Warehouse Location Decision in Pakistan: A Real Case Study

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Abstract- The manufacturing industry in Pakistan is passing through a critical phase of its history. In the changing market place consumer are increasingly vigilant and demanding better quality, more competitive prices and shorter lead times. Maintaining cost effective manufacturing along with it distribution to the different customers across the country is becomes challenging day by day. In this paper, we propose an additional new warehouse location in Pakistan using transportation cost as a decision factor. Initially the proposed warehouse will be run by the third party warehouse service provider on temporary basis, so that it lower down the inventory level of Lahore warehouse from 0.4 million liters to 0.2 million liters, saves approximately 1.5 Million Rs. / year with improved customer service .

Keywords: Warehouse Location Decision, Warehouse Management, Feasibility of Warehouse, Supply Chain Management.

1. Introduction

Warehouses are most crucial components of most modern supply chains: they are likely to be involved in various stages of sourcing, production and distribution of goods. From handling of raw materials to work in process through to finished products as the dispatch point serving the next customer in the chain, they are critical to the provisions of high customer service levels.

Warehouses are an integral part of supply chains in which they operate and therefore recent trends such as increasing market volatility, product range proliferation and shortening lead times all have an impact on the roles that warehouses are required to perform. Owning to the nature of facilities, staff and equipment requirement warehouses are one of the most costly supply chain and therefore their successful management in terms of costs and services.

Warehousing is that part of a firm's logistic system that stores products (raw materials, parts, goods-in-process, finished goods) at and between point of origin and point of consumption, provides information to management on the status, condition and disposition of items being stored [13].

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Warehouses are basically intermediate storage points in the logistics system where raw material, work in process, finished goods and goods in transit are held for varying duration of times for a variety of purposes. The warehousing functionality today is much more than the traditional function of storage.

There are several factors that have an impact of location decision. Two issues that must be addressed are the size and number of warehouse facilities. There are interrelated decisions because they typically have an inverse relationship; that is, as the number of warehouses increases, the average size of a warehouse decreases [19].

They are many techniques available for identifying potential sites for plants, warehouses or types of facilities. The process required to narrow down the decision to a particular area can vary significantly depending on the type of business we are in and the competitive pressures must also be considered.

2 Literature Review

In supply chain management, warehousing is very important to decrease lead times and increase volume and mix flexibility. Despite the importance of this activity to enable performance among global corporations, it is often outsourced [7] and [11]. At a strategic level, the major warehousing decision is about the location and size of the warehouse space. The studies and reviews about warehouse location either consider the problem from a managerial and economical perspective.

In a research at Tokyo Research Laboratory, Kazuyoshi and Hiroyuki [8] proposed a simulation based approach to the large scale Uncapacitated Warehouse (Facility) Location Problems (UFLP) with a heuristic algorithm "Balloon Search" to find out the near optimal solution for the number and locations of warehouses that could decrease the transportation and fixed cost. They found an improvement in the total cost by 12% by simulating a fixed and transportation cost on a digital map in the real world. Before this study, good amount of research was done on UFLP and numerous methods such as mathematical programming by Krarup et al [2], Dualoc by Erlenkotter [4], approximate method e.g. Greedy and Interchange Heuristic by Kuehn et al [8] and Cornuejols et al [9] and Beasley [13] proposed Lagrangean Heuristics. All the research was based on the artificial data and not entirely focused on to solve the large scale examples of the UFLP in the real world [5]. In a comparative study by Sharma and Agarwal [14] on SSCWLP exhibited that in terms of time execution the Branch and Bound (BB) method performed considerably higher than the Benders and Decomposition (BD) method. In 1995, Sridharan [16] provided a review on various solutions for capacitated plant location problem (CPLP) with several heuristics and exact methods. In fact, researchers tried to develop heuristic solution methods and exact algorithms to solve CPLP, however exact algorithm solutions are capable to solve medium sized problems with significant efforts on computations while heuristic methods need to solve realistic-sized problems [11]. Geoffarion et al in 1974 [5], produced a model for multicommodity location problem by Benders partitioning procedure to evaluate the optimized solutions for the flow of product from plant to customer through warehouse.

