APPLICATION OF LINEAR PROGRAMMING IN INDUSTRIAL SYSTEM: DISTRIBUTION

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Thesis submitted in accordance with the partial requirements of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering (Honours) in Manufacturing Management

By

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DECLARATION

I hereby, declared this thesis entitled "Application of Linear Programming in Industrial System: Distribution" is the results of my own research except as cited in references.

Signature	:	……..
Author's Name	:	…….
Date	:	…….

APPROVAL

This thesis submitted to the senate of UTEM and has been accepted as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management). The members of the supervisory committee are as follow:

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Main Supervisor

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ABSTRACT

This study discusses the use of transportation model as one of the operation research model to solve problem in transportation industry that had selected. The transportation problem is a special class of the linear programming problem. It deals with the situation in which a commodity is transported from *sources* to *destinations*. The objective of this research is to determine the transportation plan that minimizes total transportation cost to utilize need. The research is emphasis on land transportation from many sources to various destinations directly or through the transshipment point. By using the mathematical model to formulated problem and applied it to one organization which is hired to transport goods in Malaysia. To ensure this model, the simulation model was applied and it was found that the model is able to give a good illustration of transportation for the real system.

ABSTRAK

Kajian ini mebincangkan penggunaan model pengangkutan sebagai salah satu model penyelidikan operasi untuk menyelesaikan masalah dalam industri pengangkutan yang dipilih. Masalah pengangkutan merupakan salah satu model khas dalam pengatucaraan linear. Model ini tertakluk kepada situasi penghantaran barangan iaitu dari punca ke destinasi. Tujuan kajian ini ialah untuk mendapatkan suatu rancangan pengangkutan yang meminimumkan jumlah kos pengangkutan bagi memenuhi kehendak pelanggan. Kajian ini juga memberi penekanan terhadap pengangkutan barangan (darat) daripada tempat penawaran kepada tempat permintaan sama ada secara terus atau melalui titik pemunggahan. Model matematik digunakan untuk memformulasikan masalah dan diaplikasikan ke atas sebuah organisasi yang mengambil upah mengangkut barang di Malaysia. Bagi menguji keberkesanan model ini, model simulasi diaplikasikan dan didapati bahawa model yang diperolehi mampu memberikan gambaran perancangan pengangkutan yang baik kepada sistem sebenar.

DEDICATION

In God I Trust.

Dedicated to all my beloved family especially to my father, mother, brothers and sisters.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

MNC	-	Multinational Companies
BFS	-	Basic Feasible Solution
BV	-	Basic Variables
NBV	-	Non-Basic Variable
MODI	-	Modified Distributed Method
VAM	-	Vogel's Method
m	-	Supply Points
n	-	Demand Points
i	-	Index for origin, *i = 1, 2, …., m*
j	-	Index for destination, *j =1, 2, …, n*
xi	-	Number of units shipped from Source *i* to Destination *j*
cij	-	Cost of shipping one unit from Source *i to Destination j*
si	-	Source capacity
di	-	Destination needs
U	-	Value of the row
V	-	Value of the column
Ui	-	Variable at each row
Vj	-	Variable at each column

CHAPTER 1
INTRODUCTION

1.1 Introduction

The transportation sector is challenged by globalization, consolidation and the need for faster, more visible and more flexible supply chains. In response, astute providers are now seeking a more agile transportation enterprise. By adopting a service-oriented, alliance-based strategy to reach that objective, service providers can gain a competitive edge in today's transportation sector.

With the changing economic scenario, factors such as globalization of markets, international economic integration, and removal of barriers to business and trade and increased competition have enhanced the need of transportation. It is one of the most important infrastructure requirements which is essential for the expansion of opportunities and plays an important role in making or breaking the competitive positioning.

In today's business big or small, domestic or global, the value of time is clearly immense. Business today is focusing on how it can deliver goods and services to global markets in a timely and reliable manner. Besides efficiency in pick up, timely delivery, timely information and availability of other infra structural facilities for efficient handling of truck transportation have become the need of the day. In other words prompt customer service is what gives competitive edge to the players of the truck transportation industry in today's rapidly changing environment. It was this need which stimulated the growth of the express truck industry worldwide.

