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Feasibility Analysis of Financial Aspect in Determining Optimal Last Mile Warehouse Location Using P-Median Method

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ABSTRACT
This research was conducted at a company engaged in the Iot Aquaculture sector with a product in the form of a shrimp smart feeder which was distributed to almost all islands in Indonesia. Based on an assessment made by the company in the product distribution aspect on the island of Sumatra, especially Bengkulu Province, it is considered still not optimal because there are still a number of cases where the last mile point is not able to meet the demand so that a decision is made to send it directly through the central distribution warehouse in the city of Bandung. This has an impact on the total distance and shipping costs to be large. Therefore, it is necessary to design long-term strategic steps in overcoming this, one of which is determining the location of the warehouse as a lastmile point to meet demand in the Bengkulu area with an optimal location by considering aspects of optimal location and financial feasibility. The method used in this study is a feasibility analysis using the calculation of the Net Present Value, Payback Period, and IRR, as well as determining the optimal location using the P-Median method with the Mixed Integer Linear Programming approach that used in parallel. The results showed that the location with the lowest demand-weighted distance and was declared feasible based on the feasibility analysis which was located in Kaur Regency. If this decision is made, the company can reduce the total cost of shipping the Bengkulu area that must be incurred by the company.

Keywords: *P-Median, Warehouse Location, Integer Linear Programming*

1. INTRODUCTION

Competition in the industrial sector over time continues to be tight so that it requires every company to be able to design strategies in order to superior in the market and be able to compete with competitors. In designing a strategy to carry out its business activities, it is expected to be able to provide added value for both parties, both internal to the company and consumers, as well as quality improvement. Quality improvement is not only done by making improvements to the product, but can also be done by improving distribution management and warehousing management, both of which are part of improving the company's logistics management [1]

The purpose of distribution management, especially in the supply chain, is cost optimization. There are components of distribution costs including Direct Selling Expense, Advertising and Sales Promotion Expense, Transportation Expense, Werehousing and Storage Expense, General Distribution Costs Distribution Expenses) [2]. In general, there are several ways to reduce delivery time and delivery costs, one of the ways to reduce shipping costs is to determine the location of the facility [3].

In this case, the largest component of distribution costs at the IoT Aquaculture company is transportation costs where this cost accounts for 39.5% of the total distribution costs compared to other cost components where the transportation cost component of distribution costs still exceeds the company's target of 30%. This is because there are still several parameters for evaluating the distribution aspect by operational management in several market areas, such as in this case the focus example on Sumatra Island, especially the market in Bengkulu Province which is considered not

optimal. This problem arises because of the high demand from consumers who could not fulfill the existing last mile point warehouse because the location of the facility did not have sufficient capacity at that time so they decided to send it from the central warehouse in Bandung City and use it. Other lastmile points create considerable distance. This is also compounded by the reason that the initial site selection did not consider the site selection criteria, both proximity to potential markets, etc[4], so the company has not researched whether the existing location in the Bengkulu area is optimal apart from the capacity being too small.

This study was conducted in parallel to solve this case by using the P-Median with MILP approach to determine the optimal location that minimizes the demand-weighted distance and Feasibility Analysis with parameters NPV, PBP, and IRR. This settlement process is carried out in parallel with a goal based on the P-Median calculation to obtain optimal location results that minimize the demand-weighted distance, then all alternative locations are carried out with a financial aspect feasibility analysis to see the performance of the location when a rental decision is made whether it is profitable or not.

2. METHODS

2.1 Location Model Taxonomy

The location selection process has several location models which are divided into 4 namely analytical models, continuous models, networks models, and discrete models[5].

a. *Analytics Mode*
   The analytical model is the easiest to use site selection model. This model assumes that demand is uniformly distributed in the service area and the location of the facility can be anywhere within the area. This model can be solved by calculus or other simple techniques [5].
b. *Continuous Model*
   The location problem that is included in the continuous model is when the facility and the point of demand are a continuous one. The tools to solve this problem are analysis and geometry. The continuous model depends on the optimization process on linear and nonlinear programming [6].
c. *Network Models*
   The assumption of the network model is that a network has a number of requests. The depiction of this model is the interconnectedness between the point of request and the point of location. In the network model, the facility location can be located anywhere on the network and requests will only appear on nodes. In various studies and literature the focus of this model is on finding polynomial time algorithms with structured network cases [5].
d. *Discrete location model*
   A model that has limitations that demand arises at a point and that point can be used as an alternative location [5]. There are 3 types of discrete location models:
   i. *Covering based models*
      Set covering, max covering, and P-center
   ii. *Median based models*
      P-Median and Fixed Charge
   iii. *Other Models*
      P-Dispersion

