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.

1. 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 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.

Wamenaisaneconomiccenter in Papua'shighland region. However, the area isgeographicallyisolatedandreliesheavilyon long andexpensivelogisticschains. Cementiscommonlysuppliedfromoutside Papua throughseatransportationto Jayapura orotherportsandthentransportedby air orroadtoWamena. Thisdistributionpatterncauseshighlogisticscosts, unstablesupply, andpricesfarabovethenationalaverage. Whilecement in many Indonesian citiesisrelativelyaffordable, in Wamenathepricemayreachapproximately Rp400,000 to Rp600,000 per sackdependingonsupplyconditionsandtransportationavailability. Such a price gap indicatesthelargeburdenoflogisticscostsbornebyconsumers, contractors, and public projects.

The constructionof a cementplant in Wamenaisthereforeconsidered a strategicalternativetoreducedistributioncosts, stabilizesupply, support regional infrastructureprograms, andstrengthenlocaleconomicindependence. A localcementplantcouldalsocreateemployment, stimulatesupportingbusinesses, andincrease local government revenue(Gallego Dávila and Aagesen 2024). Nevertheless, investment in a cementplantiscomplex. Investorsmustconsidermarketdemand, raw material availability, productioncosts, accesstoenergy, transportationinfrastructure, governmentpolicy, socialacceptance, indigenouslandrights, and environmental impacts(Akintayo, Olanrewaju, and Olanrewaju 2024).

This study focusesonthreemajorquestions. First, whatfactorssignificantlyinfluenceinvestors' decisionstoinvest in theconstructionof a cementplant in Wamena? Second, howfeasibleistheprojectfromeconomic, social, andenvironmentalperspectives? Third, whatchallengesandopportunitiesshouldbeconsidered in realizingtheinvestment? By answeringthesequestions, the study providesanintegratedunderstandingofinvestmentdecision-making in a geographicallydifficultandsociallysensitive region.

2. 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 theoryofindustriallocationalsoprovidesanimportantanalytical frameworkfour 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'stheoryemphasizesthatindustriallocationisdeterminedbytheminimizationoftransportationandlaborcosts. In thecementindustry, rawmaterialssuch as limestoneandclay are heavyandlocalized; therefore, proximitytorawmaterials can reduce transportation costs(E., Friedrich, and Cooke 1930). However, modern industriallocationtheoryexpandsthisviewbyincludingagglomeration, accesstomarkets, energysupply, governmentpolicy, and social-environmental factors(Blair and Premus 1987). Thesevariables are especiallyrelevant in Wamena, whereroadaccess, electricitystability, andsocialacceptancestrongly affect the investment calculation.

Previousstudiesshowthatprivateinvestmentisinfluencedbyinterestrates, inflation, gross regional domesticproduct, publicexpenditure, laboravailability, andinfrastructure. Studiesonthecementindustryalsohighlightthatproductionefficiency, marketconcentration, andsupply-chainreliabilitydetermine competitiveness(Du, Zhao, and Zhu 2022). In thePapuancontext, socialandculturaldimensions are equallyimportantbecausemanypotentialindustriallocationsintersectwithindigenouslandandcustom aryauthority. Therefore, this study combineseconomic, social-environmental, andinfrastructurevariablestoassesstheir influence on investment decisions.

3. 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 obtainedthroughinterviews, questionnaires, andfieldobservations. Interviewrespondentsincludedlocalgovernmentofficials, communityleaders, indigenousrepresentatives, contractors, building material distributors, andotherstakeholdersinvolved in regional developmentandinvestment. Questionnaires were distributedtorespondentswhounderstoodlocaleconomicconditions, infrastructurereadiness, socialacceptance, andtheinvestmentclimate. Fieldobservations were conductedtounderstandgeographicconditions, roadaccess, andthepotential availability of production-supporting resources.

Secondary data were collectedfromgovernmentdocuments, officialstatistics, regional planningdocuments, previousstudies, andacademicliteraturerelatedtoinvestment, industriallocation, cementproduction, infrastructure, andsocial-environmentalrisk. Qualitative data were analyzedthroughreduction, presentation, andconclusiondrawing. Quantitative data were analyzedusingPartialLeastSquares - StructuralEquation Modeling (PLS-SEM). The variablesused in the model were EconomicFactor (FE), SocialandEnvironmentalFactor (SL), Infrastructure Factor (INF), and Investment Decision (KI). Eachconstructwasmeasuredusingmultipleindicatorson a Likertscale.