The transport and logistics sector plays a major role in the world's economy and is a significant contributor at both the national and local level. It underpins the economy, enabling the movement of goods, services and people as efficiently as possible. It is a very diverse sector, which impacts daily on all of people. It can be broken down into the three main categories. Firstly is surface transport, which includes road, rail and pedestrian transport; secondly air transport; and lastly sea transport. The simplest way to consider the complementary parts of the industry is to describe transport as relating to passengers, and logistics as freight. Freight logistics is the movement and supply of goods throughout the economy from raw materials, through all stages of the manufacturing process, to the final delivery of the finished product to companies and consumers. It is often described by the method of transporting goods using on road, rail, sea or air. In reality, large logistics companies work across all types of transport and with multiple industries.

1.2 Problem Statement

In today's market, there is lots of competition in business between companies. In order to become most successful and advantageous company in the marketplace, they usually reorganize and defined their manufacturing strategy and marketing strategy. However, most company always identifies the strategy factors such as on how to product high quality with low cost requirement and how to meet the customer requirements for the

product ordered. Normally, the company in industries actually is not aware with the importance delivery speed factor for customer's satisfaction. The terms of delivery speeds factors is how fast the response of the company to deliver the product to customers where on how reduce the time taken for transportation delivery to the customers company destination.

Therefore, it is important for the company in industries to develop a transportation model by using linear programming methods to solve the respective problems. This model will help in finding the optimal solution to give efficiency in performance, reducing the cost of the transportation, design a system in decision making, and give the maximum profit to the organization where as for company transportation scheme; it will decide the best direction to choose in order to minimize the cost of the transportation.

1.3 Objectives

The objective of this research study is:

i. To understand the application and the importance of transportation model technique for the company needs.
ii. To identify the cause and effect of transportation process / model towards company needs.
iii. To produce a mathematics model to solution could represent good approximation to true system solution transportation organization that selected.

1.4 Scope of Study

This study will cover the transportation process problems in industries especially Malaysian customers of Seon Tak Sdn. Bhd Ayer Keroh, Melaka. The major focus of this study is on how to produce best transportation scheme for the company by

understanding the factors that may affect the outcome of the transportation model. The possible constrain factors identified are type of product, type of transportation used, distance between destination, and the quantity of the transportation. This information are gathered and collected through observation and interview.

As for research study analysis, the method that will be used to calculate the transportation model is linear programming. The linear programming is used to analysis the cycle system in company distribution and other aspects of planning, design, management and operations of transport systems. The study will conduct from July 2007 until April 2008.

Below is specifying that to conduct on this project:

1. Application of transportation model and it widely.
2. Consideration in linear function.
3. The research of case will use the local company of Seon Tak Sdn Bhd. as agent transportation and it location distribution center specify in Malaysia.
4. Distribution process occurred from main center at Ayer Keroh Melaka and totally includes the 9 relocation center state (source) to 9 difference of location organization state (destination) either directly or from relocation center.
5. Control variable is a unit of goods number that will bring of i cause to destination j where i = 1, 2 =,....9 and j =1, 2 =...9

1.5 Company Background

This study chooses the organization of Seon Tak Sdn. Bhd, where this organization involves in distribution of customer's product. This organization situated at the Ayer Keroh, Melaka. They serve the service of transportation to the customer since 1988. Seon Tak Sdn. Bhd Transportation was founded in 1988 with the idea of providing a specialized service unmatched for on-time deliveries and attention to detail. The owner of Seon Tak Sdn. Bhd. has over 20 years experience in the trucking industry. This helps the company better understand the needs and requirements of their customers. Seon Tak's top quality people are thoroughly familiar with the machinery, pollution equipment, and other specialized commodities that expertly move everyday. This helps ensure a move that goes smoothly, safely, and on schedule. Beside that this organization involve the Associated Chinese Chamber of Commence and Industry of Malaysia, therefore it always competent with other industry to give the best service. Since many the transportation are exist, they competent to each other for the economic country growth.

Seon Tak Transportation Sdn. Bhd operates from only one location. This organization as the transportation argent gives the service to the customer. This organization also gives the insurance covered to the customer's products and pay back if anything happened during the operation. The customer have been given duration about one month for pay to the organization after given the services to the customer. They provide transportation solutions for the certain customers and meet the many varying needs in today's transportation market.

The center of this organization at the Ayer Keroh Melaka and Johor Bharu meanwhile they also have the branch at the Bukit Mertajam, Pulau Pinang. In this study there have relocation center which is the commodities have to be shipped to a relocation centers before they are shipped to their final destinations.

