UNIVERSITI PUTRA MALAYSIA

UTILIZATION OF TRANSPORTATION MODEL FOR PROFIT MAXIMIZATION FOR STRATEGIC CEMENT SDN BHD

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PENGESAHAN KEASLIAN LAPORAN

DENGAN INI, SAYA LEE CHOW HOOI, MATRIK 45092, PELAJAR PROGRAM MBA MENGAKU BAHAWA KERTAS PROJEK/KAJIAN KES UNTUK KURSUS INI ADALAH USAHA ASAL SAYA SENDIRI.

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TANDATANGAN

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TARIKH

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ABSTRACT

This project is entitled ' Utilization of Transportation Model for profit maximization for Strategic Cement Sdn Bhd '.

Transportation Model in this project is one class of linear programming which is one of the decision tool for solving problem in management science. The transportation model utilized in this project is based on the modelling developed by Anderson *et. al.* . The objective of this project is to determine the optimum delivery schedule of cement from two plants of Strategic Cement Sdn Bhd to fulfill the demand of twenty three different locations/destinations in Peninsular Malaysia. The factors involved in determining the profit maximization of the company are cement selling price to the various destinations, production cost, paper bag cost, stevedoring cost, commission to distributors and transportation cost.

The result generated by the Model shows that the optimum distribution pattern is following the profit or revenue maximum pattern i.e. delivery of cement to the maximum profit contribution areas. The trade-off in the Transportation Model is the unsatisfied or unfulfilled demand area or market share which will in turn affect customer satisfaction level. The current practice by Strategic Cement Sdn Bhd reveals that company is supplying to certain demand location/destination despite with lower profit margin as compared to the empirical result generated/guided by the Transportation Model. This is mainly attributed to the fact that in the real business world, other factors shall be taking into consideration besides profits , such as customer service, market share and long term business relationship.

The sensitivity analysis reveals that 1% change of the variables and demand has direct effect on the profit margin and transportation schedule for the company. Management of Strategic Cement Sdn Bhd can therefore utilizes this information to control cost and delivery schedule to achieve higher profit margin.

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.... dedicated to my wife, Poh Imm

for her love and patient, to make this MBA program complete/successful for me

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This project is entitled ‘ utilization of Transportation Model for profit maximization for Strategic Cement Sdn Bhd”. Strategic Cement Sdn Bhd is one of the cement manufacturer in Malaysia. The cement industry in Malaysia is experiencing booming stage where the demand for it is increasing year by year. This project is intended to utilize the Transportation Model to find optimum delivery schedule from supply sources to fulfill the demand by location/destination to attain maximum profit for Strategic Cement Sdn Bhd.

1.1 The Cement Industry

Cement is the essential building material in the construction industry. It is an important ingredient of concrete and concrete products such as slabs, beams, columns, roofing tiles and cement bricks.

The cement industry is characterized by :

a. High capital investment per firm and large employment size per firm, reflecting the large scale, heavy capital investment natural of the industry.

b. High capital-labour ratio. (RM168,000 per worker versus RM18,000 for other sectors)

c. High labour productivity (RM53,000 value added per worker versus RM16,500 for other sectors).

d. High average wage earning per worker (Average annual wage of RM18,000 per worker versus RM9,600 for other sectors).

The cement industry is primarily a domestic market oriented industry. However, because of the heavy investment in the industry, cement production capacity does not increase uniformly and continuously, but tends to occur in quantum leap each time a new production line is opened up. Consequently, cycles of oversupply and under-supply appear to be the inherent feature of this industry.

The gap between production and domestic demand were filled by imports, while those years where over-supply (capacity) existed saw an increase in export. The Malaysian cement imports and exports statistics are shown in Table 1.1.

TABLE 1.1

Malaysian Cement Imports And Exports (1989 to 1996)

Year	Cement Import (x 1000 MT)	Cement Export (x 1000 MT)
1989	36	466
1990	143	298
1991	94	161
1992	76	37
1993	39	11
1994	122	111
1995	650	30
1996	1,050	-

(Source : Cement & Concrete Association of Malaysia)

The sudden increase in domestic demand for cement for cement in 1995 and 1996 has resulted in cement supply shortage started from May 1995. This was due to strong demand in the country as demand for cement had grown proportionately with the high percentage growth in the construction industry. The cement was imported from various sources i.e. China, Mexico, Japan, Korea and Indonesia . The Malaysian cement output and demand is as shown in Table 1.2.