Location selection of a warehouse involves both qualitative and quantitative main and sub-criteria, hence it is a multi-criteria decision-making problem [14] and this can also be done by fuzzy ANP [14]. Demirel et al [17] stated that the choquet integral is a feasible multi-criteria method to deal with the inaccurate nature of conventional approaches to warehouse location problems and demonstrated a successful application of multi-criteria choquet integral in the real warehouse location problem. They also considered some sub-criteria due to the hierarchical structure of the problem such as tax incentives and structures, readiness of labor, quality and reliability of modes of transportation and proximity to customers. In 2010, Gua. J. et al [6] had made an impressive effort to provide a comprehensive review on warehouse design, performance evaluation, practical case studies and computational support tools, also identified the limits and probable future research directions on each research area that was discussed in the review. The review was based on a comprehensive examination on the research published on warehouse design and its important issues. They also concluded that both analytical and simulation based models were developed to provide the solutions for warehouse problems but both methods were found with some merits and demerits. The writers urged that there is a need to integrate both the methods to obtain the maximum flexibility in analyzing the warehouse problem. They also suggested that there is a huge gap between the published warehouse research and actual warehouse design and operations which indicates a limited application of the published research due to the gap between practitioner and researchers. Since warehousing is an important feature of supply chain management, the challenge for the researchers is to focus on the integrated design of warehouses. Dennis and Ronad [3] also developed an improved model to determine long-run multiple warehouse problem by providing the mixture of static and dynamic methods to solve the warehouse location problem into an efficient computational algorithm for determining the optimal solutions. In this research, the approach used it provided a synthesis of a mixed integer programming formulation for the single-period warehouse location model with a dynamic programming procedure for finding the optimal sequence of configurations over multiple periods. Pirkul and Jayaraman [14] proposed an effective heuristic based on Langragian relaxation mixed integer programming formulation for the capacitated plant and warehouse supply chain management problem.

3. Methodology

The new warehouse location is determined on the basis of outbound transportation costs strategy and the locations of demand centers or in other words geographical analysis.

As currently the company is working with three warehouse facilities that are:

1) Karachi Warehouse
2) Blending Plant (Lube Oil Blending Plant) warehouse at Hub
3) Lahore Warehouse

The Lahore warehouse is the supply source for all the demand centers of Punjab and northern areas. The capacity of level of Lahore warehouse is approximately 0.4 million liters and demand of the demand centers operated from Lahore is almost 0.38 million liters per month. This 0.4 million Liters consumption includes both the imported and local products.

Since new warehouse at any location is to be proposed it will not only release the load from Lahore warehouse but also reduce the warehouse costs such as holding cost, transportation costs, it will also reduce the Transportation Lead time as well as increase customer responsiveness and satisfaction by fulfilling the demands of customers on time.

This new warehouse will run by a third party warehouse service provider (Agility logistics).

Initially, we considered Multan, Kohat and Islamabad as alternatives on the basis of percentage sales volume and geographical analysis for new ware house location and out of these alternatives we will find out the optimal solution for new warehouse location, and this decision is made on the basis of transportation costs and geographical analysis as well as by considering other conditions favoring the selected option.

4 Case Study

XYZ Company has been an innovator in lubrication technology and has manufactured breakthrough lubricants for automotive, commercial and industrial sectors. From energy to manufacturing, cement plant to metal processing, textiles to plastics every industry can utilize and benefit from the extensive range of XYZ Company products. To meet the above requirements and challenges of competitive prices, providing better quality of products, satisfying the customer requirements with shorter lead times, on time deliveries and availability of variety of oil grades near by the customers, it has become necessary for the company to bring on some innovations to operate their business.

The major task for XYZ Company is to reduce delivery lead times and offer availability of products on time as well as reducing delivery and holding costs. For this purpose the company decided to find the location for northern cities of the country which is currently operated by Lahore warehouse. Locating new ware house near some of the demand centers will reduce fixed and variable cost of the ware house as well as the capacity of Lahore warehouse will also reduce and provide help in delivering products to the customers with lower transportation and operating costs.

