Network Optimization Design to Reduce Lost Sales Risk on Supply Chain: A Case Study of Furniture Product

Nur Layli Rachmawati[1], Adji Candra Kurniawan[2], Yelita Anggiane Iskandar[3], Kharisa Ainun Nikmah[4], Michael Sembiring[5], Talitha Adna Darrel Caluella Riyanto[6], Thobias Adriel Silaen[7], Ine Inayah[8], Kenzie Dwianugerah Delu[9]

{nl.rachmawati@universitaspertamina.ac.id[1], adjick@universitaspertamina.ac.id[2], yelita.ai@universitaspertamina.ac.id[3], 102418013@student.universitaspertamina.ac.id[4]; 102418056@student.universitaspertamina.ac.id[5]; 102418086@student.universitaspertamina.ac.id[6]; 102418079@student.universitaspertamina.ac.id[7]; 102418105@student.universitaspertamina.ac.id[8]; 102418128@student.universitaspertamina.ac.id[9]}

Universitas Pertamina Jl. Teuku Nyak Arief, RT.7/RW.8, Simprug, Kec. Kby. Lama, Kota Jakarta Selatan, Daerah Khusus Ibukota Jakarta 12220, Indonesia[1,2,3,4,5,6,7,8,9]

Abstract. We present the supply chain operational planning problem of an integrated furniture company located in Indonesia. We determine the location of the company's new facility considering demand location, coverage, and network to minimize movement costs of volumed-product. The objective is to decide optimal additional distribution center (DC) or factory allowing the company to be competitive in the greater market. Green Field Analysis (GFA) and Network Optimization (NO) of anyLogistix were used to find an optimal furniture supply chain network. GFA results reported that the new facility should be located in South Bali with a latitude point of -8.086 and a longitude point of 115.176 while NO preferred Scenario 1, build a DC generating a profit of IDR 45,755,640,179. Other alternatives would be Scenario 2, build a factory providing a profit of IDR 45,955,816,089. Operational risk comparison shows that it is better to follow the 2nd scenario.

Keywords: Furniture, Supply Chain, Facility, anyLogistix Simulation, Green Field Analysis, and Network Optimization.

1 Introduction

PT Indo Mitra Pratama is a manufacturing company that focuses on two things, namely construction design and production, with the main material from wood which is produced by the company on its own. Various kinds of furniture interior designs that are tailored based on customer requests on a large scale are usually used for interior furniture of hotels, apartments, restaurants, or houses of worship. By adjusting the vision and mission of PT Indo Mitra, which prioritizes high quality products at low costs an satisfy customers according to their requirements. In addition, the main goal of the company is to become the best furniture company

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in the world, so that each project carried out can represent the company's strategy through the concept of dynamic use of space. Realizing the goal of PT Indo Mitra to provide the best furniture construction in the world, the priority is to introduce and to reach customers all over Indonesia. That way, to be able to grasp more customers, the company should pay attention to several things such as the capacity of the building for production and storage space. These spaces are very important aspect in furniture business sector because furnitures are generally large in volume which makes the distribution route determination challenging and heavily affetcs the logistics total costs they incur. Build a new DC for customers who may be reached easier despite the volume issue since they are closer. If the construction of this new DC is considered profitable, then this solution can be a good suggestion for PT Indo Mitra Pratama.

In this case, we propose the use of a Distribution Center (DC) to optimize the supply chain network of PT Indo Mitra Pratama. The main function of this DC is to ensure effective goods flow and to minimize inventory so that goods can reach customers in the right quantity, condition, and time. That way, the determination of this new DC can be solved using the AnyLogistix software by developing a Green Field Analysis (GFA) and Network Optimization (NO) model beside maximizing its supply chain performance. The reason for choosing the GFA and NO models is because this method determines the optimal DC location to meet customer demand and NO is a method that can be used to analyze supply chain or product distribution networks that provide the capability for network optimization with the minimum total transportation costs.

The choice of distribution center (DC) location is a very important decision because it connects suppliers and customers [1]. DC location is a significant operational parameter that greatly affects operational costs [2]. Therefore the determination of DC location is very important in its selection. According to [3], the decision to determine the facility location is very useful in the long run. Considering supply chain strategic planning in every company, a good product distribution scheme is the main driver that will have a direct impact on competitive costs in the supply chain in a company both suppliers and customers as a form of customer satisfaction response in meeting demand and maintaining the level of customer service satisfaction is very important for the company , a distribution strategy and structure is needed including optimizing transportation costs by determining the right DC location [4] To ensure that the strategic plan of the organization is successful in the long term, the location of the DC plays a very dominant role compared to other alternative solutions in a company [5]. The use of the GFA model in this study is based on the purpose of the study where the research was conducted to determine the optimal location of DC facilities for the company, as well as several limitations of the study including information and data obtained from the company. And, assumptions that are not considered are operational costs and initial investment costs for building a factory or DC. In another hand, to build the GFA model only requires some data so that the analysis can run, so this research is suitable to be carried out using this method. In this case, the assumptions that are not considered are operational costs and initial investment costs for building a factory or DC.