TABLE 1.2

Malaysian Cement Output and Demand (1989 to 2000)

Year	Production (Million tons/year)	Demand (Million tons/year)	% Increase in Demand
1985	4.16	4.16	-
1986	3.51	3.69	-11.3
1987	3.21	3.06	-17.1
1988	3.83	3.36	+9.8
1989	4.77	4.34	+29.2
1990	5.87	5.73	+32.00
1991	7.32	7.26	+26.7
1992	8.21	8.26	+13.80
1993	8.91	8.67	+7.4
1994	9.98	10.07	+13.5
1995	10.90	11.80	+17.2
1996	12.00	13.60	+15.3
1997	15.00	15.00	+10.3
1998	18.33	16.58	+10.50
1999	21.35	18.32	+10.50
2000	27.60	20.24	+10.5

(Source : Cement and Concrete Associated of Malaysia (C & CA)

Obviously, while recovering from the recession in 1985 to 1996, Malaysia economy has surged substantially with an annual an annual growth rate of more than 8%. This has boosted the construction industry, particularly in the fast growing area like Klang Valley, Penang and Johore Bahru.

The central region of West Malaysia comprising Selangor, Negeri Sembilan and Pahang makes up about 50% of the cement market. The north with Perlis, Kedah, Penang and Perak have 27%, while Johore and Melaka in the south have 18%. The eastern market comprising Kelantan and Trengganu make up 5%.

Cement production technology in Malaysia has reached a level of sophistication and efficiency comparable to that in any part of the world. Practically all the cement plants in Malaysia have adopted or have converted to the dry process. Access to technology has not been a problem for the cement industry in Malaysia. However, production costs of cement remain relatively high compared to those in countries such as Singapore, Japan, the Republic of Korea and Taiwan. Industry sources claim high electricity rates and transportation costs as the main contributing factors to the high production costs.

Although all the raw materials except gypsum are available in Malaysia, it does not give much advantage as the materials cost only about 10-12% of total production costs. Fuel and electrical power constitute more than 50%. Besides, the investment cost in setting up an integrated cement plant is very high. A 1.2 million-ton integrated cement plant currently requires a capital outlay of 400-500 million ringgit. This is about three times the cost of setting up a similar plant in 1978.

1.2 Recent And Future Trend

After 14 years of lobbying, cement manufacturers were finally granted a 10% price hike on 14 august 1995. Despite this 10% increase, Malaysian cement price remains one of the lowest in this region. It should also be noted that among the ASEAN members, Malaysia and Indonesia are the only countries which still exercise price control on cement A comparison of cement price among the ASEAN countries are as follows.

TABLE 1.3

Cement Price among ASEAN countries

COUNTRY	Bagged Cement Delivered (US $ per ton)	Bulk Cement Delivered (US$ per ton)
Malaysia	79.20	79.20
Indonesia	92.94	87.44
Philippines	106.00	101.00
Singapore	102.80 to 105.60	88.40 to 95.00
Thailand	*69.29	*62.57
* Quatation is based on ex-factory price only	Exchange rate : 1 US$ = RM 2.70 as at August 1997	

(Source . ASEAN Federation of Cement Manufacturers)

The recent price hike might not be substantial enough to entice existing players and new entrants to expand capacity as indicates by a survey of the cement companies. The

Ministry of International Trade and Industry, however, believes that the recent price hike is an attractive incentive, prompting the Ministry to threaten revocation of cement production licenses of companies that have yet to begin operations.

The cement sector is expected to register strong growth over the next few years, buoyed by the massive construction activities in progress and scheduled. Some of the projects to be undertaken are as follows.