2.2 P-Median

The P-median problem is a model that determines a location with the aim of minimizing the average distance between the demand point and the facility location. There are several studies conducted by implementing the P-Median model, among others which compares the P-Median model with the P-Center model, max covering, and set covering [5]. The formulation model used in the comparison of these methods is a standard formulation model for each model, the conclusion is that the P-Median model is more commonly used with urgency when transportation costs aim to be minimized, besides that P-Median is used for distribution planning because the P-Median considers demand and distance and can place facilities in more congested areas than other models. In this study, the P-median model used as the initial basis is the P-Median model proposed by Daskin using the Mixed Integer Linear Programming approach [5]. This MILP approach has been widely used in solving optimization problems with the impact of reducing transportation costs as in the study by [7] to schedule cement transport vessels using MIRP with the MILP approach to minimize waiting time and transportation costs. The following is the P-Median equation of the MILP approach which is the reference for this research based on Daskin's research.

Minimize :	$\sum j \in J \sum i \in I \; hidijYij$	(1)
Subject to :	$\sum j \in J Yij = 1 \; \forall i \in I$	(2)
	$\sum j \in J Xj = p$	(3)
	$Yij - Xj \leq 0 \; \forall i \in I \; ; \forall j \in J$	(4)
	$Xj \in \{0,1\} \; \forall i \in J$	(5)
	$Yij \in \{0,1\} \; \forall i \in I \; ; \forall j \in J$	(6)

Description:

I = union of demand points i,

I = {1,...n}
J = concatenation of candidate point locations j,
J = {1,...m}
dij = distance from alternative location i to customer j
hi = customer demand i
p = number of alternative facilities to be opened
Xj = { 1, if the facility is opened on alternative j
0, otherwise
Yij = { 1, if demand i can be satisfied by alternative j 0, otherwise

2.3 *Feasibility Study*

A business feasibility study is a science that has the aim of finding out whether a business is feasible or not feasible (feasible or infeasible) to be carried out by placing measures both qualitatively and quantitatively [8]. According to [9] the purpose of the feasibility study is to carry out the process of evaluating alternative system solutions and to propose the most feasible business applications.

There are several aspects in the feasibility study which are the focus of attention, namely non-financial aspects (legal, market aspects, operational or technical aspects, organizational or management aspects, economic and social aspects, & environmental impact aspects) and financial aspects [10]. The feasibility of a business can be seen through the financial aspect by using formula of Net Present Value, Payback period, and IRR.

2.3.1 Net Present Value

Net Present Value is the gap between the present value of cash in and cash out of cashflow over a period of time [11].So, the calculation of NPV relies on cash flow techniques. The formula for calculating NPV is as follows.

$$NPV = \sum_{n=0}^{N}(Rn - Dn)(\frac{p}{f}, i\%, n) \qquad (7)$$

Description:
NPV : Net Present Value
Rn : Cash inflow
Dn : Cash outflow
(p/f,i%,n) : Present and future factor with i% interest rates

These are the criteria:
If NPV > 0, project proposals are worth to be considered.
If NPV < 0, project proposals are rejected.
If NPV = 0, then the value of the company is 0 or same as capital, even though the project proposal was accepted/rejected.

2.3.2 Payback Period

Payback Period (PBP) is the time span for which the initial fee is refunded. Below is how to calculate PBP [12].

$$Payback\ Period = \frac{Investment}{cashflow} \qquad (8)$$

Criteria:
if the payback period < return on investment target, that's means feasible. If payback period > target return on investment, that's means not feasible.

2.3.3 Internal Rate of Return (IRR)

According to [12], that the Internal Rate of Return is implemented to find a suitable interest rate equates the present value of expected future cash flows, or cash receipts with make an initial investment. An investment plan is feasible if the IRR level exceeds the minimum level required by the investor. Vice versa, the investment plan is considered unfeasible. In other words, the investment requirements can be said to be feasible if:
IRR > MAR. The formula used to get the Internal Rate of Return is as follows:

$$IRR = i1 + \frac{NVV\ rr}{TVP\ rr + TVP\ rt} x\ (i2\text{-}i2) \qquad (9)$$

Notation:
$i1$: Positive NPV
$i2$: Negative NPV
Selection Criteria:
If the IRR > of the required interest rate, that's means is feasible
If the IRR < than the required interest rate, that's means is less or not feasible [12]

2.4 Solution steps

The initial step in this research is the criteria for market potential and other aspects that have been adjusted to the company's circumstances, which are then carried out several calculations to get three regencys or cities in the Bengkulu region which will be the focus of research using pairwise comparisons. The next stage, which is carried out in parallel, is to perform calculations to obtain an optimal alternative area using the P-Median Method. Then an investment study was conducted in three alternative locations using NPV, PBP and IRR and finally a decision-making process was carried out to determine the best and optimal location based on the criteria of each method. The following is the data needed in the solution.