2 Basic Theory

2.1 Distribution Center

Distribution center (DC) is a facility used to maximize the utility of the company's storage. According to [3] the distribution center is in making decisions made to find the location of the facilities used in the long term. That way, the need for a suitable strategy for companies including PT. Indo Mitra where this strategy is related to the distribution strategy of furniture products that become the main reference that has an influence on costs. Because it is tailored to the destination, the distribution strategy that can optimize costs such as transportation costs through determining the location of DC [4]. The function of the DC is to connect between factory and customers as show in **Figure 1**.

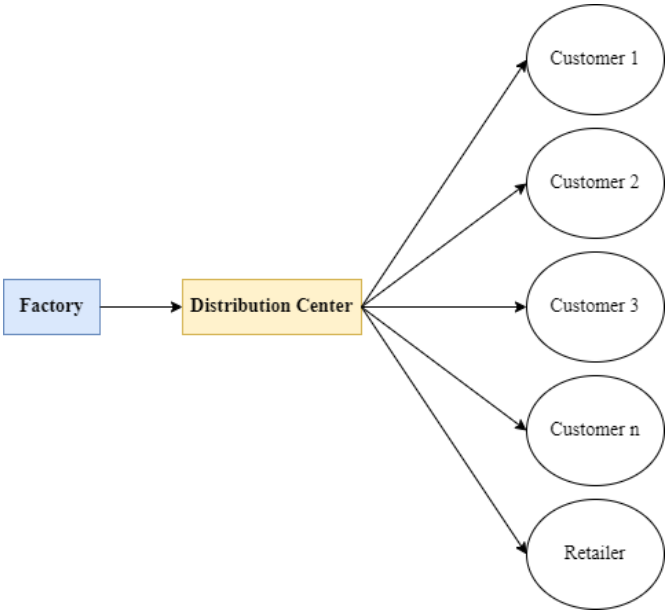

Fig. 1. Network Distribution Center [3].

2.2 AnyLogistix

AnyLogistix is an advanced and highly integrated platform, which provides ready-made solutions for optimizing and simulating logistics systems [6]. AnyLogistix is a fairly easy-to-understand software that can be used by students and professionals to handle a wide range of supply chain management issues. AnyLogistix can be used to determine the location of supply chain facilities and planning models, conduct experiments and analyze the results. This software can make it easier for users to analyze management decisions and use KPI's for operational, customer, and financial performance measurements and decision making.

2.3 Green Field Analysis (GFA)

Green Field Analysis (GFA) or known as Center-of-gravity Analysis is a method to determine the optimal location of new facilities [7]. The determination of the location of the facility is in

line with the purpose of the supply chain which is to meet customer demand with the lowest total transportation costs. GFA can help in sharing the problem to be simpler effectively in solving DC or for production facilities by placing the best location. To carry out the GFA test, data such as customer location is required, the number of requests per customer, the number of facilities to be built and the distance or range of services, which will serve as analytical input. The output of the analysis is the optimal location for the production or storage facility. The optimal location or optimal point is said to be the "center of gravity" [7].

2.4 Network Optimization (NO)

Network Optimization is the design of a supply chain network that aims to optimize the most efficient network in determining factory or DC in the supply chain. This depends on the supply and demand associated with the low cost of the design. The result of NO is the determination of optimal manufacturing or DC location and maximum profit. The formulas of Network Optimization are [8]:

$$Min \quad Z = \sum_{s \in S} f_s \cdot y_s + \sum_{s \in S} C_{sm} \cdot \sum_{m \in M} X_{sm} \tag{1}$$

$$\sum_{s \in S} x_{sm} = 1, \ \forall m \in M \tag{2}$$

$$X_{sm} \leq y_s, \forall_S \in S, \forall_m M \tag{3}$$

$$y_s \in \{0; 1\} \forall_s \in S, x_s \in \{0; 1\} \forall (s, m) \in \tag{4}$$

Network optimization is indispensable for minimizing the total costs in facilities and transportation networks that are in the equation (1), so that each request can be served appropriately in one facility (2). If by building facilities and supply appropriately to meet demand, then this new facility can be built (3). With each available facility can be used opening and closing and it also affects the availability of transportation networks available for use or cannot be used. Any available or closed facilities, and any available transportation, for each network used and not (4).

