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RESEARCH ARTICLE

ANALYSIS OF FACTORS INFLUENCING INVESTMENT DECISIONS IN THE CONSTRUCTION OF A CEMENT PLANT IN WAMENA

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Abstract

The high price of cement in Wamena is mainly caused by limited logistics access, dependence on long distance distribution, and inadequate supporting infrastructure. This study analyzes the factors influencing investment decisions in the construction of a cement plant in Wamena, evaluates project feasibility from economic, social, and environmental perspectives, and formulates strategic recommendations for stakeholders. The research applied a mixed-methods approach by combining qualitative and quantitative data. Data were collected through interviews, questionnaires, observation, documentation, and literature review. Qualitative data were analyzed through data reduction, data presentation, and conclusion drawing, while quantitative data were examined using Partial Least Squares - Structural Equation Modeling (PLS-SEM). The results indicate that economic, social-environmental, and infrastructure factors have positive and significant effects on investment decisions. Economic factors are the most dominant determinant, followed by social environmental factors and infrastructure. However, financial analysis indicates that the project is not yet feasible under current assumptions, as shown by a negative Net Present Value (NPV) of approximately Rp414.84 billion, an Internal Rate of Return (IRR) of about 4.5%, a Benefit Cost Ratio (BCR) of 0.86, and a Payback Period of 8.63 years. Although financially unfeasible, the project remains conditionally feasible from social and environmental perspectives if supported by government policy, conflict management, respect for indigenous land rights, and consistent environmental mitigation.

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Introduction:-

Cement is one of the most important materials for regional development because it is required for roads, bridges, housing, public buildings, schools, hospitals, and other infrastructure facilities (Barbhuiya et al. 2025). In Indonesia, infrastructure development remains a national priority to strengthen connectivity, reduce regional inequality, and improve competitiveness (Taufik, Putri, and Kevin 2023). Papua, particularly the central highland region, still faces

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limited infrastructure and high construction costs. In this context, the availability of cement becomes a strategic issue for accelerating development in Wamena and surrounding districts. Wamena is an economic center in Papua's highland region. However, the area is geographically isolated and relies heavily on long and expensive logistics chains. Cement is commonly supplied from outside Papua through sea transportation to Jayapura or other ports and then transported by air or road to Wamena. This distribution pattern causes high logistics costs, unstable supply, and prices far above the national average. While cement in many Indonesian cities is relatively affordable, in Wamena the price may reach approximately Rp400,000 to Rp600,000 per sack depending on supply conditions and transportation availability. Such a price gap indicates the large burden of logistics costs borne by consumers, contractors, and public projects.

The construction of a cement plant in Wamena is therefore considered a strategic alternative to reduce distribution costs, stabilize supply, support regional infrastructure programs, and strengthen local economic independence. A local cement plant could also create employment, stimulate supporting businesses, and increase local government revenue (Gallego Dávila and Aagesen 2024). Nevertheless, investment in a cement plant is complex. Investors must consider market demand, raw material availability, production costs, access to energy, transportation infrastructure, government policy, social acceptance, indigenous land rights, and environmental impacts (Akintayo, Olanrewaju, and Olanrewaju 2024). This study focuses on three major questions. First, what factors significantly influence investors' decisions to invest in the construction of a cement plant in Wamena? Second, how feasible is the project from economic, social, and environmental perspectives? Third, what challenges and opportunities should be considered in realizing the investment? By answering these questions, the study provides an integrated understanding of investment decision-making in a geographically difficult and socially sensitive region.

Literature Review:-

Investment is the allocation of capital or assets to an economic activity with the expectation of future returns. In investment theory, every investment decision involves a trade-off between risk and return. Higher expected returns are usually accompanied by higher risks, while low-risk investments generally produce lower returns (Ningsih 2024). For a cement plant project in Wamena, investors need to examine not only potential profit from high market prices but also risks related to logistics, energy, infrastructure, social conflict, environmental impact, and regulatory uncertainty (Oguntola, Boakye, and Simske 2024). The theory of industrial location also provides an important analytical framework for four main theories that deal with the problem of selecting the industrial location: Least Cost Location Theory, Market Location Process Theory, Profit Maximization Theory, and Low-Cost Consumer Theory. With an explanation of the factors and foundations on which each theory is based, and the similarities and differences between these theories (Salih and Mohammed 2024). Weber's theory emphasizes that industrial location is determined by the minimization of transportation and labor costs.