3. RESULTS AND DISCUSSION

First, there are three criteria in determining the location used to determine alternatives based on market potential and other aspects that have been determined by the company, namely the number of shrimp farmers, the number of shipping companies, and the number of rental buildings. The number of alternative locations that were chosen after being discussed with the company were three regencies or cities, which at the end of the study, 1 rental location was selected.

Table 1. Method and data used

Method	Data
Pairwise Comparion	1. Bengkulu province (city and regency) data 2. Number of shrimp farmers in each city and regency 3. Number of shipping expeditions in each city and regency 4. Number of building tenants in each city and regency
P-Median	1. Demand data Bengkulu 2. Distance between rental facility point and demand point
Feasibility Analysis	1. Market aspect (demand and sales plan) 2. Management aspect (manpower needed and salaries) 3. Technical aspect (tangible assets, depreciation, operational cost, and transportation cost

The steps taken to determine alternative locations are the calculation of pairwise comparisons, the calculation of the rating value, and the calculation of the weighted value. The results of these calculations will obtain three alternative regions. The following is a calculation using pairwise comparisons from 10 regions, only 3 regions will be selected as below.

Based on the results obtained through the above calculations, three alternative regions were selected. The next process from each alternative city or regency is to look for building rental locations from several rental locations in each alternative area, adjusted to the minimum specifications of the building area that have been set by the company so that the building rental location is selected as follows.

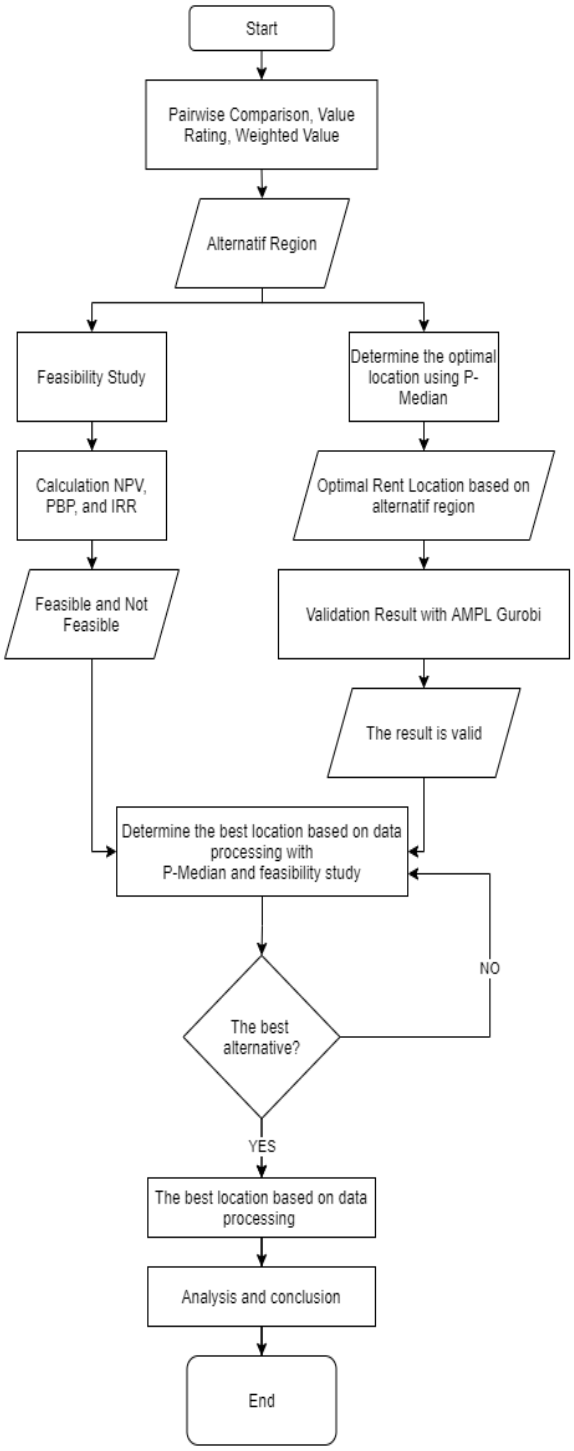

Figure. 1 Research Flowchart

Table 2. Weighted Values for each Region

No	Regency/City	SB	a	EP	b	RM	c	Weighted Value
1	Bengkulu Selatan	2.446	0.703	7.083	0.182	8.642	0.115	4.004
2	Bengkulu Tengah	17.839	0.703	3.333	0.182	4.938	0.115	13.713
3	Bengkulu Utara	18.960	0.703	6.250	0.182	4.938	0.115	15.033
4	Kaur	25.841	0.703	10.417	0.182	12.346	0.115	21.479
5	Kepahiang	7.135	0.703	5.000	0.182	9.877	0.115	7.061
6	Lebong	0.000	0.703	2.917	0.182	6.173	0.115	1.241
7	Mukomuko	10.448	0.703	10.000	0.182	9.877	0.115	10.301
8	Rejang Lebong	0.000	0.703	9.167	0.182	12.346	0.115	3.089
9	Seluma	10.245	0.703	1.667	0.182	6.173	0.115	8.213
10	Bengkulu	7.085	0.703	44.167	0.182	24.691	0.115	15.866