3 Research Methodology

The research methodology in this research can be seen in **Figure 2**. The research carried out in this paper begins with conducting a field study. The field studies implemented by conducting interviews with one of the stakeholders of PT Indo Mitra Pratama. After conducted interviews, the next stage is literature study. At this stage, the authors analyze the results of interviews to the literature in the form of books, papers and other sources. After conducted literature study, the authors able to identify the existing problems in PT Indo Mitra Pratama. PT Indo Mitra Pratama only has one warehouse located in the factory itself. PT Indo Mitra Pratama often experienced delays because all shipments were made from their main warehouse located in East Jakarta, while their own customers are spread across Jabodetabek.

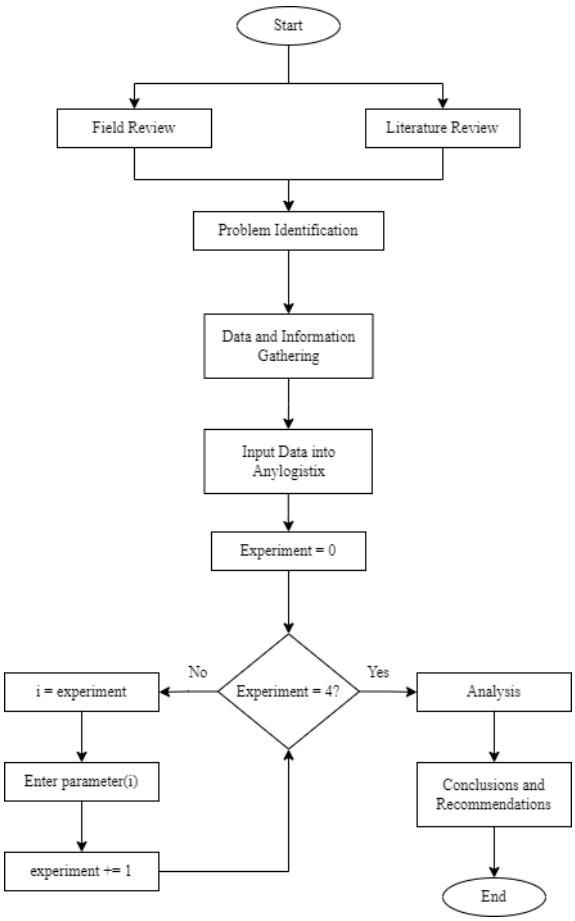

Fig. 1. Research Methodology Diagram

In this research, there are three data collected, namely the location of the warehouse, the location of the distribution of customers and customer‘s demand data. This research uses Green Field Analysis (GFA) and Network Optimization (NO) on anyLogistix software. GFA is being performed to determine the optimal DC location. In the GFA stage, the optimal DC location will be generated. From the results of the GFA, proceed to the NO stage, which begins with entering the required data. At the NO stage, iterations are being generated and each iteration is having a different scenario. The iteration results that have the highest profit will be analyzed and then the conclusions will being drawn.

We collect two types of data for this research, namely primary data and secondary data. For the primary data collection, in this study we conduct interviews with the aim of obtaining reliable and accurate data. In this study, researchers conducted interviews with one of the employees at PT Indo Mitra Pratama as the interviewees. In addition, we also collect secondary data obtained from the company's website, namely company overview, company vision and mission, services offered by the company, and projects and clients (focused on hotels and resorts). The data used here including : 1) supplier locations, 2) historical demand data, 3) customer/client locations, 4)

existing factory locations, 5) revenue, 6) selling price, 7) raw material cost, 8) production cost, 9) truck types and capacity.

4 Result

This research result is extracted following the two stages of methodology, the first is the Green Field Analysis (GFA) and the second is the Network Optimization (NO). Both methods will produce an optimal supply chain path. In GFA, a Distribution Center (DC) will be generated, while in NO, an optimal network distribution will be generated. Regarding the experiment, we set two scenarios.

The scenario in this study has one main difference, namely building a new DC or building a new factory. In this first scenario, the result of the GFA i.e. a DC will be considered as a DC in the NO stage. As for scenario two, the results from the GFA will be assumed to be a new factory.

