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THE USE AND PRODUCTIVITY OF SHORT-TERM CREDIT IN SMALL-SCALE CEMENT PRODUCT AND READY-MADE GARMENT FIRMS IN THAILAND

By

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ABSTRACT

THE USE AND PRODUCTIVITY OF SHORT-TERM CREDIT IN SMALL SCALE CEMENT PRODUCT AND READY-MADE GARMENT FIRMS IN THAILAND

By

Saroj Aungsumalin

Previous studies regarding small-scale industries in developing countries did not provide quantitative measurement of the amount and timing of short-term credit needs from commercial banks. This study has attempted to fill this void.

In response to this need, a generalized linear programming model was constructed that can be applied to any small-scale industry providing certain essential data are available. For this study the model was adapted for analyzing the need for short-term credit by firms in the cement product and the ready-made garment industries in Thailand.

The genrealized linear programming model has the following characteristics: (1) multiperiod to analyze one 12 month production cycle; (2) separate production and marketing activities with input prices and wage vary by seasons; (3) a differentiation between cash and credit transactions for input purchases and product sales; (4) a finished product inventory by product in physical terms by season adjusted by production, sales, and carryover phenomenon; (5) a seasonal cash flow and financial accounting (row activity); and (6) an objective function to maximize net

return to fixed assets, family labor, and equity capital subject to demand, inventory, machinery, borrowed capital, and other financial constraints.

Results of the analysis of short-term credit needs can be summarized as follows: (1) the amount of credit needed from commercial bank sources varies directly with the level of total production, the percentage of production costs paid in the form of cash, the amount of trade credit provided to buyers and the inventory maintained for finished product; (2) it appears that the credit needs and timing of these needs of small-scale firm varies substantially among firms even for those of comparable size and produce line; (3) shadow prices of borrowed capital varies widely by season according to the production, inventory, input acquisition and sale strategies of the firm as they relate to the lending policies of commercial banks; and (4) when the firm expands (other things equal), the amount of credit needed in any period will increase or decrease depending on the type of expansion, raw material acquisition policy, and the credit sales policy which the firm chooses to follow.

To my wife, Wipada, and our parents

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INTRODUCTION

1.1 Problem

Thailand, like many other LDC's, faces complex problems of rural poverty. Rural incomes are extremely low in absolute terms and are low relative to urban incomes. Inequality between and within regions in many cases is substantial. Rural incomes in the North and Northeast Regions are much lower than incomes in the South and Central Regions. Furthermore, within individual regions the gap between rich and poor households has widened. Unemployment and underemployment is assumed to exist everywhere, particularly in rural areas. At the formulation stage of the Fourth Five-Year Plan (1977-1981) the Rural Thai Government (RTG) was faced with the following problems:

- A slow down in industrial and agribusiness growth.
- An increased level of unemployment and underemployment, particularly in rural areas.
- A greater concentration of industrial activities in the Bangkok area with consequent urban migration problems.
- Low income in rural areas.
- Continued uneven income distribution between urban and rural areas.
- Continued dependence on exports of unprocessed primary commodities. (NESDB, 1977)

The RTG has tried to solve these problems in several ways. Attempts are being made to increase agricultural incomes through changes in

technologies and introduction of new crops, intensification of cropping through irrigation, improvements in the supply of financial and marketing services, and investment in social infrastructure.

In addition to the above alternatives, the government has tried very hard to develop the industrial sector. Yet the emphasis of the government industrial programs has been largely placed on the promotion of large-scale "modern" enterprises, particularly those with foreign capital investment. The value added of the manufacturing sector as a percent of gross domestic product has raised from 10 percent in the early 1960's to 22 percent now. The expansion of the industrial sector in terms of value added is quite impressive. Other performance measures, however, tell an opposite story: 1) The proportion of manufacturing employment in the labor force has remained at a small 7 percent, implying the relatively low ability of the sector to create employment. 2) A dualistic structure has emerged in the sector. On the one hand, there is a modern portion consisting mainly of large firms which enjoy several types of incentives and privileges. On the other hand, there is an unorganized portion, with mostly small-scale firms, producing low quality products, often using poorly paid child and female workers, working in appalling conditions, with little or no access to industrial incentives and privileges. 3) The concentration of industries in and around Bangkok has created a serious congestion in Bangkok. 4) The ownership and control of industrial production and distribution has been concentrated in relatively few families and multinational corporations (Akrasenee, 1980).