TABLE 1.4

Major projects undertaken by the government and private sector

Project	Value (RM billion)	Expected Years of completion
1. Sepang Airport	20	2004
2. Pennisular Gas Utilisation III	7.3	1997
3. National Sewerage System	6.3	2012
4. Commonwealth Game Facilities	1.5	1998
5. Light Rail Transit	1.2	1997
6. Second Link With Singapore	1.6	1997
7. Shah Alam Expressway	1.1	1998
8. Lumut Power Plant	3.9	1997
9. Pasir Gudang and Paka Power Plant	2.5	1997
10. Port Klang West Port	1.3	2000
11. Johore Water Treatment Plants	0.6	2002
12. K.L.-Karak Highway	0.5	1997
13. NSE Central Link	0.9	1997
14. Various Townships	5.0	1998
15. Various Road Contracts	3.8	1998
16. Bakum Hydroelectric Dam	5.0	1999
17. KTM Double Tracking	4.5	2000
18. LRT (other phases)	5.0	2000
19. Brickfields Central Station	3.5	2008
20. Johore Waterfront City	4.0	2014

As the bulk of these mega-projects are to be completed in 1997/1998, the usage of cement is likely to increase towards the designated completion dates, which will benefit the cement manufacturers in the next two to three years. Cement companies, in response to the imminent increase in demand, have either embarked or proposed to embark on capacity expansion plans.

1.3 Logistic In Cement Industry

Cement is a finely ground hydraulic building medium for mortar and concrete. When mixed with water or contacted with moisture contact in air, cement will harden and it will retain its strength under water. The life-span for cement is approximately 5 weeks; after which its strength will decrease gradually. Therefore, it is crucial to dispatch cement produced quickly.

The logistic/distribution of cement play an important part in fulfilling customers requirement i.e. fast and on time delivery in the construction industry. The commonly used transportation modes or carrier for cement are lorries and tankers respectively. The common carrier capacities for lorries and tankers are 400 bags per lorry and 30 metric tones per tanker respectively.

The distance between source of supply and demand location/destination has an direct effect on the distribution of cement pattern. The dispatches of cement to the nearest demand location/destination will inevitably increase the carrier turnaround frequency and hence increase the total dispatch efficiency. However, since cement is one of the government controlled price item, its distribution pattern is also partially being determined by the area controlled price and transportation cost to the demand location/destination.

1.4 Statement of Problem

Manufacturing of cement is a heavy investment. The cost involved in constructing a 1.8 million tones annual capacity integrate cement plant is estimated at RM600 million. Since the life span of cement is very short i.e. maximum 5 weeks, after which its strength will decreased gradually, it is therefore imperative to market/sell and dispatch all tonnage of cement produced quickly.

Since Cement's selling price is fixed at various location/destination based on the Government Control Item Act, the profit maximization objective of cement manufacturer is by selling to the right destination with minimum transportation cost and other related cost, such as production cost, paper bag cost, stevedoring cost and commission cost. On the other hand, Company has to take other factors into consideration in pursuit of its financial objective i.e. by rationalized the service to market and other marketing related matters such as market share, customers' satisfaction level, brand awareness in the market etc. Therefore, there is a need for this study to utilize the transportation Model to achieve the above objectives.

1.5 The Objective of Project

The objective of the project is to find ways to maximize profit of the company. Several factors to be taken into consideration included cement selling price transportation costs, commission cost, , paper bag cost, stevedoring cost and customers' requirement by location/destination.

The specific objective of this project is to :

1) Evaluate the transportation model in terms of its theoretical framework.
2) Utilizing the transportation model for profit maximization for Strategic Cement Sdn Bhd.
3) Analysis the issue of customer service.

1.6 Importance of Project

The importance of this project can be discuss in terms of profit maximization and goodwill improvement for cement manufacturer.

The objective of a business entity either in manufacturing or service industry is to maximize profit for the shareholders of the business entity itself. For cement, which is a government controlled price item in Malaysia, the selling price of cement to various towns in Peninsular Malaysia is varies according to various factors, such as proximity to cement plants, economy condition of state, the demographic/population of the state, the investment cost of manufacturer and the comparison of cement price within the South East Asia Region. The listed selling price for cement is as shown in Table 1.5

TABLE 1.5
Cement listed selling price for main cities in Peninsular Malaysia
(with effective form 14-08-1995)

Town (with city & municipal limited)	Government Controlled Price	
	RM/50 kg bag	RM/tone
Kangar	9.70	194.00
Alor Setar	9.90	198.00
Pulau Pinang	10.20	204.00
Ipoh	9.70	194.00
Kuala Lumpur	9.90	198.00
Shah Alam	10.00	200.00
Seremban	10.00	200.00
Melaka	10.20	204.00
Johore Bahru	10.20	204.00
Kota Bahru	10.60	212.00
Kuala Trengganu	10.60	212.00
Kuantan	10.60	212.00

In order to attain maximum profit, cement shall be delivered to higher selling price area with minimum transportation cost or maximize profit margin.