Yn = Weighted value of the regency or city
a = Weight of interest (priority vector) criteria for the number of cultivators
b = Weight of importance criteria number of shiping companies
c = The weight of the importance of the criteria for the number of building leases
SB = Rating of the number of shrimp farmers in the city or regency
EP = Rating of the number of construction delivery expeditions in the city or regency
RM = Rating of the number of rental buildings in the nth city or regency

3.1. P-Median

The first thing to do in the P-Median calculation is to need data as input, namely demand data and the distance from each alternative point of the facility location to each point of demand. The following is the demand data and the distance from each alternative location to the point of demand.

Table 3. The result of alternative rent location

Regency/City	Address	Rent Cost/year
Kaur	Jl Raya Pagar Dewa No 87	Rp24,000,000
Bengkulu	Jl Manggis (Pasar Pano-rama) No 36A	Rp23,000,000
North Bengkulu	Jl Arga Makmur No 120	Rp43,250,000

Table 4. Demand data

No	Customer Name	Qty
1	PT. DUA PUTRA PERKASA PRATAMA	20
2	PT. GLOBAL FEED	14
3	EKO TEGUH HARIYANTO	18
4	MUNAWIR	12
5	PT EHT	12
6	BAMBANG KS	22
7	PT EHT B	22
8	BUDI S	15
9	JOKO SUGIANTORO	25
10	PT. GLOBAL FEED B	8
11	PT SENTOSA	6
12	NYOMAN	14
13	PT SENTRA	5
14	PT LAUT BIRU	26
15	PT INTERACO LAUT BIRU	6
16	SOFYAN	11
17	PT EVERGREEN	11

Table 5. Distance data from alternative rental locations to the point of demand

No	Customer Name	Kaur	Bengkulu	North Bengkulu
1	PT. DUA PUTRA PERKASA PRATAMA	168	10	72
2	PT. GLOBAL FEED	86	110	164
3	EKO TEGUH HARIYANTO	38	207	268
4	MUNAWIR	43	147	205
5	PT EHT	50	148	200
6	BAMBANG KS	33	202	263
7	PT EHT B	50.5	148.3	200.7
8	BUDI S	211	40	28
9	JOKO SUGIANTORO	30	203	264
10	PT. GLOBAL FEED B	86.3	111	164.6
11	PT SENTOSA	205	40	28
12	NYOMAN	206	42	29
13	PT SENTRA	122	73	126
14	PT LAUT BIRU	202	30.5	34.1
15	PT INTERACO LAUT BIRU	53.5	141	193
16	SOFYAN	203	33	35
17	PT EVERGREEN	29	199	260

And then this the distance data between demand and alternative rental location that will be process in *P-Median.* Based on the results of the weighted values shown in Table 6.

Table 6. The Result of P-Median Calculation

No	Location	Demand-Weighted Distance	Rank
1	Kaur Regency (Jl. Raya Pagar Dewa No 87)	25655	1
2	Bengkulu City (Jl Manggis (Pasar Panorama) No 36A)	28660	2
3	Bengkulu Utara Regency (Jl Arga Makmur No 120)	38452	3

Three regencies or cities were chosen as alternatives, namely Kaur Regency, Bengkulu City, and North Bengkulu Regency. After determining the three selected alternative locations, then determining the optimal area for each selected regency and city using the P-Median Method with the MILP approach and the criterion being considered is the smallest demand-weighted distance. The results are shown in the table below.

The next process is a validation process to check whether the calculation results are the same using the Gurobi AMPL program as shown in the following figure.

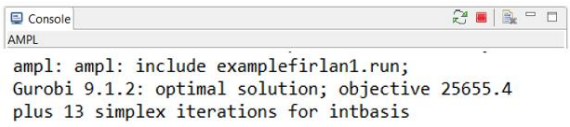

Figure 2 Validation of P-Median Calculation between Excel Solver and AMPL

Based on the validation results showing the similarity of the results, the results can be said to be valid with the first optimal location chosen, namely warehouse rental in Kaur Regency.