With the above disappointing performance of past industrial and agricultural development policy and the low capability of absorption of labor from the agricultural sector, the government has become

increasingly aware of and interested in the role that small-scale enterprises might play in its income and employment generation capacities. This is because research on small scale industries in other countries have shown that small-scale industries compared with large scale, "modern industries" have the following desirable characteristics. They: 1) are more geographically dispersed; 2) are less capital intensive; 3) offer more opportunities for unskilled and family labor; 4) have greater linkages with the agricultural sector; and 5) have greater export potential than frequently assumed (Meyer, 1978; Liedholm, 1976). Therefore, small scale industries might be a good candidate for promotion to help solve the problems of low income, unemployment, and underemployment of rural households.

The following items, taken from the Fourth Five-Year Plan, illustrate that the Royal Thai Government has shown strong interest in the promotion of small-scale, labor-intensive industries.

> "To alleviate the unemployment problem in general and seasonal unemployment and rural underemployment in particular, rural projects must be as labor intensive as possible ....incentive must be given to cottage industries, these processing agricultural commodities, and industries that manufacture goods to meet the needs of rural farmers."
>
> "The Government will encourage the development of small-scale industries which are important in generating employment."
>
> "In order to achieve this growth rate, output expansion in the import substitution industries, agro-industries, and labor-intensive small-scale industries in particular have to be accelerated."
>
> "The investment promotion act will be revised to give more incentive to investment in labor-intensive industries. More information on the possibilities and viability of adopting labor-intensive techniques of production will be provided to investors. Small-scale labor-intensive industries will receive additional privileges so that they can compete more effectively vis-a-vis large scale industries."

It is clear that the Royal Thai Government is deeply interested in rural small-scale enterprises as a means to raise income and employment levels. In Thailand, many institutions have been created to help and promote small-scale enterprises. These institutions are:

1. Small Industries Finance Office (SIFO) to provide credit facilities;
2. Industrial Service Institute (ISI) to provide technical advisory services;
3. Thailand Management Development and Productivity Center (TMDPC) to provide management advisory services; and
4. the creation of a marketing center in Bangkok.

The creation and implementation of these institutions, however, is reported to have not helped the small-scale industries very much. Many problems such as lack of funds, poor accounting, inadequate quality control of finished product and raw materials, and poor personnel management still remain with the small-scale enterprises (Sangwanruang, et. al., 1978).

This is to say that if the small-scale industry is to be used as one of the vehicles to increase income and reduce unemployment of rural households, many problem areas have to be studied to seek appropriate solutions. All problem areas cannot receive attention in a single study. To keep this study to manageable size, the emphasis will be directed primarily to the study of credit needs of small-scale firms.

The study of credit needs of small-scale firms can be divided into the study of long-term credit needs and the study of short-term credit needs. However, the study of long-term credit needs of the small-scale firms involves interaction with the acquisition of fixed assets. The kind of questions the firms raise when they consider the acquisition of

new fixed assets are: 1) Should the investment be made and what are the expected benefits of the investment? 2) How should the investment be financed? 3) What is the firm's capacity for loan repayment? 4) What would be the appropriate timing for the schedule of repayment? etc.

This study is concerned primarily with short-term credit needs which are related to the firm's current operation and the management of cash. Cash for current operation may be obtained internally from profits and externally through borrowings. That is, if cash generated internally is not enough to finance current operation to the desired level, the firm could borrow some cash from sources outside the firm. However, before making any agreement to borrow cash from outside sources, the following relevant questions should be answered. 1) How much credit should the firm obtain? If the firm has already borrowed, the firm must decide whether an increase in the level is required, if so what would be the size of the required increase? 2) When should the credit be obtained? 3) What rate of interest can the firm afford to pay for the proposed borrowings? These questions are of particular importance if the firm management contemplates expansion through an increase in the volume of production of existing product lines, or changes its level or mix of existing products, changes the technology of production being used or introduces a new product line.