Product distribution will use one type of truck with a capacity of $25m^3$. Goods are distributed in units with an assumed volume of 5m^3. The details of transportation costs are as the following Table 1.

Table 1. Fixed and Variable Cost.

	Cost Type	Cost (IDR) (0.1L/Km)	Cost (IDR/day)
Fixed Cost	Driver and Driver Asst. Salary	N/A	479,955.40
Variable Cost	Transportation Cost	555.44	N/A

4.1 Green Field Analysis (GFA)

The parameter uses a limit on the number of facilities built, one new facility where we can choose the type of the building, whether it is factory or DC that will be selected based on optimality considerations in serving all stakeholders. The result obtained with the GFA is that the new DC/factory should be built in Bali. The location is assigned to serve customers who are in Bali. As for the old factory that has been operating until now, it will be assigned to serve customers in the Greater Jakarta area (known as JABODETABEK).

From the running result using GFA at AnyLogistix, the optimal manufacturing location is in the location shown in **Figure 3**, point in yellow which is near to the customers in the Greater Jakarta area. Meanwhile for the new factory, the selected location is shown in **Figure 4**, point in red, that is around the center of Bali island. In **Figure 3** and **Figure 4**, the distribution channels are also shown, the points in blue.

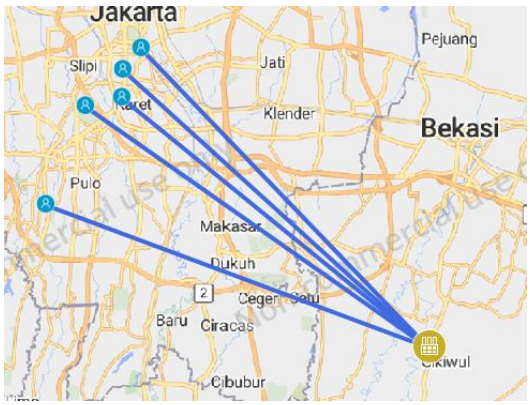

Fig. 2. Product Distribution Network from Manufacturing.

After the program is run, the results obtained are DC/factory locations and Manufacturing in the form of latitude and longitude data which can be seen in Table 2.

Fig. 3. Product Distribution Network from Distribution Center.

Table 2. Location of Manufacturing Facilities and Distribution Center.

	Name	Latitude	Longitude
1	GFA DC	-8.806	115.176
2	Factory	-6.336	106.979

At the Network Optimization stage, scenarios will be made based on the location of the new facility from the GFA results. In the first scenario, the facility built is a Distribution Center (DC). And the second scenario, the facility being built is a new factory.

In the first scenario, the distribution network that can be used can be seen in **Figure 5**. The distribution network is described as a network for distributing goods from the old factory to the new DCs in Bali. The realized distribution network from DC to customers in Bali is shown in **Figure 6**, path in blue. Meanwhile, the detail distribution network from the old factory to customers in the Greater Jakarta area is shown in **Figure 7**, the blue line. The structure of the supply chain network in the first scenario can be seen in **Figure 8**, the color represents each of

the actors; green is the supplier, yellow is the manufacturer, red is for the distribution center, and blue is the customer.

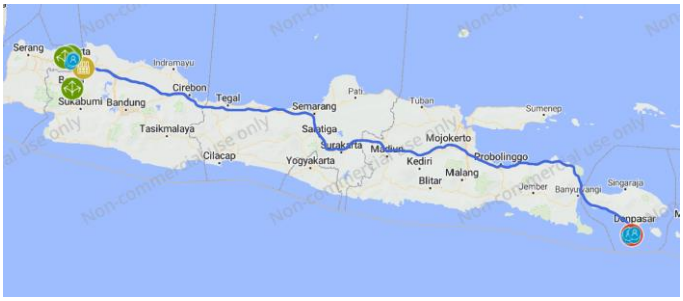

Fig. 4. Product Distribution Network from Manufacture to Distribution Center.

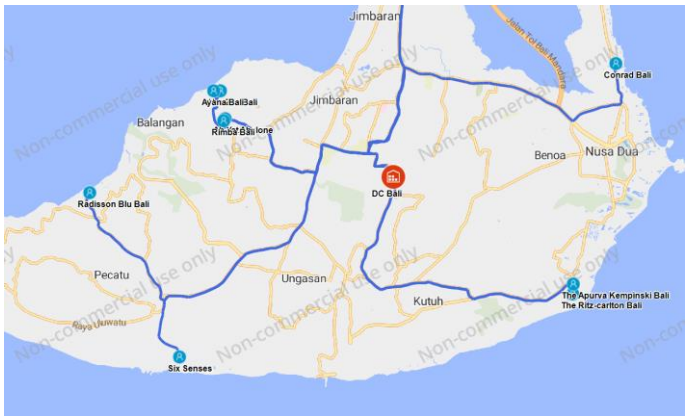

Fig. 5. Product Distribution Network from Distribution Center to Bali Customers.