Firstly, their customer from Melaka area is Ayer Keroh, Alor Gajah, Tanjung Keling, Kerubung, Tanggal Batu and Bukit Rambai, Then they export the customer's product at the Ipoh, Taiping, Seberang Prai, Butterworth, Sungai Pettani,, Alor Setar and Kangar. The main point area is Bukit Mertajam,Muar and Ayer Keroh where is this point area as the role to relocate the goods or commodity.

The main type of service's transportation at this organization is truck and trailer. They have about 4 trucks and 12 trailers come out with different size. There have varying size of trucks which is 10'X7' (3 tone) and 7'X7' (1 tone). For the trailers there have one size that is 20'X8' (20 tone). Consider that when this company using big capacity of truck and trailer, it means the distance between source and destination is long and the load of commodity supply and demand are too high.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

In this chapter, several literatures will be review regarding the title of the project. All aspects and subject involved within the project scope will be highlighted. There are three main fields that involved in this chapter which are operation research, linear programming, and transportation problem. One important application of linear programming has been in the area of physical distribution (Transportation) of resources from one place to another, to meet a specific set of requirements. It is easy to express a transportation problem mathematically in terms of a linear programming model, which can be solved by the simplex method. Since transportation problem involves a large number of variables and constraints, it takes a very long time to solve it by simple simplex method. Simplex algorithms can be specialized to solve several linear programming models that arise from network flow problems.

A transportation problem basically deals with the problem, which aims to find the best way to fulfill the demand of n demand points using the capacities of m supply points. While trying to find the best way, generally a variable cost of shipping the product from one supply point to a demand point or a similar constraint should be taken into consideration.

There were many journal and book referring to the project scope. From the broad area, the review then highlighted the model of transportation which is give the improvement and benefit to the organization especially to reduce the cost and optimization solution Literature review works as a guideline and better understanding to the field of project. It helps to identify the current problems, information, new techniques, and method of study, solution and recommendation.

2.2 Transportation in Industry

Transport or transportation is the movement of people and goods from one place to another. The term is derived from the Latin trans ("across") and portare ("to carry"). Industries which have the business of providing equipment, actual transport, transport of people or goods and services used in transport of goods or people make up a large broad and important sector of most national economies, and are collectively referred to as transport industries. Transportation is the basic to the economy development for each country. “No nation has become great that did not give major attention to the development of transportation” (Muhammad Harun, 1983). Transportation is relevant to all parts of the world: industrialized, newly industrialized or developing.

Transportation problems belong to a broad class of problems known as network flow problems. The goal for any business owner is to minimize transportation costs while also meeting demand for products. Transportation costs generally depend upon the distance between the source and the destination, the means of transportation chosen, and the size and quantity of the product to be shipped. In many cases, there are several sources and many destinations for the same product, which adds a significant level of complexity to the problem of minimizing transportation costs. Transportation concerns the movement of products from a source such as a plant, factory, or work-shop to a destination such as a warehouse, customer, or retail store. Transportation may take place via air, water, rail, road, pipeline, or cable routes, using planes, boats, trains, trucks, and telecommunications equipment as the means of transportation.

2.2.1 Transportation as a Driver of Business Performance

Constant changes in market dynamics drive businesses to continually improve their performances. Over the decades, the landscape of doing business has changed. Commercial considerations continue to demand better and more competitive ways of doing business. More emphasis is placed by business entities on meeting customer demands and providing excellent customer service.

One of the most vital components of business is transportation, with which raw materials are procured by manufacturers and end-products delivered to customers. Transportation typically represents the biggest portion of a company's logistics costs, taking up from 40% to 60% of its costs, which also include warehousing and inventory carrying charges (Murphy, J., 1998). It has been estimated that transportation expenditure makes up between 2-5% of the cost of sales (Soriano, 2001). For many companies; this can translate into huge expenditure on freight bills. The planning of transport strategies by large multinational companies (MNC), for example, takes into account many variables involving complex, trans-modal movement on a global scale. Given transport's central role in business, it is not surprising that companies strive to optimize transport usage to deliver the most goods at the least cost and time.

Challenges faced by players in the transport industry, a fiercely competitive sector, are numerous and at times daunting. Market, operational and regulatory pressures have led to stiff competition in the sector. Ever greater emphasis is being given on supply chain management in delivering quality service. This has put transportation, the glue that joins the supply chain together, in the spotlight as a key component in ensuring the smooth and efficient running of the chain.

In today's fast-paced world, shippers of products increasingly demand efficiency from transportation industry. They expect features such as better tracking of their shipment, online ordering facilities, timely and predictable delivery, and more transparent