3.2 Feasibility Study

The next parallel step is to carry out an investment feasibility analysis of each alternative rental location previously determined. This investment feasibility study will be processed using the calculation of Net Present Value (NPV), Payback period, and IRR with the criteria considered are NPV > 0, Payback Period < 5 years, and IRR > MARR.

In the calculation of the feasibility analysis, it is necessary to need data in the investment that will be carried

Table 7. Sales Plan

Period		0	1	2	3	4	5
Regency/City	Demand 2020	2021	2022	2023	2024	2025	2026
Kaur	76	84	93	103	114	126	139
Bengkulu	20	22	25	28	31	35	39
North Bengkulu	72	80	88	97	107	118	130
Seluma	27	30	33	37	41	46	51
Central Bengkulu	52	58	64	71	79	87	96
TOTAL	247	274	303	336	372	412	455

out based on several aspects such as market, management, and technical aspects. The following is the market aspect data that is projected for the next 5 years with inflation of 10% (based on the growth of target customer of this product).

The following is a profit and loss report for alternative rental locations in Kaur Regency which provides information related to income data originating from revenue and expenditure data on costs.

Then the last step is to calculate the feasibility analysis using the NPV, PBP, and IRR parameters from each alternative rental location. The following is an analysis of rental location in Kaur regency.

Table 8. Profit and loss Kaur Regency

Profit and Loss (Kaur)			
Year	2022	2023	2024
Revenue	Rp 256,214,281.46	Rp 292,102,545.65	Rp 332,486,765.81
Cost			
Building Depreciation Cost	Rp -	Rp -	Rp -
Facility Depreciation Cost	Rp 4,286,000.00	Rp 4,286,000.00	Rp 4,286,000.00
Labor Cost	Rp 197,531,317.76	Rp 211,359,000.00	Rp226,155,000.00
Rental Cost	Rp 24,000,000.00	Rp 24,674,400.00	Rp 25,367,750.64
Electricity Cost	Rp 7,200,000.00	Rp 7,402,320.00	Rp 7,610,325.19
Internet Cost	Rp 4,800,000.00	Rp 4,934,880.00	Rp 5,073,550.13
Petty Cash	Rp 12,000,000.00	Rp 12,337,200.00	Rp 12,683,875.32
Transportation Cost	Rp 14,188,210.83	Rp 15,607,031.91	Rp 17,167,735.10
Total Cost	Rp264,005,528.59	Rp 280,600,831.91	Rp 298,344,236.38
EBIT (Earning Before Interest and Tax)	Rp(7,791,247.12)	Rp 11,501,713.74	Rp 34,142,529.43
Interest Rate	Rp -	Rp -	Rp -
EBT (Earning Before Tax)	Rp(7,791,247.12)	Rp11,501,713.74	Rp 34,142,529.43
Tax	Rp (78,000.00)	Rp 115,000.00	Rp 341,000.00
EAIT (Earning After Interestand Tax)	Rp(7,713,247.12)	Rp 11,386,713.74	Rp33,801,529.43
Depreciation	Rp 4,286,000.00	Rp 4,286,000.00	Rp 4,286,000.00
EAT	Rp(3,427,247.12)	Rp 15,672,713.74	Rp 38,087,529.43

Table 8 (continued..)

Profit and Loss (Kaur)		
Year	2025	2026
Revenue	Rp 378,585,519.62	Rp 429,846,642.20
Cost		
Building Depreciation Cost	Rp -	Rp -
Facility Depreciation Cost	Rp 4,286,000.00	Rp 4,657,557.70
Labor Cost	Rp 241,987,000.00	Rp 258,928,000.00
Rental Cost	Rp 26,080,584.43	Rp 26,813,448.86
Electricity Cost	Rp 7,824,175.33	Rp 8,044,034.66
Internet Cost	Rp 5,216,116.89	Rp 5,362,689.77
Petty Cash	Rp 13,040,292.22	Rp 13,406,724.43
Transportation Cost	Rp 18,884,508.61	Rp 20,772,959.47
Total Cost	Rp 317,318,677.47	Rp 337,985,414.88
EBIT (Earning Before Interest and Tax)	Rp 61,266,842.14	Rp 91,861,227.32
Interest Rate	Rp -	Rp -
EBT (Earning Before Tax)	Rp 61,266,842.14	Rp 91,861,227.32
Tax	Rp 613,000.00	Rp 919,000.00
EAIT (Earning After Interes-tand Tax)	Rp 60,653,842.14	Rp 90,942,227.32
Depreciation	Rp 4,286,000.00	Rp 4,657,557.70
EAT	Rp 64,939,842.14	Rp 95,599,785.02