This study has particular interest in these questions as they relate to short-term credit needs of the firm.

A more complete understanding of short-term credit needs would be very useful to both the firms themselves and to financial institutions. The firms could use the information when agreements are made with lenders with respect to amount of credit and rate of interest as they attempt to

maximize the firms return to equity capital. Financial institutions could use the information to estimate roughly the demand for credit from small-scale industries. Knowledge of the seasonal demand for credit of different small-scale industries could help facilitate the mobilization of credit among the credit institutions. The information on returns to borrowed capital would give financial institutions, especially government supported institutions, and the legislators ideas about the rate of interest which would best serve national development goals.

The small-scale firms in rural areas are very diverse in terms of products and in structure. A thorough analysis of each would be unmanageable in a single study. To provide some of the diversity as well as to permit in-depth case study analyses, the cement product industry and ready-made garment industries are chosen to be studied.

1.2 Objectives

The specific objectives of this research are as follows:

1. Using data obtained from actual firms, develop a linear programming model which can be used to analyze seasonal short-term credit needs of small-scale industries.

2. To evaluate net return, borrowings, savings, lending and productivity of borrowed capital of the firm under various marketing systems subject to different assumptions pertaining to expansion in size of firm in relation to given levels of other resources.

3. To interpret the analysis for their implications for small-scale firm management and institutional credit policies affecting such firms.

1.3 Research Approach

1. The selected firms are classified according to marketing characteristics.

2. Production, marketing, and financial characteristics of selected firms of the cement product and ready-made garment industries are described.

3. The information from No. 2 above is used to construct representative firms which can be analyzed with a linear programming model.

4. The basic linear programming models developed in No. 3 above are extended to perform some analyses with respect to the expansion in size of the firms.

1.4 Related Research

There are two areas of related research. The first area includes studies related to credit aspects of small-scale industries, and the second area includes studies related to modelling of the firm.

1.4.1 Studies Related to Credit of Small-Scale Industries

The issues specified in studies related to credit of small-scale industries were divided into two groups, i.e., those related to supply of credit and those related to demand for credit.

The issues related to supply of credit, mentioned in a number of studies such as Khambata, et. al. (1981), Lim (1977), Lim (1979), Meyer (1978), Sam (1980) and Wilson (1981), were: 1) What would be the appropriate delivery channels for providing financial services to small-scale industries, e.g., development bank, commercial bank, specialized institutions, etc.? 2) What would be the appropriate incentives to persuade existing financial institutions to provide more credit, both short-term

and long-term, to small-scale industries? 3) What is the role of informal lenders? 4) What would be the appropriate rate of interest given high administrative costs on the financial institutions side, and high business and financial risks on the firm side? 5) What would be the appropriate lending procedure, i.e., should the amount lended be based on the value of collateral pledged or should it be based on pro-forma cash flow, balance sheet, and income statement?

The main issues related to demand for credit mentioned in various studies were: 1) What would be the amount of credit needs? 2) Was the credit needed primarily for short-term investment in working capital or long-term investment in fixed assets? However, none of the studies which were reviewed, except those reviewed in the modelling section, provide estimates of the amount of credit needed by small-scale firms. Some studies pose the question as to whether the firms really need credit at all (Child, 1977; Haggblade, et. al., 1979; Harper, 1975; Harper, 1976; Somerset and Marris, 1972; Wilcock, 1981; Fisseha and Davies, 1981). These studies approached the issue of demand for credit by asking the firms to identify the most important constraints facing their operations. The focus was on whether the perception of the firms manager revealed that lack of credit or lack of capital was the major constraint. Credit constraints were not measured in terms of credit needs. The methodological question raised in this research was whether the perception was real or illusory. Some studies (Liedholm and Chuta, 1976; Haggblade, et. al., 1979; Child, 1977) have attempted to demonstrate that the managers' perception might be true and the amount of credit needs might be quite large since the "average" rate of return on capital of the firms were quite high. Some other researchers have taken the

opposite position and have tried to show that the perception was illusory by showing that mismanagement of inventory, lack of demand, or managerial incompetance, etc. were the actual constraints (Harper, 1975; Harper, 1976). Chuta and Liedholm (1979) pointed out also that the amount of credit needed might be slight because of their observation from other studies (Haggblade, et. al., 1979; Steel, 1977; Ahmed, et. al., 1979) revealed that most of initial capital and capital for expansion came from personal savings and retained earnings.