For the scenario 2, the specific distribution network from the old factory to customers in the Greater Jakarta area is shown in **Figure 9**. Meanwhile, the distribution network from the new factory to customers in Bali is shown in **Figure 10**, represented in lines drawn from yellow point to each blue points. The structure of the supply chain network in the second scenario can be seen in **Figure 11**, the color represents each of the actors; green is the supplier, yellow is the manufacturer, and blue is the customer.

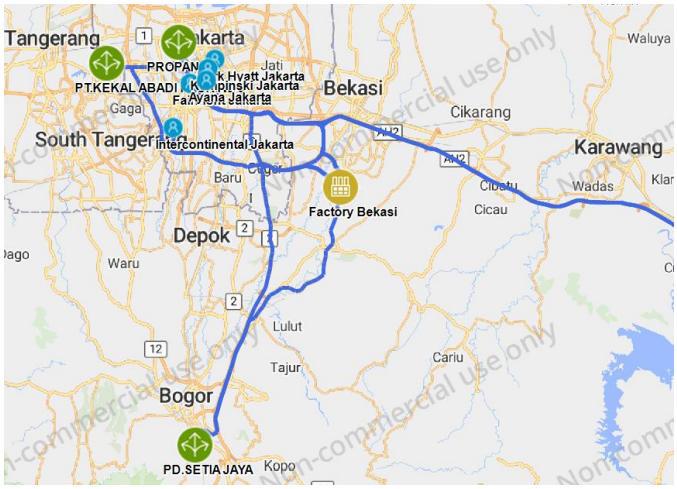

Fig. 6. Product Distribution Network from the old Factory to Greater Jakarta Customers.

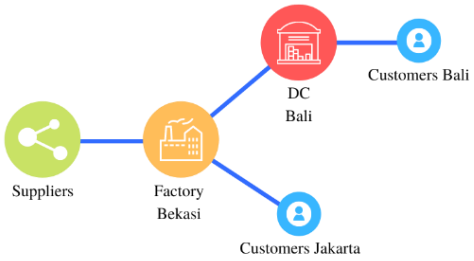

Fig. 7. Supply Chain Network Scenario 1.

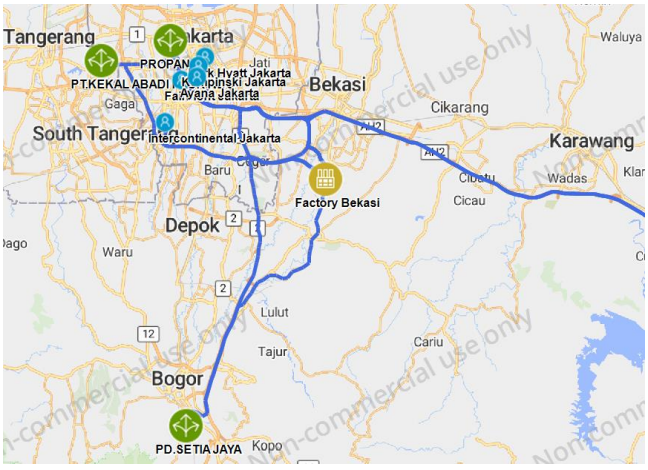

Fig. 8. Product Distribution Network from the old Factory to Greater Jakarta Customers.

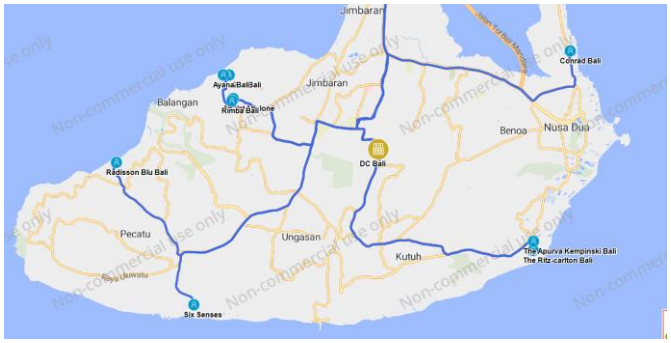

Fig. 9. Product distribution network from the new factory to Bali Customers.