Financial feasibilitywasevaluatedusing Net PresentValue (NPV), Internal Rate ofReturn (IRR), BenefitCostRatio (BCR), andPaybackPeriod. Theseindicators were usedtoassesswhethertheprojectedbenefitsofthecementplantcouldcoverinvestmentandoperationalcostsundertheassumptionsused in the study.

4. 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.

Regardingcementprices, 95 respondentsor 86% agreedthatthecurrentpriceofcement in Wamena, rangingfromapproximately Rp400,000 to Rp600,000 per sack, indicates a stronginvestmentopportunity. However, 15 respondentsor 14% arguedthatthecurrentpriceshould not betheonly basis forinvestmentbecauselocalproductionwouldlikelyreduceprices in thefutureandchangemarketconditions.

In termsofraw material availability, 102 respondentsor 93% statedthatlimestone, sand, andothersupportingmaterials are abundant in Wamena. Only 8 respondentsor 7% expresseduncertainty, mainlybecauseraw material sustainabilitydependsonthelengthofoperationandproduction capacity of the plant.Public perception also revealed socialrisks. Around 72% ofrespondentsconsideredthepotentialforsocialconflicttobehigh, especiallybecausetheprojectmayinvolveindigenousland. Communityacceptancethereforedependsonconsultation, respectforcustomaryrights, transparentbenefitsharing, andclearenvironmentalsafeguards.

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 plantisassumedtooperate as a grindingplantwithcoreequipmentsuch as a ballmillorverticalrollermill, storagesilos, packagingsystems, andsupportinginfrastructure. This model isrelativelymorerealisticthan a fullyintegratedplantbecauseitfocusesonclinkergrindingandcementpackaging. However, theprojectstillrequiresreliableenergysupplyandefficientlogistics.

Coal isanimportantenergycomponent. For 200,000 tonsofcement per year, clinkerdemandisestimatedat 190,000 tons. Coal demandrangesfrom 13,300 tonsto 25,270 tons per year, dependingonthefuelconsumptionscenario. The annualcoalcostisestimatedbetween Rp22.77 billionand Rp52.11 billion. In addition, coalshipmentfrom Kalimantan toWamenainvolvesseatransportto Jayapura androadtransporttoWamena, withlogisticscostsestimatedat Rp16,000 to Rp17,000 per kilogram in the study scenario. Theselogisticsconstraintsconfirmthatenergyandtransportationremaincriticalrisks.

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 discriminantvaliditytestusingtheHeterotrait-MonotraitRatio (HTMT) alsoshowedacceptableresults. All HTMT values were below 0.90, indicatingthattheconstructs were empiricallydistinct. Thus, themeasurement model wassuitableforstructural model evaluation.

The R-squarevaluefor Investment Decisionwas 0.537, whiletheadjusted R-squarewas 0.524. ThismeansthatEconomicFactor, Infrastructure, andSocialandEnvironmentalFactortogetherexplain 53.7% ofthevariance in investmentdecisions. The remaining 46.3% maybeexplainedbyothervariables not included in the model, such as nationalpolicychanges, financingstructure, security conditions, or macroeconomic dynamics.

Table 1 PLS-SEM StructuralResults.

Relationship	Path Coefficient	T-statistic	P-value	Interpretation

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 resultsindicatethatallthreefactorshavepositiveandsignificanteffectsoninvestmentdecisions. EconomicFactoristhemostdominantvariable, followedbySocialandEnvironmentalFactorand Infrastructure. The structuralequationcan be expressed as follows:

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

Thismeansthatimprovements in economicconditions, infrastructurereadiness, andsocial-environmentalmanagementincreasethelikelihoodofpositiveinvestmentdecisions. The dominanceofeconomicfactorsislogicalbecauseinvestorsprimarilyevaluatemarketpotential, productioncosts, raw material availability, andexpectedreturns. However, thestrongcoefficientofsocialandenvironmentalfactorsshowsthat in Wamena, communityacceptance, indigenouslandrights, andenvironmentalcontrol are almost as important as financialconsiderations.

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.

Basedontheseassumptions, annualrevenuewasestimatedat Rp419.84 billion, whileannualproductioncostwas Rp253 billion. The estimatedannual net cashflowwas Rp166.84 billion. Nevertheless, whendiscounted over theprojectperiod, thefinancialindicatorsshowthattheinvestment is not yet feasible.

Table 2 Financial FeasibilityIndicators.