In the cement industry, raw materials such as limestone and clay are heavy and localized; therefore, proximity to raw materials can reduce transportation costs (E., Friedrich, and Cooke 1930). However, modern industrial location theory expands this view by including agglomeration, access to markets, energy supply, government policy, and social-environmental factors (Blair and Premus 1987). These variables are especially relevant in Wamena, where road access, electricity stability, and social acceptance strongly affect the investment calculation. Previous studies show that private investment is influenced by interest rates, inflation, gross regional domestic product, public expenditure, labor availability, and infrastructure. Studies on the cement industry also highlight that production efficiency, market concentration, and supply-chain reliability determine competitiveness (Du, Zhao, and Zhu 2022). In the Papuan context, social and cultural dimensions are equally important because many potential industrial locations intersect with indigenous land and customary authority. Therefore, this study combines economic, social-environmental, and infrastructure variables to assess their influence on investment decisions.

Research Method:-

This research used a mixed-methods approach, combining qualitative and quantitative methods. The study location was Wamena, Jayawijaya Regency, Papua Pegunungan Province. Wamena was selected because it is a strategic economic center in the highland region and faces high cement prices due to logistics limitations. Primary data were obtained through interviews, questionnaires, and field observations. Interview respondents included local government officials, community leaders, indigenous representatives, contractors, building material distributors, and other stakeholders involved in regional development and investment. Questionnaires were distributed to respondents who understood local economic conditions, infrastructure readiness, social acceptance, and the investment climate.

Field observations were conducted to understand geographic conditions, road access, and the potential availability of production-supporting resources.

Secondary data were collected from government documents, official statistics, regional planning documents, previous studies, and academic literature related to investment, industrial location, cement production, infrastructure, and social-environmental risk. Qualitative data were analyzed through reduction, presentation, and conclusion drawing. Quantitative data were analyzed using Partial Least Squares - Structural Equation Modeling (PLS-SEM). The variables used in the model were Economic Factor (FE), Social and Environmental Factor (SL), Infrastructure Factor (INF), and Investment Decision (KI). Each construct was measured using multiple indicators on a Likert scale. Financial feasibility was evaluated using Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR), and Payback Period. These indicators were used to assess whether the projected benefits of the cement plant could cover investment and operational costs under the assumptions used in the study.

Results and Discussion:-

Public perception of the cement plant investment:-

The survey results indicate strong public recognition of cement market potential in Wamena. From 110 respondents, 87 respondents or 79% believed that a cement plant in Wamena has very large market potential because cement is highly needed for infrastructure and housing development. Meanwhile, 23 respondents or 21% were uncertain, mainly because potential limestone resources are often located in customary forest or indigenous land areas, and geological mapping may require a long process. Regarding cement prices, 95 respondents or 86% agreed that the current price of cement in Wamena, ranging from approximately Rp400,000 to Rp600,000 per sack, indicates a strong investment opportunity. However, 15 respondents or 14% argued that the current price should not be the only basis for investment because local production would likely reduce prices in the future and change market conditions. In terms of raw material availability, 102 respondents or 93% stated that limestone, sand, and other supporting materials are abundant in Wamena. Only 8 respondents or 7% expressed uncertainty, mainly because raw material sustainability depends on the length of operation and production capacity of the plant. Public perception also revealed social risks. Around 72% of respondents considered the potential for social conflict to be high, especially because the project may involve indigenous land. Community acceptance therefore depends on consultation, respect for customary rights, transparent benefit sharing, and clear environmental safeguards.

Readiness of production and logistics:-

The study estimates that a cement plant with a production capacity of 200,000 tons per year would require significant investment. The total capital expenditure is estimated at approximately Rp1.44 trillion, consisting of direct costs and indirect costs. Direct costs include major equipment and machinery, civil construction, machine erection and installation, and land acquisition. Indirect costs include utilities, engineering, permits, and contingency funds. The plant is assumed to operate as a grinding plant with core equipment such as a ball mill or vertical roller mill, storage silos, packaging systems, and supporting infrastructure. This model is relatively more realistic than a fully integrated plant because it focuses on clinker grinding and cement packaging. However, the project still requires reliable energy supply and efficient logistics. Coal is an important energy component. For 200,000 tons of cement per year, clinker demand is estimated at 190,000 tons. Coal demand ranges from 13,300 tons to 25,270 tons per year, depending on the fuel consumption scenario. The annual coal cost is estimated between Rp22.77 billion and Rp52.11 billion. In addition, coal shipment from Kalimantan to Wamena involves sea transport to Jayapura and road transport to Wamena, with logistics costs estimated at Rp16,000 to Rp17,000 per kilogram in the study scenario. These logistics constraints confirm that energy and transportation remain critical risks.