Since XYZ Company has its customers all over the country in various cities of Pakistan, so in order to satisfy customer's demands on time presently the company does have three warehouse facilities.

1) Blending Plant (Lube Oil Blending Plant) at Hub.
2) Karachi Warehouse.
3) Lahore Warehouse.

All these three are company owned warehouses. The Karachi and Blending Plant (Hub, Baluchistan) ware houses are satisfying the demand for upper and lower Sindh along with some regions of Baluchistan. The BLENDING PLANT is the exclusive blender and marketer of XYZ Company Lubricants in Pakistan. It is the only company in Pakistan having the in-line blending facility of oil. The capacity of warehouse is about 5.5-7 million liters and the capacity of commercial container is about 70-75 drums i.e. about 16000 liters.

The Karachi site warehouse which mainly consists of international products is also shifting to the Hub. Currently, about 40% of the inventory already has been shifted at hub from Karachi site warehouse. The capacity of Lahore warehouse is 0.4 million liters that fulfils the demands of approximately 0.35 to 0.38 million liters per month and this warehouse is the source of supply to all cities in Punjab and northern areas. This 0.4 million liters capacity of warehouse is used to store both the imported and local products.

A new warehouse at any location is to be proposed that will not only releases the load from Lahore warehouse but also reduces the warehouse costing such as holding cost etc.

This new warehouse will be run by third party warehouse service provider. This new warehouse location is selected on the basis of transportation costs that occur as the outbound transportation costs from plant to the warehouse.

The analysis is constrained by the following factors:

- Transshipments of products to Lahore and Karachi Warehouses can only be done through containers due to feasibility in transportation cost.
- Approximately 45 to 50 different grades including different pack size products are imported and only stored at Karachi & Lahore Warehouse due to the high impact of government duties at BLENDING PLANT Warehouse.
- Local products only manufactured at Lube Oil Blending Plant (LOBP) located at HUB industrial Area near Karachi and stored in HUB and Lahore Warehouses.
- Karachi Warehouse is only dedicated for the imported products.

4.1. Warehouse Location Decision

Planning tackles four major problem areas: customer service levels, ***facility location***, inventory decisions, and ***transportation decisions***, as shown in Figure 1 Except for setting a desired customer service level (customer service is a resultant of the strategies formulated in the other three areas); logistics planning may be referred to as a triangle of logistic decision making. These problem areas are interrelated and should be planned as a unit, although it is common to plan them separately [2].

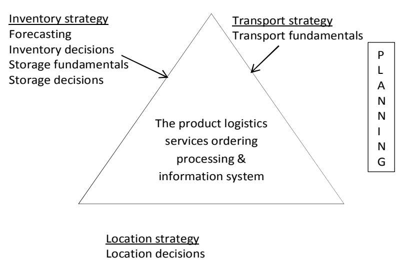

Figure 1. Location Approach

4.2. Facility Location Strategy (Geographical analysis-minimized cost strategy)

The geographic placement of the stocking points and their sourcing points creates an outline for the logistics plan. Fixing the number, location and size of the facilities and assigning market demand to them determines the paths through which products are directed to the marketplace. The proper scope for the facility location problem is to include all product movements and associated costs as they take place from plant, vendor, or port locations through the intermediate stocking points, and on to customer locations. Assigning customer demand to be served directly from plants, vendors, or ports or directing it through selected stocking points, affects total distribution costs.

Finding the lowest cost assignments, or alternatively the maximum profit assignments, is the essence of facility location strategy [2].

Our (XYZ Company) warehouse location decision is also based on the same facility location strategy of minimizing transportation costs, with reduce delivery lead times, increased flexibility and making availability of products on time as well as reducing delivery and holding costs.

Since by locating new warehouse near some of the demand centers will also reduce the fixed and variable cost of currently operating Lahore warehouse, and the capacity of Lahore warehouse will also get reduced and will also help in delivering products to customers with lower transportation and operating costs.