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

Indicator	Result	Feasibility Interpretation
		< 1
Payback Period	8.63 years	Long recovery period

The negative NPV indicatesthatthepresentvalueofbenefitsislowerthantheinvestmentcost. The IRR ofapproximately 4.5% isbelowtheassumedinvestmentbenchmarkof 10%, indicatingthatprojectreturns are not attractiveundercurrentassumptions. The BCR of 0.86 meansthatbenefits are smallerthancosts. The PaybackPeriodof 8.63 yearsisrelatively long andincreasestheriskforinvestors, especially in a region withhigh logistics and social risks.

Therefore, theprojectis not financiallyfeasiblewithoutintervention. Severalstrategiesmayimprovefeasibility: reducinginitialinvestment, increasingproductionscale, securingenergysubsidies, usinglower-costfinancing, obtaininggovernmentparticipation, andimprovinglogisticsefficiency. Governmentsupportmayincludetaxincentives, landfacilitation, infrastructuredevelopment, 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.

Environmentalfeasibilityalsorequiresstrictmitigation. Cementproductionandrelatedminingactivitiescangeneratedustemissions, landscapechanges, wateruseissues, waste, andbiodiversityimpacts. The projectmustthereforecomplywithenvironmentalregulations, conduct a comprehensiveenvironmentalimpactassessment, implementdustandemissioncontrols, managewasteproperly, 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.

Basedonthesefindings, a phasedinvestmentstrategyisrecommended. The projectshould not proceeddirectly as a full-scalecommercialplantwithoutimprovingfinancialfeasibility. A morerealisticpathwayistobeginwith a smalleror modular plant, securegovernmentsupport, establish a customarylandagreement, prepareanenvironmentalmanagement plan, anddevelopanindependentenergystrategy. After theseprerequisites are fulfilled, theprojectmaybeexpandedgradually.

5.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.

Fromthefinancialperspective, theprojectis not yetfeasibleundertheassumptionsused in the study. The projectshows a negative NPV ofapproximately Rp414.84 billion, an IRR ofaround 4.5%, a BCR of 0.86, and a PaybackPeriodof 8.63 years. Theseresultsshowthattheexpectedbenefits are not sufficienttocoverthehighinvestmentandoperationalrisks. However, fromthesocialandenvironmentalperspectives, theprojectisconditionallyfeasibleifsupportedbystronggovernmentpolicy, communityparticipation, respectforindigenouslandrights, effectiveconflictmanagement, andconsistentenvironmentalmitigation.

The realizationof a cementplantinvestment in Wamenathereforerequiresanintegratedstrategy. Investorsshouldconduct a deeperfeasibility study, especiallyonenergysupply, raw material reserves, logistics, andfinancingstructure. Localgovernmentshouldprovide legal certainty, spatialplanningclarity, infrastructuresupport, andfacilitationofdialoguewithindigenouscommunities. Future studies are recommendedtoanalyzethecementsupplychainusing a multimodaltransport model toidentifythemostefficientdistributionsystemforWamena and surrounding highland districts.

6. Recommendation

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

1. Investorshouldconduct a morecomprehensivefeasibility study coveringraw material reserves, energysupply, logisticscosts, productioncapacity, sellingprice, andfinancingstructure.
2. The localgovernmentshouldprovide legal certainty, clearspatialplanning, streamlinedlicensingprocedures, basicinfrastructuresupport, andfacilitationofdialoguewithindigenouscommunities.
3. Supportinginfrastructure, includingroads, electricity, rawwatersupply, telecommunications, andlogisticssystems, shouldbeprioritizedtoreduceproductionanddistributioncosts.
4. Localcommunitiesandindigenouslandownersshouldbeinvolvedfromtheplanningstagethrou ghconsultation, compensation, benefit-sharingmechanisms, andfairemploymentopportunities.
5. Environmentalaspectsshouldbemanagedthrough a rigorousenvironmentalimpactassessment, emissioncontrol, wastemanagement, landreclamation, andregularenvironmentalmonitoring.
6. A partnershipschemeinvolvingthegovernment, investors, regional-ownedenterprises, andlocalcommunitiesshouldbeconsideredtoimprovethefinancialfeasibilityoftheproject.

7. Future studiesshouldanalyzethecementsupplychainusing a multimodaltransport model toidentifythemostefficientdistributionsystemforWamenaandthesurroundinghighlandregions.
8. Furtherresearchshouldincludeadditionalvariablessuch as securityrisks, localworkforcereadiness, marketcapacity, governmentpolicy, andenergypricestabilitytoprovide a morecomprehensiveinvestmentanalysis.

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