Table 9. Profit and loss Bengkulu City

Profit and Loss (Bengkulu)			
Year	2022	2023	2024
Revenue	Rp256,214,281.46	Rp292,102,545.65	Rp332,486,765.81
Cost			
Building Depreciation Cost	Rp -	Rp -	Rp -
Facility Depreciation Cost	Rp3,904,750.00	Rp 3,904,750.00	Rp3,904,750.00
Labor Cost	Rp197,531,317.76	Rp211,359,000.00	Rp 226,155,000
Rental Cost	Rp 23,000,000.00	Rp 23,646,300.00	Rp 24,310,761.03
Electricity Cost	Rp 7,200,000.00	Rp 7,402,320.00	Rp 7,610,325.19
Internet Cost	Rp 4,800,000.00	Rp 4,934,880.00	Rp 5,073,550.13
Petty Cash	Rp 12,000,000.00	Rp12,337,200.00	Rp 12,683,875.32
Transportation Cost	Rp 15,163,349.62	Rp 16,679,684.58	Rp 18,347,653.04
Total Cost	Rp 263,599,417.38	Rp280,264,134.58	Rp 298,085,914.71
EBIT (Earning Be-fore Interest and Tax)	Rp (7,385,135.92)	Rp11,838,411.07	Rp 34,400,851.10
Interest Rate	Rp -	Rp -	Rp -
EBT (Earning Before Tax)	Rp(7,385,135.92)	Rp11,838,411.07	Rp 34,400,851.10
Tax	Rp (74,000.00)	Rp 118,000.00	Rp 344,000.00
EAIT (Earning After Interestand Tax)	Rp(7,311,135.92)	Rp 11,720,411.07	Rp 34,056,851.10
Depreciation	Rp 3,904,750.00	Rp 3,904,750.00	Rp 3,904,750.00
EAT	Rp(3,406,385.92)	Rp15,625,161.07	Rp 37,961,601.10

Table 9 (continued)

Profit and Loss (Bengkulu)		
Year	2025	2026
Revenue	Rp 378,585,519.62	Rp 429,846,642.20
Cost		
Building Depreciation Cost	Rp -	Rp -
Facility Depreciation Cost	Rp 3,904,750.00	Rp 4,243,256.75
Labor Cost	Rp 241,987,000.00	Rp 258,929,000.00
Rental Cost	Rp 24,993,893.41	Rp 25,696,221.82
Electricity Cost	Rp 7,824,175.33	Rp 8,044,034.66
Internet Cost	Rp 5,216,116.89	Rp 5,362,689.77
Petty Cash	Rp 13,040,292.22	Rp 13,406,724.43
Transportation Cost	Rp 20,182,418.35	Rp 22,200,660.18
Total Cost	Rp 317,148,646.19	Rp 337,882,587.61
EBIT (Earning Before Interest and Tax)	Rp 61,436,873.43	Rp 91,964,054.60
Interest Rate	Rp -	Rp -
EBT (Earning Before Tax)	Rp 61,436,873.43	Rp 91,964,054.60
Tax	Rp 614,000.00	Rp 920,000.00
EAIT (Earning After Interest and Tax)	Rp 60,822,873.43	Rp 91,044,054.60
Depreciation	Rp 3,904,750.00	Rp 4,243,256.75
EAT	Rp 64,727,623.43	Rp 95,287,311.35

Table 10. Profit and loss North Bengkulu Regency

Profit and Loss (North Bengkulu)			
Year	2022	2023	2024
Revenue	Rp 256,214,281.46	Rp 292,102,545.65	Rp332,486,765.81
Cost			
Building Depreciation Cost	Rp -	Rp -	Rp -
Facility Depreciation Cost	Rp 3,523,500.00	Rp3,523,500.00	Rp3,523,500.00
Labor Cost	Rp197,531,317.76	Rp211,359,000.00	Rp226,155,000.00
Rental Cost	Rp 43,750,000.00	Rp 44,979,375.00	Rp 46,243,295.44
Electricity Cost	Rp 7,200,000.00	Rp 7,402,320.00	Rp7,610,325.19
Internet Cost	Rp 4,800,000.00	Rp 4,934,880.00	Rp 5,073,550.13
Petty Cash	Rp 12,000,000.00	Rp12,337,200.00	Rp12,683,875.32
Transportation Cost	Rp20,376,353.23	Rp 22,413,988.55	Rp24,655,387.41
Total Cost	Rp289,181,170.99	Rp306,950,263.55	Rp 325,944,933.48
EBIT (Earning Before Interest and Tax)	Rp(32,966,889.52)	Rp(14,847,717.90)	Rp 6,541,832.33
Interest Rate	Rp -	Rp -	Rp -
EBT (Earning Before Tax)	Rp (32,966,889.52)	Rp(14,847,717.90)	Rp 6,541,832.33
Tax	Rp (330,000.00)	Rp (148,000.00)	Rp 65,000.00
EAIT (Earning After Interest and Tax)	Rp(32,636,889.52)	Rp (14,699,717.90)	Rp6,476,832.33
Depreciation	Rp 3,523,500.00	Rp 3,523,500.00	Rp3,523,500.00
EAT	Rp(29,113,389.52)	Rp (11,176,217.90)	Rp10,000,332.33