Keeping all these problem statements in mind, now our aim is to locate new warehouse for XYZ Company Lubricants with reduced transportation costs.

The new warehouse location is determined on the basis of outbound transportation costs strategy and the locations of demand centers or in other words geographical analysis and transportation model.

4.3. Transportation Model

Transportation model finds the least-cost means of shipping supplies from several origins to several destinations. Origin points (sources) can be factories, warehouse or any other points from which goods are shipped. Destinations are any points that receive goods. To use the transportation model, we need to know the following;

1) The origin points and the capacity or supply per period at each.
2) The destination points and the demand per period at each.
3) The cost of shipping one unit from each origin to each destination.

There are many LP models for location decisions but the one we used is given below;

4.4. Simple Transportation Model

4.4.1. Assumptions

- Need to determine the net supply (or plant output) and demand for each region.
- Supply $ demand.

- There is a central shipping and receiving point in each region.
- The transportation cost between shipping points is known.
- The objective is to minimize total transportation costs.
- There are no economies of scale in transportation costs.
- Cost per unit distance (e.g., mile) can decrease as the distance increase.
- Cost per unit cannot decrease as volume increases.

According to our problem statement simple transportation linear programming model is chosen to get the optimal cost for the transportation between the warehouse and demand centers (cities).

4.5. Transportation Costs

The transportation costs from the warehouses to the demand centers (cities) are given below.

Table 1. Transportation Cost

Cities		Transportation Cost (Rs./Litres)
From	**To**	
Karachi	Lahore	2.045
Lahore	Faisalabad	1.47
Lahore	Gujranwala	1.27
Lahore	Sialkot	1.42
Lahore	Rahim Yar Khan	1.31
Lahore	Sawat	1.36
Lahore	Bahawalpur	1.53
Lahore	D. G. Khan	1.27
Lahore	Peshawar	1.23
Lahore	Islamabad	1.24
Lahore	Kohat	1.39
Lahore	Sahewal	1.45
Lahore	Khanewal	1.34

Table 2. Transportation Cost

Cities		Transportation cost (Rs./Ltr)
From	**To**	
Karachi	Islamabad	2.62
Islamabad	Sawat	1.12
Islamabad	Peshawar	0.85
Islamabad	Kohat	0.87

Table 3. Transportation Cost

Cities		Transportation cost (Rs/Litrs)
From	**To**	
Karachi	Multan	2.94
Multan	Faisalabad	1.38
Multan	Gujranwala	1.22
Multan	Sialkot	1.38
Multan	Rahim Yar Khan	1.19
Multan	Sawat	1.27
Multan	Bahawalpur	1.48
Multan	D. G. Khan	1.15
Multan	Islamabad	1.17
Multan	Kohat	1.29
Multan	Sahewal	1.3
Multan	Khanewal	1.18
Multan	Peshawar	1.00

4.6. Warehouse Demand Centers (Existing)

Currently the cities that are covered by Lahore warehouse are Faisalabad, Gujranwala, Sialkot, Rahim Yar khan, Bahawalpur, D. G. Khan, Khanewal, Sahewal, Islamabad, Sawat, Kohat, Kohat.

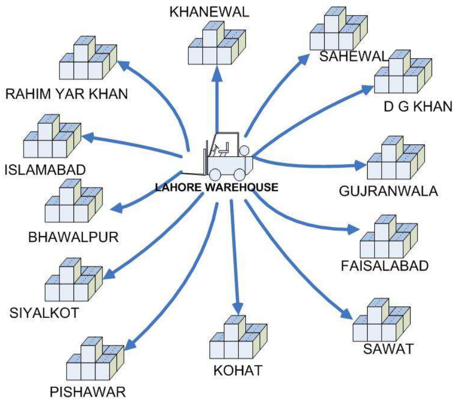

Figure 2. Cities Covered By Lahore Ware House (Current)

4.7. Warehouse Selection

As the Lahore warehouse has the capacity of 0.4 million liters and is currently operated at approximately 0.38 million liters, the objective is to cut down the capacity of Lahore warehouse to 0.2 million liters, the remaining inventory will automatically be shifted to the new proposed warehouse. The new warehouse will be run by third party warehouse service provider and it doesn't have any capacity constraints, XYZ Company will pay only the inventory holding cost to the third party warehouse service provider and logistics suppliers.