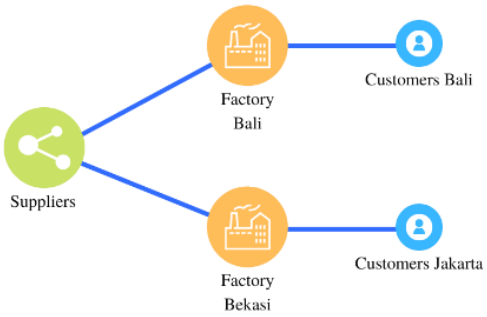

Fig. 10. Supply Chain Network Structure Scenario 2.

From the results of Network Optimization (NO), the total profit that can be obtained if using the resulting distribution channel is also obtained. The profit depends on what costs you want to take into account. In Table 3, the total profit obtained from the NO results for scenario 1. It shows that the profit obtained is IDR 658.009.348.600,38 and the flows amount obtained is 644,540 units with total revenue of IDR 602.840.6454.146,22, production costs of IDR 4.018.940.021.002,88, raw material supply costs of IDR 1.339.646.196.744,07, and transportation costs of IDR 11.810.887.870,80. Table For details of revenue data and transportation mileage can be seen in Table 4, Table 5 and Table 6.

In scenario two, the total profit generated is shown in Table 3. It shows that the profit obtained is IDR 660.892.302.119,21 and the amount of the flow obtained is 497,510 units with total revenue of IDR 6.028.406.454.146,22, production costs of IDR 4.018.940.021.002,88, the cost of supplying raw materials is IDR 1.339.646.196.744,07, and transportation costs are USD 8.927.934.308,83. Details of revenue and transportation distance data can be seen in Table 6, Table 7 and Table 8.

Table 3. Optimization Result.

Scenario	Profit (NetOpt) (IDR)	Flows Amount (Units)
1	658.009.348.600,38	644,540
2	660.892.302.119,21	497,510

Table 4. Scenario 1 Demand Fufillment.

Customer	*Product*	*Demand Min*	*Demand Max*	*Satisfied*	*Percentage*	*Revenue, per item* (Rp)	*Revenue Total* (Rp)
Intercontinental Jakarta	*Furniture*	3900	3900	3900	100	121.171.563,47	472.569.097.529,10
Fairmont Jakarta	*Furniture*	4940	4940	4940	100	121.171.563,47	598.587.520.660,65
Bali Jungle	*Furniture*	5239	5239	5239	100	121.171.563,47	634.817.814.974,05
Kempinski Jakarta	*Furniture*	3887	3887	3887	100	121.171.563,47	470.993.869.217,35
Conrad Bali	*Furniture*	4784	4784	4784	100	121.171.563,47	579.684.766.538,60
The Ritz-carlton Bali	*Furniture*	4199	4199	4199	100	121.171.563,47	508.799.391.842,50
Radisson Blu Bali	*Furniture*	1443	1443	1443	100	121.171.563,47	174.850.572.701,05
Ah Yat Abalone	*Furniture*	468	468	468	100	121.171.563,47	56.708.291.128,25
HonZen Bali	*Furniture*	286	286	286	100	121.171.563,47	34.655.066.001,65
Six Senses	*Furniture*	1469	1469	1469	100	121.171.563,47	178.001.029.324,55
Park Hyatt Jakarta	*Furniture*	2860	2860	2860	100	121.171.563,47	346.550.674.397,55
The Apurva Kempinski Bali	*Furniture*	6318	6318	6318	100	121.171.563,47	765.561.937.421,90
Ayana Bali	*Furniture*	5200	5200	5200	100	121.171.563,47	630.092.130.038,80
Ayana Jakarta	*Furniture*	4758	4758	4758	100	121.171.563,47	576.534.295.534,05

Table 5. Product Flows Scenario 1.

From	*To*	*Arrival Period*	*Product*	*Flow*	*Unit*	*Distance*	*Vehicle Type*	*Travel Time, day*
PD.Setia Jaya	*Factory* Bekasi	*Time period*	*Raw Material 1*	14925.3	pcs	48.450	*Truck* 25m	0.0404
Propane	*Factory* Bekasi	*Time period*	*Raw Material 2*	14925.3	pcs	36.986	*Truck* 25m	0.0308
PT.Abadi Abadi Packindo	*Factory* Bekasi	*Time period*	*Raw Material 3*	19900.4	pcs	44.497	*Truck* 25m	0.0371
Factory Bekasi	DC Bali	*Time period*	*Furniture*	29406	pcs	1148.782	*Truck* 25m	0.9573
Factory Bekasi	Intercontinental Jakarta	*Time period*	*Furniture*	3900	pcs	29.557	*Truck* 25m	0.0246
Factory Bekasi	Fairmont Jakarta	*Time period*	*Furniture*	4940	pcs	32.774	*Truck* 25m	0.0273
Factory Bekasi	Park Hyatt Jakarta	*Time period*	*Furniture*	2860	pcs	35.356	*Truck* 25m	0.0295

Table 6. Product Flows Scenario 1 (Continued).

