glycol (MEG) is a glycol compound with a single chain bond. MEG is an organic compound that can lower the freezing point of its solvent by disrupting the formation of solvent ice crystals. The main function of MEG as an antifreeze that has a very low freezing point when mixed with resin water, films and fibers. MEG is important in the production of antifreezes, coolants, and solvents. The sales price on the site is quite promising, ranging from: US\$ 1,200-1,600 / Metric Ton (source: <https://www.alibaba.com/product-detail/Mono-Ethylene-Glycol-Propylene-Glycol-Price>). The use of MEG which is increasing every year provides considerable and competitive investment opportunities (Almairan et al., 2023; Espinoza et al., 2011) which encourages promotion from consumers (Siahtiri et al., 2024) based on derivative products created from MEG.

MEG as a raw material for making polyester with a good market share in Indonesia and polyester can be an important material for the textile industry, which is used by several polyester producing companies such as: PT.MC Pet Film Indonesia, PT.Polychem Indonesia, PT.Indorama Synthetics, PT.Polindo Utama, PT Coats Rejo Indonesia, and small and medium enterprises such as: Perlonindo, CV. Mitra Duta, CV. Sumber Baru Mandiri Jaya, Karunia Textile Bandung, Wiriapratama, Cendratex, Gudang Curtains, Print Kain, Kreons Print, Citra Kualita Perdana, Adh Baru, CV. Deltatex Global Niaga, Megah Printing, Waluya Mitra Abadi, Indonesia Fabric Textile and other companies projected below:

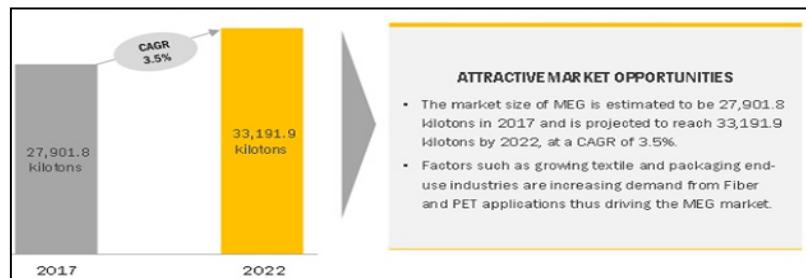


Figure 6. Attractive Market Opportunities

Source: <https://www.marketintellica.com/report/MI53796-global-mono-ethylene-glycol-market-report>

- Emerging markets such as APAC and South America are expected to be the major drivers of the MEG market, growing automotive and construction building industries contribute to the growth of the polyester staple fiber market. China is a major consumer and producer of polyester and accounted for more than 65 percent of the global polyester consumption and India is a major player. Huge potential in the application of polyester in the textile industry leads to growth in the significant MEG market.
- China has the largest demand for MEG and imports MEG despite being a major producer of MEG. Coal-based process which is one of the technologies used in MEG production is expected to provide growth opportunities in the country.

Financial Aspects

The calculation results are based on benchmarks carried out on a number of literature and information that has been carried out, so that the information obtained provides a more or less accurate picture with the following value composition. The project will have to import or bring in technology from abroad (China, Germany or USA) with machine tools consisting of: ASU (Air Suspension Unit), Gasification, Purification, Methanol Synthesis and Distillation, MEG unit, Sulfur Recovery unit, Power plant and sea water intake and discharge with the following CAPEX projections.