Table 10. (continued)

Profit and Loss (North Bengkulu)		
Year	2025	2026
Revenue	Rp 378,585,519.62	Rp 429,846,642.20
Cost		
Building Depreciation Cost	Rp -	Rp -
Facility Depreciation Cost	Rp 3,523,500.00	Rp 3,828,955.80
Labor Cost	Rp 241,987,000.00	Rp 258,929,000.00
Rental Cost	Rp 47,542,732.04	Rp 48,878,682.81
Electricity Cost	Rp 7,824,175.33	Rp 8,044,034.66
Internet Cost	Rp 5,216,116.89	Rp 5,362,689.77
Petty Cash	Rp 13,040,292.22	Rp 13,406,724.43
Transportation Cost	Rp 27,120,926.15	Rp 29,833,018.76
Total Cost	Rp 346,254,742.62	Rp 368,283,106.23
EBIT (Earning Before Interest and Tax)	Rp 32,330,777.00	Rp 61,563,535.98
Interest Rate	Rp -	Rp -
EBT (Earning Before Tax)	Rp 32,330,777.00	Rp 61,563,535.98
Tax	Rp 323,000.00	Rp 616,000.00
EAIT (Earning After Interestand Tax)	Rp 32,007,777.00	Rp 60,947,535.98
Depreciation	Rp 3,523,500.00	Rp 3,828,955.80
EAT	Rp 35,531,277.00	Rp 64,776,491.78

Table 11. Feasibility Analysis Kaur Regency

Year	2021	2022	2023
Period	0	1	2
Initial Cash Flow (Cash Out)	Rp82,073,882		
Operational Cash Flow (Cash In)	Rp -	Rp(3,427,247)	Rp15,672,714
Salvage Value			
Working Capital			
Net Cash	Rp (82,073,882)	Rp(3,427,247)	Rp15,672,714
P/f Factor	1	0.9095	0.8272
NPV	Rp (82,073,882)	Rp(3,117,096)	Rp12,964,439
NPV Cumulative	Rp (82,073,882)	Rp (85,190,978)	Rp(72,226,539)

Table 11 (continued)

Year	2024	2025	2026
Period	3	4	5
Initial Cash Flow (Cash Out)			
Operational Cash Flow (Cash In)	Rp38,087,529	Rp64,939,842	Rp 95,599,785
Salvage Value			Rp 4,657,558
Working Capital			Rp64,929,882
Net Cash	Rp38,087,529	Rp 64,939,842	Rp165,187,225
P/f Factor	0.7523	0.6843	0.6223
NPV	Rp28,654,782	Rp 44,435,523	Rp102,801,698
NPV Kumulatif	Rp (43,571,758)	Rp 863,765	Rp103,665,463

Table 12. Value of feasibility Analysis Kaur

Parameter	Value
Interest Rate	9.95%
NPV	Rp 103,665,463.4
PBP	3.019
IRR	33.8%

Table 13. Feasibility Analysis Bengkulu City

Year	2021	2022	2023
Period	0	1	2
Initial cash flow (cash out)	Rp82,073,882		
Operation cash flow (cash in)		Rp3,406,386	Rp15,625,161
Salvage valve			
Working capital			
Net cash	Rp82,073,882	Rp3,406,386	Rp15,525,161
P/f factor	1	0,9095	0,8272
NPV	Rp82,073,882	Rp85,172,005	Rp72,246,901

Table 13. (continued)

Year	2024	2025	2026
Period	3	4	5
Initial cash flow (cash out)			
Operation cash flow (cash in)	Rp37,961,601	Rp64,727,623	Ro95,287,311
Salvage valve			Rp4,243,257
Working capital			Rp64,929,882
Net cash	Rp37,961,601	Rp64,727,623	Ro164,469,459
P/f factor	0,7523	0,6843	0,6223
NPV	Rp28,560,041	Rp44,290,311	Rp102,349,401
NPV cumulative	Rp43,686,861	Rp603,450	Rp102,952,851

So, this is the summary of parameter in feasibility analysis using NPV, PBP, and IRR of Kaur Regency.

