Optimal Transportation Schedule for 

a Lumber Company in Ghana 

Douglas Kwasi Boah 
Department of Mathematics 
University for Development Studies 
P. O. Box 24 Navrongo - Ghana 

Isaac Kwasi Adu 
Department of Mathematics 
Valley View University, Techiman Campus 
P. O. Box 183 B/A-Ghana 

Stephen Eduafo 
Department of Mathematics 
Valley View University, Techiman Campus 
P. O. Box 183 B/A-Ghana 

Abstract 

In this paper, the concept of transportation problem was applied to a Lumber Company A in Ghana which had a difficulty in transporting wood from its four logging sites to five wood markets weekly in order to minimize cost. Based on the data collected, Management Scientist Version 5 Software was used to solve the transportation problem. Optimal weekly transportation schedule was obtained for the Lumber Company. Finally, the total optimal transportation cost of the company for every week was found to be GH₵ 2500. It is strongly recommended that the Lumber Company should adhere to the optimal transportation schedule and also employ at least one operations researcher to assist the company in its activities.
Keywords: Transportation Problem, Optimal Solution, North-West Corner Method, Least Cost Method, Vogel’s Approximation Method, Modified Distribution Method

Introduction

The transportation problem (TP) arises frequently in planning for the distribution of goods and services from several supply locations to several demand locations. The transportation problem is concerned with finding the minimum cost of transporting a single commodity from a given number of sources (e.g. factories) to a given number of destinations (e.g. warehouses). The objective is to determine how many units should be shipped from each origin to each destination so that all destination demands are satisfied and the total transportation costs are minimized (David et al., 1988). Every transportation problem consists of the level of supply at each source and the amount of demand at each destination. It also has a unit transportation cost of the commodity from each source to each destination. Since there is only one commodity, a destination can receive its demand from more than one source. When transportation method is employed in solving a transportation problem, the very initial step that has to be undertaken is to obtain a feasible solution satisfying demand and supply requirement (Lu and Chen, 2011). North-West Corner Method, Least Cost Method and Vogel’s Approximation Method are among the most popular algorithms used to find the initial basic feasible solutions of transportation problems. After obtaining initial solution, it has to pass through an optimal testing process. By definition, an optimal solution refers to a solution in which no more transportation routes can manage to reduce the total transportation cost (Chaudhuri and De, 2011). This process is usually carried out in terms of opportunities aiming at reducing the overall transportation cost (Zargari et al., 2009). The Modified Distribution Method is one of the most popular algorithms for obtaining an optimal solution of a transportation problem (Mayo, 2009).

A number of papers in the theory and applications of assignment problems have been reported in the literature. The transportation problem was formalized by the French Mathematician, Gaspard Monge in 1781. Major advances were made in the field during World War II by the Soviet/Russian Mathematician and Economist Leonid Kantorovich. Consequently, the problem as it is now stated is sometimes known as the Monge-Kantorovich transportation problem. The origin of transportation was first presented by Hitchcock (1941). Kantorovich (1942) published a paper on continuous version of the problem. Koopmans (1947) presented an Optimum Utilization of the Transportation System. Dantzig (1951) presented ‘Application of the Simplex Method to the Transportation Problem’. Gani and Razak (2006) looked at Two Stage Fuzzy Transportation Problem. Adlakha et al (2006) worked on solving transportation problems with mixed constraints. Nikolic (2007) presented a Total Time Minimizing Transportation Problem. Iman et al (2009) looked at ‘Solving transportation problem using Object-
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A lumber company in Ghana had a difficulty in transporting wood from its four logging sites to five wood markets weekly in order to minimize transportation cost. We used the concept of transportation problem to determine an optimal weekly transportation schedule for the company so as to minimise its total transportation cost thereby maximizing its profit. Since the company requires anonymity, it is identified by surrogate name A throughout the paper.

Materials and Methods

The concept of transportation problem was applied to a Lumber Company A in Ghana which had a difficulty in transporting wood from its four logging sites to five wood markets weekly in order to minimize cost. Secondary data (total weekly supply at each logging site, total weekly demand at each market and unit transportation cost of wood from each site to each market) was collected from the Manager of the company as shown in Table 1.

Table 1: Unit Transportation Costs (in Ghana Cedi), Total Supply at each site and Total Demand at each market.

<table>
<thead>
<tr>
<th>Logging Sites</th>
<th>Market 1</th>
<th>Market 2</th>
<th>Market 3</th>
<th>Market 4</th>
<th>Market 5</th>
<th>Available Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>30</td>
<td>50</td>
<td>40</td>
<td>60</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>Site 2</td>
<td>65</td>
<td>35</td>
<td>45</td>
<td>30</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>Site 3</td>
<td>35</td>
<td>40</td>
<td>60</td>
<td>40</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Site 4</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>45</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>Market Demand</td>
<td>15</td>
<td>18</td>
<td>10</td>
<td>17</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Source: Lumber Company A in Ghana, 2015

Results and Discussions

Based on the data collected, Management Scientist Version 5 Software developed by Anderson et al (2000) was used to solve the problem. Optimal weekly transportation schedule was obtained for Lumber Company A as shown in Table 2.
Table 2: Optimal Weekly Transportation Schedule for Lumber Company A

<table>
<thead>
<tr>
<th>Logging Sites</th>
<th>Market 1</th>
<th>Market 2</th>
<th>Market 3</th>
<th>Market 4</th>
<th>Market 5</th>
<th>Available Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>10</td>
<td>30</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
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<tr>
<td>Site 2</td>
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<td>30</td>
<td>15</td>
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<td>15</td>
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<tr>
<td>Site 3</td>
<td>3</td>
<td>40</td>
<td>2</td>
<td>20</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Site 4</td>
<td>5</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Market Demand</td>
<td>15</td>
<td>18</td>
<td>10</td>
<td>17</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

It follows from Table 2 that, ten (10) logs of woods each should be transported from Site 1 to both Market 1 and Market 3 weekly. Fifteen (15) logs of woods should be transported from Site 2 to Market 4 weekly. Also, three (3), two (2) and twenty (20) logs of woods should be transported from Site 3 to Market 2, Market 4 and Market 5 respectively in every week. Finally, five (5) and fifteen (15) logs of woods should be transported from Site 4 to Market 1 and Market 2 respectively in every week. Hence, the total optimal transportation cost of Lumber Company A for every week should be GH₵ 2500. That is, \((10 \times 30) + (10 \times 40) + (15 \times 30) + (3 \times 40) + (2 \times 40) + (20 \times 30) + (5 \times 20) + (15 \times 30) = 2500\).

Conclusion and Recommendations

In this paper, the concept of transportation problem was applied to a Lumber Company A in Ghana which had a difficulty in transporting woods from its four logging sites to five wood markets weekly in order to minimize cost. Based on the data collected, Management Scientist Version 5 Software was used to solve the transportation problem. Optimal weekly transportation schedule was obtained for the Lumber Company. Finally, the total optimal transportation cost of the company for every week was found to be GH₵ 2500. It is strongly recommended that the Lumber Company should adhere to this optimal transportation schedule and also employ at least one operations researcher to assist the company in its activities.

References


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