PLS-SEM analysis of factors influencing investment decision:-

The PLS-SEM results show that all measurement indicators are valid and reliable. Outer loading values for all indicators were above 0.70, meaning that the indicators adequately represented their constructs. Cronbach's Alpha values for Economic Factor (0.907), Infrastructure (0.855), Investment Decision (0.886), and Social and Environmental Factor (0.865) were all above the accepted minimum of 0.70. Composite Reliability values ranged from 0.896 to 0.928, and Average Variance Extracted (AVE) values ranged from 0.633 to 0.686, indicating good convergent validity. The discriminant validity test using the Heterotrait-Monotrait Ratio (HTMT) also showed acceptable results. All HTMT values were below 0.90, indicating that the constructs were empirically distinct. Thus, the measurement model was suitable for structural model evaluation. The R-square value for Investment Decision was 0.537, while the adjusted R-square was 0.524. This means that Economic Factor, Infrastructure, and Social and Environmental Factor together explain 53.7% of the variance in investment decisions. The remaining 46.3% may be

explained by other variables not included in the model, such as national policy changes, financing structure, security conditions, or macroeconomic dynamics.

Table 1 PLS-SEM Structural Results.

Relationship	Path Coefficient	T-statistic	P-value	Interpretation
Economic Factor -> Investment Decision	0.397	5.549	0.000	Positive and significant
Infrastructure -> Investment Decision	0.229	3.172	0.002	Positive and significant
Social and Environmental Factor -> Investment Decision	0.360	5.507	0.000	Positive and significant

The results indicate that all three factors have positive and significant effects on investment decisions. Economic Factor is the most dominant variable, followed by Social and Environmental Factor and Infrastructure.

The structural equation can be expressed as follows:

$$KI = 0.397(FE) + 0.229(INF) + 0.360(SL)$$

This means that improvements in economic conditions, infrastructure readiness, and social-environmental management increase the likelihood of positive investment decisions. The dominance of economic factors is logical because investors primarily evaluate market potential, production costs, raw material availability, and expected returns. However, the strong coefficient of social and environmental factors shows that in Wamena, community acceptance, indigenous land rights, and environmental control are almost as important as financial considerations.

Financial feasibility analysis:-

Financial analysis was conducted using the assumption of a cement plant capacity of 200,000 tons per year. The initial investment was estimated at Rp1.44 trillion. Production cost was estimated at Rp1,265 per kilogram, while the selling price under the 30% margin scenario was Rp2,099.20 per kilogram. Annual production was assumed to be 200,000,000 kilograms. Based on these assumptions, annual revenue was estimated at Rp419.84 billion, while annual production cost was Rp253 billion. The estimated annual net cash flow was Rp166.84 billion. Nevertheless, when discounted over the project period, the financial indicators show that the investment is not yet feasible.

Table 2 Financial Feasibility Indicators.

Indicator	Result	Feasibility Interpretation
Initial Investment	Rp1.44 trillion	High capital requirement
Net Present Value (NPV)	-Rp414.84 billion	Not feasible because $NPV < 0$
Internal Rate of Return (IRR)	Approximately 4.5%	Not feasible because $IRR < 10\%$ benchmark
Benefit Cost Ratio (BCR)	0.86	Not feasible because $BCR < 1$
Payback Period	8.63 years	Long recovery period

The negative NPV indicates that the present value of benefits is lower than the investment cost. The IRR of approximately 4.5% is below the assumed investment benchmark of 10%, indicating that project returns are not attractive under current assumptions. The BCR of 0.86 means that benefits are smaller than costs. The Payback Period of 8.63 years is relatively long and increases the risk for investors, especially in a region with high logistics and social risks. Therefore, the project is not financially feasible without intervention. Several strategies may improve feasibility: reducing initial investment, increasing production scale, securing energy subsidies, using lower-cost financing, obtaining government participation, and improving logistics efficiency. Government support may include tax incentives, land facilitation, infrastructure development, and public-private partnership schemes.