The present study will address several credit issues not included in the above studies including timing of credit needs, seasonal credit needs, how credit needs change when there is a change in product mix and level of demand, etc.

1.4.2 Studies Related to Modelling of the Firm

Charnes, Cooper and Miller (1959) were the first group of researchers to modify the single product warehouse linear programming model originally developed by Cahn (1948) to include: 1) financial constraints of purchasing, inventory, and selling activities; 2) the treatment of trade credit provided by suppliers as a source of funds; and 3) the addition of borrowing and lending activities. In other words, Charnes, Cooper and Miller were the first group of researchers who tried to incorporate financial activities into a multiperiod linear programming model.

After Charnes, Cooper and Miller there were many researchers who developed linear programming models to help improve cash flow management of the firms and for many other purposes.

Without considering any production, inventory, and marketing activities, Robicheck, Teichroew and Jones (1965) developed a linear

programming model designed to help the manager to finance seasonal credit needs from various sources in the cheapest way. Mao (1968) used their original idea to formulate a model in a slightly different way to make the model easier to understand. Unsatisfied with Robicheck, Teichroew and Jones' model which operated under certainty surroundings, Pogue and Bussard (1972) developed a linear programming model to answer the same kind of questions, yet operate under uncertainty circumstances.

Ijiri, Levy and Lyon (1963) went in a different direction to develop a single period financial model (no marketing activities) by combining linear programming and accounting together through "spread sheet" convention. The ordinary linear programming variables, then, were transformed into balance sheet variables which reflected transaction flows among items in a balance sheet.

To overcome a shortcoming in the Charnes, Cooper and Miller's multiperiod model which had not explicitly included production and labor hiring activities and the shortcoming of Ijiri, Levy and Lyon's model which was a single period financial model, Baker and Damon (1973) developed the multiperiod model which had production, including inventory and labor hiring activities, and financial activities. Even though Baker and Damon's model showed an improvement over Charnes, Cooper and Miller's model by showing production and labor hiring activities explicitly, or showed an improvement over Ijiri, Levy and Lyon's model by making it a multiperiod model, the model still had a deficiency. Unlike Charnes, Cooper and Miller's model in which the purchasing, inventory and selling activities are expressed in terms of physical units, Baker and Demon's model (like Ijiri, Levy and Lyon's model) expressed

activities in terms of monetary values which were difficult to convert back into physical units. This makes it difficult for the firm's manager to understand.

Unsatisfied with the other models which treated marketing activities as given, Damon and Schramm (1972) developed a nonlinear model which treated marketing decision endogenously.

Burton, Damon and Obel (1979) thought that the analysis of multi-period short-term planning was just one aspect of financial management of the firm. They then combined the ideas of Charnes, Cooper and Miller and Weingartner (1967) together and developed a model containing both short-term and long-term financial activities

The present study has benefited from the modelling efforts of the researchers mentioned above. Their work has been adapted to fulfill the study objectives by incorporating selected features to produce a model containing the following general characteristics: 1) multi-period to analyze one 12-month production cycle; 2) separated production and selling activities with input prices varying by season; 3) a differentiation between cash and credit transaction for input purchases and product sales; 4) finished product inventory by product in physical terms by season adjusted by production, sales and carryover phenomenon; and 5) a seasonal cash flow and financial accounting reflecting sales, borrowing, accounts receivable, purchases and other cash outflows and accounts payable of the firm.

1.5 Data Sources

An understanding of the data base for this study requires first some appreciation for the Rural Off-Farm Employment Assessment Project

(ROFEAP)[1] of Thailand of which the present study is an integral part. The following brief description of the ROFEAP provides the research setting in which the present effort was conducted.

1.5.1 ROFEAP Objectives and Sponsorship

The Project was funded by the Thailand Mission of the U.S. Agency for International Development. The overall objective of the Project was to provide information to the Royal Thai Government, USAID, and other international donors to be used to identify and develop appropriate policies and programs for the rural nonfarm sector in Thailand.