From	*To*	*Arrival Period*	*Product*	*Flow*	*Unit*	*Distance*	*Vehicle Type*	*Travel Time, day*
Factory Bekasi	Kempinski Jakarta	*Time period*	*Furniture*	3887	pcs	34.942	*Truck* 25m	0.0291
Factory Bekasi	Ayana Jakarta	*Time period*	*Furniture*	4758	pcs	33.191	*Truck* 25m	0.0277
DC Bali	The Ritz-carlton Bali	*Time period*	*Furniture*	4199	pcs	8.633	Truck 25m	0.0072
DC Bali	Radisson Blu Bali	*Time period*	*Furniture*	1443	pcs	12.123	Truck 25m	0.0101
DC Bali	Ah Yat Abalone	*Time period*	*Furniture*	468	pcs	6.352	*Truck* 25m	0.0053
DC Bali	HonZen Bali	*Time period*	*Furniture*	286	pcs	7.679	*Truck* 25m	0.0064
DC Bali	Bali Jungle	*Time period*	*Furniture*	5239	pcs	6.454	*Truck* 25m	0.0054
DC Bali	Six Senses	*Time period*	*Furniture*	1469	pcs	10.231	*Truck* 25m	0.0085
DC Bali	The Apurva Kempinski Bali	*Time period*	*Furniture*	6318	pcs	8.609	*Truck* 25m	0.0072
DC Bali	Ayana Bali	*Time period*	*Furniture*	5200	pcs	7.664	*Truck* 25m	0.0064
DC Bali	Conrad Bali	*Time period*	*Furniture*	4784	pcs	10.776	*Truck* 25m	0.0090

Table 7. Scenario 2 Demand Fulfillment.

Customer	*Product*	*Demand Min*	*Demand Max*	*Satisfied*	*%*	*Revenue, per item* (Rp)	*Revenue Total* (Rp)
Intercontinental Jakarta	*Furniture*	3900	3900	3900	100	121.171.563,47	472.569.097.529,10
Fairmont Jakarta	*Furniture*	4940	4940	4940	100	121.171.563,47	598.587.523.536,86
Bali Jungle	*Furniture*	5239	5239	5239	100	121.171.563,47	634.817.821.014,09
Kempinski Jakarta	*Furniture*	3887	3887	3887	100	121.171.563,47	470.993.867.204,00
Conrad Bali	*Furniture*	4784	4784	4784	100	121.171.563,47	579.684.759.635,70
The Ritz-carlton Bali	*Furniture*	4199	4199	4199	100	121.171.563,47	508.799.395.006,33
Radisson Blu Bali	*Furniture*	1443	1443	1443	100	121.171.563,47	174.850.566.085,77
Ah Yat Abalone	*Furniture*	468	468	468	100	121.171.563,47	56.708.291.703,49
HonZen Bali	*Furniture*	286	286	286	100	121.171.563,47	34.655.067.152,13
Six Senses	*Furniture*	1469	1469	1469	100	121.171.563,47	178.001.026.735,96
Park Hyatt Jakarta	*Furniture*	2860	2860	2860	100	121.171.563,47	346.550.671.521,34
The Apurva Kempinski Bali	*Furniture*	6318	6318	6318	100	121.171.563,47	765.561.937.997,14
Ayana Bali	*Furniture*	5200	5200	5200	100	121.171.563,47	630.092.130.038,80
Ayana Jakarta	*Furniture*	4758	4758	4758	100	121.171.563,47	576.534.298.985,50

Table 8. Product Flows Scenario 2.