Social and environmental feasibility:-

Although the project is financially weak, it has conditional social and environmental potential. Social feasibility depends on meaningful consultation with indigenous communities, recognition of customary land rights, fair benefit-sharing mechanisms, local employment, and clear conflict-resolution procedures. The data show that the community is not fully opposed to the project, but support is conditional. Many respondents expect job creation, lower cement prices, and accelerated development; at the same time, they are concerned about land disputes, social inequality, and environmental damage. Environmental feasibility also requires strict mitigation. Cement production and related mining activities can generate dust emissions, landscape changes, water use issues, waste, and biodiversity impacts. The project must therefore comply with environmental regulations, conduct a comprehensive environmental impact assessment, implement dust and emission controls, manage waste properly, and monitor environmental quality continuously.

SWOT-based strategic implications:-

The main strengths of the project are high local cement prices, large market demand, potential raw material availability, and the strategic position of Wamena as a highland economic center. The main weaknesses are high capital expenditure, high logistics costs, limited energy supply, and long investment recovery. Opportunities include government infrastructure programs, regional autonomy, local market demand, and the possibility of public-private partnerships. Threats include indigenous land conflict, environmental opposition, security instability, energy limitations, and uncertainty in logistics conditions. Based on these findings, a phased investment strategy is recommended. The project should not proceed directly as a full-scale commercial plant without improving financial feasibility. A more realistic pathway is to begin with a smaller or modular plant, secure government support, establish a customary land agreement, prepare an environmental management plan, and develop an independent energy strategy. After these prerequisites are fulfilled, the project may be expanded gradually.

Conclusion:-

This study concludes that Economic Factor, Social and Environmental Factor, and Infrastructure Factor all have positive and significant effects on investment decisions in the construction of a cement plant in Wamena. Economic Factor is the most dominant determinant, followed by Social and Environmental Factor and Infrastructure. The PLS-SEM model explains 53.7% of the variance in investment decisions, indicating that the selected variables are relevant and meaningful for investment analysis in Wamena. From the financial perspective, the project is not yet feasible under the assumptions used in the study. The project shows a negative NPV of approximately Rp414.84 billion, an IRR of around 4.5%, a BCR of 0.86, and a Payback Period of 8.63 years. These results show that the expected benefits are not sufficient to cover the high investment and operational risks. However, from the social and environmental perspectives, the project is conditionally feasible if supported by strong government policy, community participation, respect for indigenous land rights, effective conflict management, and consistent environmental mitigation. The realization of a cement plant investment in Wamena therefore requires an integrated strategy. Investors should conduct a deeper feasibility study, especially on energy supply, raw material reserves, logistics, and financing structure. Local government should provide legal certainty, spatial planning clarity, infrastructure support, and facilitation of dialogue with indigenous communities. Future studies are recommended to analyze the cement supply chain using a multimodal transport model to identify the most efficient distribution system for Wamena and surrounding highland districts.

Recommendation:-

In light of the findings and conclusions, the following recommendations are given:

1. Investors should conduct a more comprehensive feasibility study covering raw material reserves, energy supply, logistics costs, production capacity, selling price, and financing structure.
2. The local government should provide legal certainty, clear spatial planning, streamlined licensing procedures, basic infrastructure support, and facilitation of dialogue with indigenous communities.
3. Supporting infrastructure, including roads, electricity, raw water supply, telecommunications, and logistics systems, should be prioritized to reduce production and distribution costs.
4. Local communities and indigenous landowners should be involved from the planning stage through consultation, compensation, benefit-sharing mechanisms, and fair employment opportunities.
5. Environmental aspects should be managed through a rigorous environmental impact assessment, emission control, waste management, land reclamation, and regular environmental monitoring.

6. A partnership scheme involving the government, investors, regional-owned enterprises, and local communities should be considered to improve the financial feasibility of the project.
7. Future studies should analyze the cement supply chain using a multimodal transport model to identify the most efficient distribution system for Wamena and the surrounding highland regions.
8. Further research should include additional variables such as security risks, local workforce readiness, market capacity, government policy, and energy price stability to provide a more comprehensive investment analysis.

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