The Project began in August 1979, and lasted for 2 1/2 years. In addition to Kasetsart University, Chiang Mai University and Khon Kaen University were involved in data collection. Michigan State University and Ohio State University provided technical assistance to the Project.

1.5.2 Project's Components

The Project was divided into three major components, namely rural nonfarm enterprises, farm level surveys, and rural financial markets (Onchan, et. al. 1979). Since this study was a portion of the study of rural nonfarm enterprises, then the following discussion on study areas, data collection strategy, sample selection, and types of questionnaires will primarily focus on this component of the Project. The discussion on the same issues of the other components of the Project were discussed in detail in Mead and Meyer (1981).

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[1] Many working papers and other published reports describing and providing empirical results from this project are available by contacting the Center for Applied Economic Research, Kasetsart University, Bangkok 10900, Thailand.

1.5.3 Study Areas

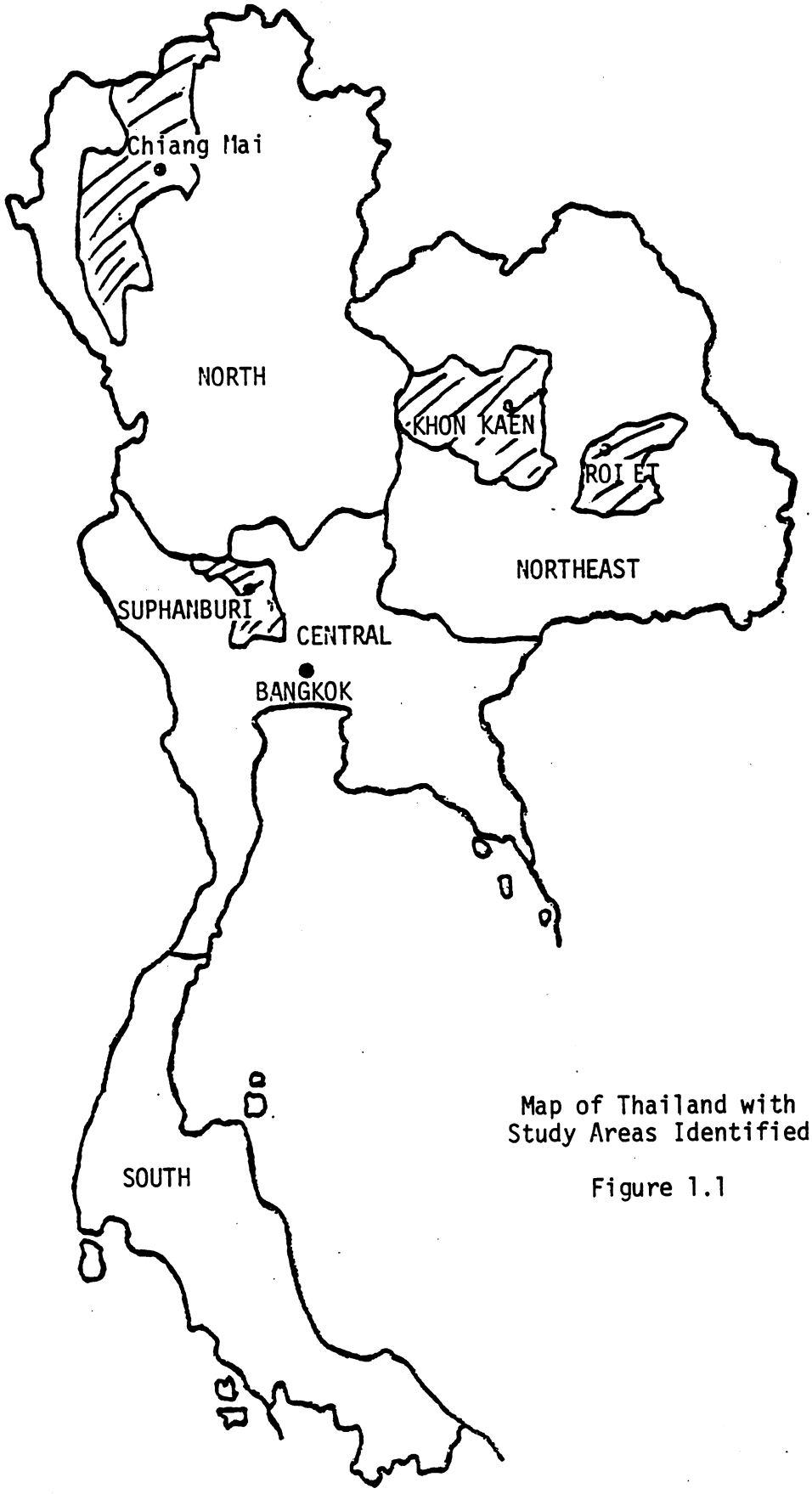
Based on some criteria (see Mead and Meyer, 1981) four provinces were selected for study: Khon Kaen and Roi Et in the Northeast; Chiang Mai in the North; and Suphan Buri in the Central Region. Figure 1.1 shows the locations of these provinces. Within these four provinces, four provincial capitals and seven other district capitals were chosen to be included in the town surveys or the survey of rural nonfarm enterprises (Table 1.1).