On the other hands, the cement requirement or consumption pattern is not restricted to areas which can always promise higher return or maximum profit. In this regards, the company shall views customer service or filling customer requirement as the criteria.

The Transportation Model can thus provide optimum solution for profit maximization from multiple plants to multiple location/destination. This model will inevitably assist management of Strategic Cement Sdn Bhd to analysis and make sound judgement for the transportation/delivery of cement to customers. Though this Transportation Model is designed for Strategic Cement Sdn Bhd, it can be applicable to other cement industry members with slight adjustment/modification.

1.7 Project Outline

This project is organized into six chapters. The literature review is presented in chapter 2. The methodology used is described in chapter 3. The theoretical framework of the model and its variables are discussed in chapter 4. Chapter 5 presents the result and discussion. The summary and conclusion of the project is given in chapter 6.

CHAPTER TWO

LITERATURES REVIEW

Earlier models to solve plant location problems were developed and applied by French (1960), Hendry and Seagraves (1960), Olson (1959) and Williamson (1962). They treated space as continuous and assumed that a region had uniform average density of supply and demand. The solution specified the most efficient plant size and corresponding market area. Later, Stollsteimer (1963) developed a model which was capable of including pre-selected potential plant location and supply or demand locations. The solution provided the least cost combination of number and location of marketing facilities. Further extensions of the Stollsteimer model were made by Polopolus (1965), Chern and Polopolus (1970), Ladd and Halvorson (1970) and Warrack and Fletcher (1970). King and Logan (1964) applied a transhipment model to the plant location problem, where material may move from a supply point through another intermediate supply point to the demand point or to an intermediate demand point. This model was extended further by Hurt and Tramel (1965) and Leath and Martin (1966).

More recent studies of the optimal plant location type are those by Cassidy, Maccarthy and Toft (1970), Open and Scott (1976), Mackay and Toff (1978), Ryland and guise (1975) and Guedry (1976).

Toft, Cassidy and McCarthy (1970) developed a sensitivity test to determine the stability of the solution obtained with the transhipment model. To accommodate those situations in which nonlinear long-run total processing cost exists, Kloth and Blakley (1971) employed separable programming while Candler, Snyder and Fraught (1972) used concave programming.

Linear Model

The earlier plant location model developed by Stollsteimer (1963) considered the problem of determining the number, size and location of plants that will minimize the transportation and processing costs. The procedure required minimizing the objective function with respect to variations in plant number and location and the presence or absence of economies of scale in plant operation. The model developed does not yield a system that simultaneously minimizes assembly, processing and distribution cost, but it is applicable to a wide range of problems in the general area of plant location.

Polopolus (1965) extended the plant location model to include the multiproduct problem. This multiproduct model is different from the Stollsteimer model in the aggregate assembly cost. Also total processing cost varies both with number of plants and the combination of products handled at each optimum plant location. The results of his study show that multiproduct processing of identical quantities of raw product result in greater economic advantage than with single product processing.

With regard to processing cost function, Chern and Polopolus (1970) attempted a further modification of the Stollsteimer model for wider applications in the location problem. As economies of scale is assumed to increase when the plant size increases, for a given industry output, an increase in plant number necessitates a smaller average size of plant, and this will lead to a loss in industry efficiency and economies of scale. Additionally, plants can be built in different locations to reduce total distance and hence reduce the cost of transportation. This gain will eventually be offset by an increase in total processing cost as the industry continuously increases the number of plants. Conceptually, an equilibrium situation can be defined as the point where the marginal gain from assembly costs is equal to marginal loss in economies of scale. Stollsteimer model was modified to handle a discontinuous total processing cost function. The overall optimum solution is found when the total assembly and processing costs for the industry is minimized.

Ladd and Halvorson (1970) developed a procedure to determine the sensitivity of the Stollsteimer model solution to variations in parameter and the effect of continuous change in the parameter on the minimum cost solution. The analysis shows the effects of varying processing cost, transportation cost and the supply of raw material.

The Stollsteimer long-run model requires a large amount of input data and is computationally demanding. Warrack and Fletcher (1970), in their study have tried to enlarge the applicability of the model for which the basic computational model can be used.

As an exrtension of the Stollsteimer model, King and Logan (1964) include the distribution cost and a nonlinear cost function in their model. The problem is to