5. Warehouse Proposals

XYZ Company focuses to reduce the transportation cost between the warehouses and the demand centers which has become the basis of the warehouse location. Now for the alternatives are evaluated according their transportation cost from the demand centers (cities) and from the main plant.

On the basis of geographical analysis and rule of thumb (strategically) the locations are identified and they are evaluated mainly on the basis of their transportation cost.
Another factor is kept into mind while identification of the warehouse location.
For the new warehouse facility location ***three*** alternatives have been considered.

1 LAHORE – MULTAN
2 LAHORE – ISLAMABAD
3 LAHORE – KOHAT

These three alternatives have been proposed on the basis of geographical analysis (strategic decision/heuristic approach) that mainly focuses over the demand centers or destinations. [See Pakistan map in Appendices]
The detail analysis on each warehouse (facility) is given as follows.

5.1. Lahore–Multan Alternative

The first proposed warehouse is the Multan warehouse. The reason for selecting the Multan as a proposal is its location that can be strategically sound as it can cover the lower Punjab region and some cities of upper Sindh thereby dropping the load of Lahore warehouse. It will be run by a third party, there is no initial cost or fixed cost for it, rather company would pay on the basis Rs/Ltr that is being stored.

The demand centers (destination cities) are being proposed by geographical location and current allocation. The approach here is to save the transportation cost and it happens when the demand centers or the cities of which the demand has to be fulfilled are near to the warehouse and the transportation cost from Karachi and hub (BLENDING PLANT) warehouse to the proposed warehouses must be minimum.

5.2. Calculations (Transportation model)

For finding the total transportation cost transportation model is developed. These whole calculations are done by using the software DS-Windows and TORA.
Our objective function is to minimize cost. By using the transportation model (Linear Programming) the evaluation is being done. Here we have two sources i.e. Lahore and Multan warehouse and twelve destinations (cities).
The noticeable thing here is the capacity constraint at Lahore warehouse, which is also our main objective. There is no capacity (supply) constraint on the new warehouse proposed warehouse as it will be run by third party warehouse service provider. The following table shows the basic transportation model for Lahore–Multan warehouse

Table 4. Solution of DS Windows

Cost at	Faisalabad	Gujranwala	Sialkot	Islamabad	Kohat	Sawat	
Lahore	3.515	3.315	3.465	3.285	3.275	3.405	
Multan	4.32	4.16	4.32	4.11	3.94	4.21	
Demand	55800	30500	21550	23500	45000	64000	
	Kohat	RY khan	Bahawalpur	DG khan	Khanewal	Sahewal	Supply
Lahore	3.435	3.355	3.575	3.315	3.385	3.495	200000
Multan	4.23	4.13	4.42	4.09	4.12	4.24	200000
Demand	50540	27600	32800	16500	12400	8600	388790\400000

Table 5. Transportation cost for Lahore and Multan warehouse

Cities		Transportation cost (Rs/Ltrs)
From	To	
Karachi	**Lahore**	**2.045**
Lahore	Faisalabad	1.47
Lahore	Gujranwala	1.27
Lahore	Sialkot	1.42
Lahore	Sawat	1.36
Lahore	Bahawalpur	1.53
Lahore	Islamabad/RWP	1.24
Karachi	**Multan**	**2.94**
Multan	Faisalabad	1.38
Multan	Rahim Yar Khan	1.19
Multan	D. G. Khan	1.15
Multan	Kohat	1.29
Multan	Sahewal	1.3
Multan	Khanewal	1.18
Multan	Peshawar	1.00

5.3. Demand Centers Distribution

The proposed cities that will be covered by the Lahore warehouse are:

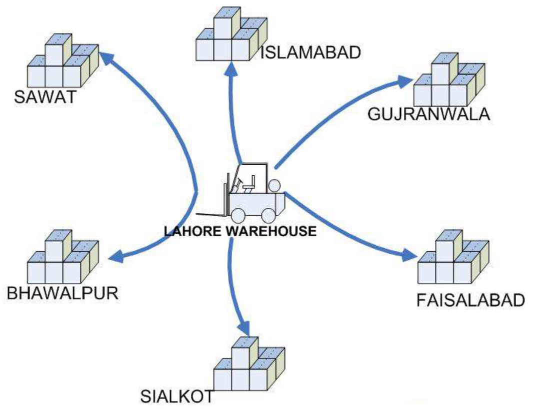

Figure 3. Cities that will be covered by Lahore afterwards

The proposed cities (demand centers) that will be covered by the Multan warehouse are:

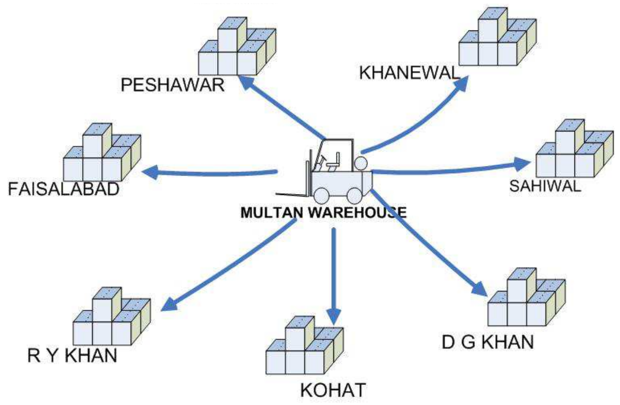

Figure 4. Cities that will be covered by Multan warehouse

5.4. Shipment Chart

The shipment chart of Lahore–Multan warehouse, for the minimum cost based on the result of transportation model evaluation is;

Table 6: Transportation Costs from Lahore

From	To	Shipment (Ltr/month)	Cost per unit(Rs/Ltr)	Shipment cost (Rs/month)
Lahore	Faisalabad	27650	3.515	97189.8
Lahore	Gujranwala	30500	3.315	101108
Lahore	Sialkot	21550	3.465	74670.8
Lahore	Islamabad	23500	3.285	77197.5
Lahore	Sawat	64000	3.405	217920
Lahore	Bahawalpur	32800	3.575	117260
Multan	Faisalabad	28150	4.32	121608
Multan	Peshawar	45000	3.94	177300
Multan	Kohat	50540	4.23	213784
Multan	Rahim Yar Khan	27600	4.13	113988
Multan	D.G. Khan	16500	4.09	67485
Multan	Khanewal	12400	4.12	51088
Multan	Sahewal	8600	4.24	36464
Multan	Dummy	11210	0	0

Adding all shipment cost for Lahore and Multan = 97189.8 + 101108 + 74670.8 + 77197.5 + 217920 + 117260 + 121608 + 177300 + 213784 + 113988 + 67485 + 51088 + 36464 = **Rs.1467063.00/month.**

Total cost of Lahore–Multan warehouse = Rs.1467063.00/month

5.5. Lahore- Islamabad Alternatives

The second warehouse proposal is for Islamabad. The reason for selecting the Islamabad as a proposal is due to its location as it can cover the complete northern region. It will also be run by a third party warehouse service provider, hence there is no initial cost or fixed cost for it, the company would pay on the basis of Rs/Ltrs i.e. only the holding cost of the inventory is being paid.

The demand centers (destination cities) are being proposed by geographical location and current allocation. The approach here is to save the transportation cost and it happens when the demand centers or the cities of which the demand has to be fulfilled are near to the warehouse and the transportation cost between the destinations are minimum.

5.6. Calculations (Transportation Model)

For finding the total transportation cost transportation model is developed. These whole calculations are done by using the software DS-Windows and TORA.