From	*To*	*Arrival Period*	*Product*	*Flow*	*Unit*	*Distance*	*Vehicle Type*	*Travel Time, day*
PD. Setia Jaya	*Factory* Bekasi	*Time period*	*Raw Material 1*	6103.5	pcs	48.450	*Truck* 25m	0.0404
PD. Setia Jaya	*Factory* Bali	*Time period*	*Raw Material 1*	8821.8	pcs	1200.228	*Truck* 25m	1.0002
Propane	*Factory* Bekasi	*Time period*	*Raw Material 2*	6103.5	pcs	36.986	*Truck* 25m	0.0308
Propane	*Factory* Bali	*Time period*	*Raw Material 2*	8821.8	pcs	1168.699	*Truck* 25m	0.9739
PT. EternalLy Immortal Packindo	*Factory* Bekasi	*Time period*	*Raw Material 3*	8138	pcs	44.497	*Truck* 25m	0.0371
PT. EternalLy Immortal Packindo	*Factory* Bali	*Time period*	*Raw Material 3*	11762.4	pcs	1178.877	*Truck* 25m	0.9824

Table 9. Product Flows Scenario 2 (Continued).

From	*To*	*Arrival Period*	*Product*	*Flow*	*Unit*	*Distance*	*Vehicle Type*	*Travel Time, day*
Factory Bali	The Ritz-carlton Bali	*Time period*	*Furniture*	4199	pcs	8.633	*Truck* 25m	0.0072
Factory Bali	Radisson Blu Bali	*Time period*	*Furniture*	1443	pcs	12.123	*Truck* 25m	0.0101
Factory Bali	Ah Yat Abalone	*Time period*	*Furniture*	468	pcs	6.352	*Truck* 25m	0.0053
Factory Bali	HonZen Bali	*Time period*	*Furniture*	286	pcs	7.679	*Truck* 25m	0.0064
Factory Bali	Bali Jungle	*Time period*	*Furniture*	5239	pcs	6.454	*Truck* 25m	0.0054
Factory Bali	Six Senses	*Time period*	*Furniture*	1469	pcs	10.231	*Truck* 25m	0.0085
Factory Bali	The Apurva Kempinski Bali	*Time period*	*Furniture*	6318	pcs	8.609	*Truck* 25m	0.0072
Factory Bali	Ayana Bali	*Time period*	*Furniture*	5200	pcs	7.664	*Truck* 25m	0.0064
Factory Bali	Conrad Bali	*Time period*	*Furniture*	4784	pcs	10.776	*Truck* 25m	0.0090
Factory Bekasi	Intercontinental Jakarta	*Time period*	*Furniture*	3900	pcs	29.557	*Truck* 25m	0.0246
Factory Bekasi	Fairmont Jakarta	*Time period*	*Furniture*	4940	pcs	32.774	*Truck* 25m	0.0273
Factory Bekasi	Park Hyatt Jakarta	*Time period*	*Furniture*	2860	pcs	35.356	*Truck* 25m	0.0295
Factory Bekasi	Kempinski Jakarta	*Time period*	*Furniture*	3887	pcs	34.942	*Truck* 25m	0.0291
Factory Bekasi	Ayana Jakarta	*Time period*	*Furniture*	4758	pcs	33.191	*Truck* 25m	0.0277

5 Analysis

From the results of data processing using GFA and NO for both scenarios, the resulting data does not differ significantly for profit, namely, for scenario 1, the profit generated is IDR 658.009.348.600,38 in one year, while for scenario 2, the profit generated is USD 660.892.302.119,21 in one year. The difference in profit is due to a large difference in the

transportation cost sector where the difference is IDR 2.882.953.514.508,54. From both scenarios, all requests can be fulfilled. However, in deciding the best scenario, scenario 2: building a new factory is found better. Apart from the higher profit factor, the type of make-to-order company that only produces when there is order also influences the decision.

6 Conclusion

The selection of new facilities aimed at minimizing transportation costs can be search by many ways and various software, one of them is Anylogistix. The determination of the optimal facility location can be solved using the Green Field Analysis (GFA). The GFA considers the distance between the facility and the customers. In addition, it also considers the number of demands from each customer. From the calculation result using GFA, one new facility was obtained located in Bali Province. After that, we carried out further data processing using Network Optimization (NO), which consider two scenarios. In the first scenario, the new facility will function as a Distribution Center (DC) and in the second scenario, the new facility will function as a factory. From the result of NO, total expense and total revenue cost are obtained. From the analysis result, scenario 2 is the best one. Scenario 2 provides higher profit, which is IDR 658.009.348.600,38 and the total transportation cost is smaller, which is IDR 8.927.934.308,83. Therefore, scenario 2 was selected by building a new factory located at -8,806,115,116. Moreover, with scenario 2, the operational risk is minimized because the demand fulfillment percentage is 100%, it is mean all the demand can fulfil by the factory.

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