The evaluation of the total operating expenditure (OPEX) carried out in the project industrial investment project for 20 years is estimated at **Rp. 34,731,641,140,986**, - consisting of costs:

Biaya	Jumlah
Biaya bahan baku	Rp. 29.307.156.000.000,-
Biaya Tenaga Kerja	Rp. 289.226.000.000,-
Biaya Listrik	Rp 5.880.790.000
Biaya Administrasi dan Umum	Rp. 2.715.768.910.000,-
Biaya Pemeliharaan, Produksi dan Lainnya	Rp. 4.073.653.360.000,-

Figure 7. The evaluation of the total operating expenditure (OPEX)

The Weighted Average Cost of Capital (WACC) method is a calculation of the cost of capital based on the portion between debt and equity of the company, generally used to test the feasibility of investing in companies based on various capital structures, usually involving debt and equity. Cost of capital is the discount rate used to achieve the minimum return projected based on the present value in the NPV calculation explained as follows:

WACC (Weighted Average Cost of Capital)	Persentase
Cost of Equity	7,85%
Cost of Debt	6,00%
WACC Equity	3,05%
WACC Debt	4,80%
Total WACC	7,85%
Rounded WACC	7,80%

Sumber: Hasil Analisis

Figure 8. The Weighted Average Cost of Capital (WACC)

PP (Pay Back Period) describes the period to recover an investment expense through proceeds or what is known as net cash flow, the results of sensitivity testing state that the average return on capital is in the range of four years, namely 4.25 years which increases sales profit (Amaral et al., 2023). It is said to be feasible with a large investment spent being able to return capital in an average of four years as follows:

Asumsi	Hasil	Syarat Kelayakan	Keterangan
IRR	13,80 %	IRR > WACC	Layak
NPV *	32.251.157.812.011	NPV > 0	Layak
PP	4,25 tahun		Layak
BCR	5,06	BCR > 1	Layak

Keterangan : *NPV dalam jutaan
 Sumber : Hasil Analisis

Figure 9. PP (Pay Back Period)

The tax assumptions used in this study still refer to Law No. 36 of 2008 concerning income tax, the tax rate imposed is 25 percent referring to the general corporate income tax according to the Ministry of Finance.



Figure 10. Law no. 36 of 2008
 Source: Ministry of Finance, 2020

Social and Business Aspects

According to PT Bukit Asam's Masterplan, MSMEs can be allocated in the trade and service area, which is in Block L with an area of 4.85 Ha. There are at least four types of MSMEs that can be developed for this industry, including:

1. MSMEs for aluminum smelting with coal demand analysis from diesel and used oil replacement;
2. MSMEs for askiri oil refining (replacement of biomass such as clove leaves); and

3. MSMEs for tofu and hebel making
4. PT Bukit Asam's partnership with MSMEs is expected to encourage the development of the industrial estate.

In general, the positive impacts of industrial estates are as follows:

1. Increase residents' income;
2. Produce various goods;
3. Expanding employment opportunities;
4. Reduce dependence on other regions;
5. Increase the use of raw materials in the vicinity of the industrial area; and
6. Increase the country's foreign exchange.

In general, the negative impacts of industrial estates are as follows:

1. Leads to urbanization flows;
2. The occurrence of environmental pollution;
3. Leads to consumerism;
4. People's way of life changes;
5. Industrial waste causes soil pollution; and
6. Community livelihoods shift.

Risk identification is to identify any risks that may occur and not to eliminate risks including: Demand risk, Licensing risk, Supporting infrastructure implementation risk, Regulatory and political risk, Financing and currency exchange rate risk, Industrial estate construction and development risk, and Force majeure and environmental risk point to the importance of combining different types of innovations in a complex to obtain external effectiveness as well as internal efficiency (Samuelsson, 2023).

CONCLUSION

Based on the analysis conducted in the preparation of the project review, the following conclusions can be stated:

1. The very large value of the project has the potential for funding problems that may be difficult to obtain because investors who have large capital will be quite difficult to obtain and will be difficult to realize in the short term and credit risk (Javadi & Osah, 2024) serta dinamika investasi perusahaan (Jens & Page, 2024).
2. High technology creates its own difficulties in project implementation because not all countries have the technology, so implementation in the short term can be constrained
3. The project will make the province of South Sumatra more advanced and prosperous by empowering its people through reducing unemployment and empowering MSMEs with a mutually supportive relationship.
4. Fulfillment of the needs of domestic MEG material elements that reduce imports and increase foreign exchange

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