Our objective function is to minimize the cost. By using the transportation model (Linear Programming) the evaluation is being done. Here we have two sources i.e. Lahore and Islamabad warehouse and twelve destinations (cities).

The noticeable thing here is the capacity constraint that restricts the inventory of Lahore warehouse to 0.2 million litres, which is also our main objective. There is no capacity constraint on the new (proposed) warehouse as it will be run by third party warehouse service providers.

But for the optimal solution when the capacity of Lahore is kept 0.2 million liters the solution to the problem is not optimal. The optimal transportation cost results with the Lahore capacity (supply) of 205750 litres (0.20575 million litres).

Although this optimization violets the capacity constraint but in practical the warehouse capacity is not fully utilized and hence this approach is practical.

The following chart shows the basic transportation model for Lahore – Islamabad warehouse:

Table 7. Transportation Model

COSTS							
	Faisalabad	Gujranwala	Sialkot	Islamabad	Kohat	Sawat	
Lahore	3.515	3.315	3.465	1000	1000	1000	
Islamabad	1000	1000	1000	2.62	3.47	3.74	
Demand	55800	30500	21550	23500	45000	64000	
	Kohat	RY khan	Bhp	DH khan	Khanewal	Sahewal	Supply
Lahore	1000	3.355	3.575	3.315	3.385	3.495	205750
Islamabad	3.49	1000	1000	1000	1000	1000	200000
Demand	50540	27600	32800	16500	12400	8600	388790 \ 405750

Table 9: Transportation cost for Lahore and Islamabad warehouse

Cities		Transportation cost (Rs/Ltrs)
From	**To**	
Karachi	**Lahore**	**2.045**
Lahore	Faisalabad	1.47
Lahore	Gujranwala	1.27
Lahore	Sialkot	1.42
Lahore	Rahim Yar Khan	1.31
Lahore	Bahawalpur	1.53
Lahore	D. G. Khan	1.27
Lahore	Sahewal	1.45
Lahore	Khanewal	1.34
Karachi	**Islamabad**	**2.62**
Islamabad	Sawat	1.12
Islamabad	Peshawar	0.85
Islamabad	Kohat	0.87

5.7. Demand Centers Distribution

The proposed cities that will be covered by the Lahore warehouse are:

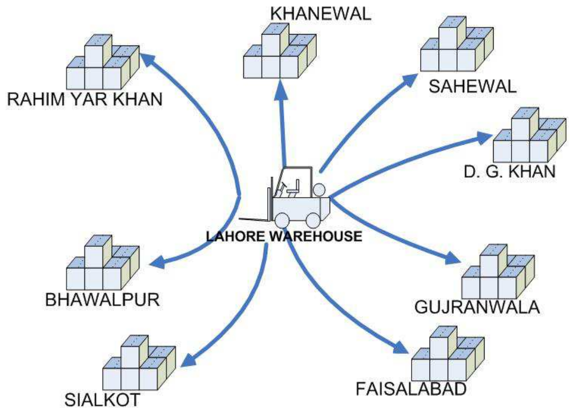

Figure 5. Demand Center distribution from Lahore

The proposed cities (destinations) that will be covered by the Islamabad warehouse are:

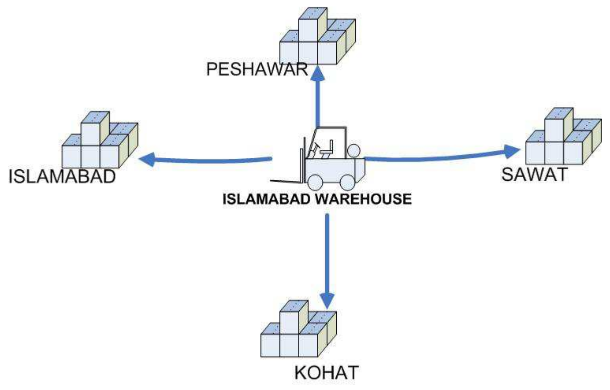

Figure 6. Demand Center distribution from Islamabad

5.8. Shipment Chart

The shipment chart of Lahore – Multan warehouse, for the minimum cost based on the result of transportation model evaluation is