NPV = Rp(82,073,882) + Rp(3,117,096) + Rp12,964,439 + Rp28,654,782 + Rp44,435,523 + Rp102,801,698
= Rp103,665,463

$$PBP = 3 + \left(\frac{Rp863{,}765}{Rp863{,}765-(-Rp43{,}571{,}758)}\right)$$
= 3.019

$$IRR = 30\% + \frac{Rp9{,}126{,}688}{-Rp15{,}117{,}639} \text{ x } (40\% - 30\%)$$
= 33.8%

Next is feasibility analysis of rental locations in Bengkulu City as in the Table 17 and Table 18.
So, this is the summary of parameter in feasibility analysis using NPV, PBP, and IRR of Bengkulu City.

NPV = Rp(82,073,882) + Rp(3,098,123) + Rp12,925,104 + Rp28,560,041 + Rp44,290,311 + Rp102,349,401
= Rp102,952,851

PBP = 3 + $(\frac{Rp603,450}{Rp603,450-(-Rp43,686,861)})$
= 3.014

IRR = 30% + $\frac{Rp8,787,235}{-Rp15,362,715}$ x (40% - 30%)
= 33.6%

Table 14. Value of feasibility Analysis Bengkulu

Parameter	Value
Interest Rate	9.95%
NPV	Rp 102,952,851.3
PBP	3.014
IRR	33.6%

Table 15. Feasibility Analysis North Bengkulu Regency

Year	2021	2022	2023
Period	0	1	2
Initial cash flow (cash out)	Rp82,073,882		
Operation cash flow (cash in)		Rp29,113,390	Rp11,176,218
Salvage valve			
Working capital			
Net cash	Rp82,073,882	Rp29,113,390	Rp11,176,218
P/f factor	1	0,9095	0,8272
NPV	Rp82,073,882	Rp26,478,754	Rp9,244,946
NPV cumulative	Rp82,073,882	Rp108,552,636	Rp117,797,582

Table 16. Feasibility Analysis North Bengkulu Regency (continued)

Year	2024	2025	2026
Period	3	4	5
Initial cash flow (cash out)			
Operation cash flow (cash in)	Rp10,000,332	Rp35,531,277	Rp64,776,492
Salvage valve			Rp3,828,956
Working capital			Rp64,929,882
Net cash	Rp10,000,332	35,531,277	Rp133,535,330
P/f factor	0,7523	0,6843	0,6223
NPV	Rp7,523,653	Rp24,312,515	Rp83,103,634
NPV cumulative	Rp110,273,929	Rp85,961,415	Rp2,857,781

Table 17. Value of feasibility Analysis North Bengkulu Regency

Parameter	Value
Interest Rate	9.95%
NPV	-Rp2,857,780.8
PBP	>5
IRR	9.3%

Table 18. Calculation Results for Feasibility Study

Feasibility Analysis	Kaur Regency	Bengkulu City	Bengkulu Utara Regency
NPV	Rp103,665,463.4	Rp102,952,851.3	-Rp2,857,780.8
PBP	3.019 Year	3.014 Year	> 5 Year
IRR (9.95%)	33.8%	33.6%	9.3%
Decision	Feasible	Feasible	Not Feasible

The last is feasibility analysis of rental locations in North Bengkulu Regency as in the Table 20 and Table 21.

So, this is the summary of parameter in feasibility analysis using NPV, PBP, and IRR of North Bengkulu Regency.

x (10% - 9%)
= 9.3%

NPV = Rp(82,073,882) + Rp(26,478,754) + Rp(9,244,946) + Rp7,523,653 + Rp24,312,515 + Rp83,103,634
= -Rp2,857,781

PBP = >5

IRR = 9% + $\frac{Rp1,491,933}{-Rp3,080,472}$

As for the calculation results, for the feasibility anlysis of each selected alternative is shown in Table 18.

4. CONCLUSION

Based on calculations carried out in parallel to get a location selection decision from this problem using the P-Median and Feasibility Analysis of the financial aspect (NPV, PBP, and IRR). So it can be concluded that these results provide the best decision to be taken by the company, namely renting a warehouse in Kaur Regency which is the optimal location according to the P-Median calculation and feasible from the financial aspect. Furthermore, the impact that can be felt by the company, such as the initial goal of reducing transportation costs when compared to the existing condition, which was originally the total transportation cost of the Bengkulu area was Rp. 26,996,000 to Rp. 11, 405,305 or decreased by 57.75%. Then because the previous location was not considered in the site selection criteria, the company did not know whether the existing location was optimal. This study also provides an answer that when compared to the location at the current location with the assumption of being able to meet all demands, the proposed location still has an impact on reducing transportation costs and there is a decrease of 30%.

Table 19. Summary of comparison

Condition	Existing	Proposal	decrease%
Actual	Rp26,996,000	Rp11, 405,305	57.75%
Assumption if existing point last-mile can fullfil all demand	Rp16,476,692	Rp11,405,305	30%

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