Table 10. Shipment Cost from Lahore

From	To	Shipment (Ltr/month)	Cost per unit(Rs/Ltr)	Shipment Cost (Rs/month)
Lahore	Faisalabad	55800	3.515	196137
Lahore	Gujranwala	30500	3.315	101108
Lahore	Sialkot	21550	3.465	74670.8
Lahore	Rahim Yar khan	27600	3.355	92598
Lahore	Bahawalpur	32800	3.575	117260
Lahore	Dg khan	16500	3.315	54697.5
Lahore	Khanewal	12400	3.385	41974
Lahore	Sahewal	8600	3.495	30057
Lahore	Dummy	0	0	0
Islamabad	Islamabad	23500	2.62	61570
Islamabad	Kohat	45000	3.47	156150
Islamabad	Sawat	64000	3.74	239360
Islamabad	Kohat	50540	3.49	176385
Islamabad	Dummy	16960	0	0

5.9. For total transportation cost

Adding all shipment cost for Lahore and Islamabad = 196137 + 101108 + 74670.8 + 92598 + 117260 + 54697.5 + 41974 + 30057 + 61570 + 156150 + 239360+176385 = **Rs.1341966/month.**

Total cost of Lahore-Islamabad warehouse = Rs.1341966/month

Table 11. Marginal Cost

MARGINAL COST							
	Faisalabad	**Gujranwala**	**Sialkot**	**Islamabad**	**Kohat**	**Sawat**	
Lahore				997.38	996.53	996.26	
Islamabad	996.485	996.685	996.535				
	Kohat	**RY khan**	**Bhp**	**DG khan**	**Khanewal**	**Sahewal**	**Dummy**
Lahore	996.51						
Islamabad		996.645	996.425	996.685	996.615	996.505	

5.10 Lahore-Kohat Warehouse

The third and last option as an alternative that was proposed was Kohat warehouse, but due to certain constraints further progress on this alternative was not made. These constraints include:

- There is uncertainty of situation.
- Political risk is also a factor for not proceeding on this alternative.
- Although it could be a good option for covering the northern areas demand centers, but the percentage sales volume covered by this warehouse were not enough to be a reason for its selection.

6. Findings

From the above calculation the following results are obtained.

Cost Of Lahore –Multan = Rs. 1467063/month

Cost Of Lahore – Islamabad = Rs. 1341966/month

Difference (savings) **= (**1467063 – 1341966) Rs/month = **Rs.125097/month**

Savings Per Month = **Rs. 125097/month**

Savings Per Annum = (125097x12) = Rs. 1501164/annum = 1501164/1000000 = **Rs. 1.5 million/annum**

Saving Per Annum = **Rs. 1.5 Million/Annum**

Saving (Rs/Ltr) = 125097(Rs/month) / 388790 (Ltrs/month) = 0.3214 Rs/Ltr

Saving (Rs/Ltr) = **0.321 Rs/Ltr.**

Lahore consumption level decreased to 205750 Ltr or .205 million Ltrs/month.

The above result clearly identifies that if Lahore-Islamabad warehouse alternative is chosen then the company will get the benefit of **Rs.1501164 million/annum (Rs.1.5 million/annum)** i.e. **0.321 Rs/Ltr.** So, Islamabad will be selected for the new warehouse location

7. Conclusion

Based on above study we found that only identifying the new suitable location of warehouse will give us the saving of **0.321 Rs/Ltr.** which is significant. Moreover, we also have following benefits which help us in fulfilling customer demand and improving customer service level.

1. XYZ Company reduces delivery lead times and offer availability of products on time
2. XYZ Company reduced delivery and holding costs.
3. XYZ Company reduces the load on Lahore warehouse and will operate for some of the regions covered by Lahore warehouse.
4. Locating new warehouse near some of the demand centers will reduce fixed and variable cost of the warehouse
5. Lahore new warehouse will also get reduced and will also facilitate delivering products to customers with lower transportation and operating costs.

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