1.5.4 Data Collection

There were three steps involved in the collection of data: the Phase I town surveys; the pre-town surveys; and the Phase II town surveys.

The Phase I town survey was designed to provide preliminary information on the magnitude, type and spatial distribution of rural nonfarm activities in the study areas. Some limited information was also collected about the nature of these activities such as type of workshop, level of employment, and use of machines. The information was used to generate a list of the "universe" of firms found in the study areas, from which a sample for the Phase II survey was drawn.

Since information in the Phase I questionnaire provided little knowledge of the operations of the industries which were candidates for inclusion in the survey, the pre-town survey was implemented to provide a further understanding of the structure and future potential of a number of different industries. The pre-town survey was administered to approximately 230 enterpreneurs in 21 industries.



Map of Thailand with
Study Areas Identified

Figure 1.1

Table 1.1 Project Research Areas

Region	Province	District
North	Chiang Mai	1. Chiang Mai (Muang)[a] 2. San Kamphaeng 3. San Pa Tong
Northeast	Khon Kaen	1. Khon Kaen (Muang) 2. Ban Phai 3. Chonnabot 4. Nam Phong
	Roi Et	1. Roi Et (Muang) 2. Chaturaphak Phiman
Central	Suphan Buri	1. Suphan Buri (Muang) 2. Don Chedi

[a]Muang means city or municipality.

On the basis of the pre-town survey eight industries were selected for more detailed study. (See the first column of Table 1.2.)

The Phase II survey was designed to collect detailed information concerning pattern of production, marketing, finance and management in a sample of firms in selected industries in the study areas. This information in turn was used to help explore questions concerning the future prospects for these industries, and the types of projects, policies, and programs which may be needed to facilitate and encourage the growth of employment and income in these industries.

1.5.5 Sample Selection

The sample firms in each industry were chosen on the basis of the recommendations of the industry supervisors (a project staff who supervised data collection and performance subsequent analysis of the industry) to reflect the diversity of firm size, product type, production technology and location. Therefore, in some cases, the selection was based on random choice within particular groups of firms; more often, it was a purposive choice reflecting the industry supervisor's search for representativeness and diversity, in the dimension specified above, along with the respondent's willingness to cooperate by participating in this study. The distribution of sample firms in each selected industry is shown in Table 1.2

Table 1.2 Firms in Town Survey Sample, By Location

	Chiang Mai			Khon Kaen			Roi Et	
	Muang	San Kamphaeng	San Pa Tong	Muang	Ban Phai	Chon-nabot	Muang	Total
1. Bricks	3	-	-	-	-	-	-	3
2. Cement Products	9	-	2	3	2	-	3	19
3. Fruit and Vegetable Processing	8	-	-	-	-	-	-	8
4. Furniture	8	-	-	5	3	-	3	19
5. Ready-Made Garments	12	14	-	4	1	-	-	31
6a. Noodles	4	-	-	3	2	-	5	14
6b. Bean Curds	4	-	-	3	1	-	1	9
7. Silk	-	-	-	-	6	29	-	35
8. Wood Crafts	8	3	-	-	-	-	-	11
TOTAL	56	17	2	18	15	29	12	149

1.5.6 The Sample of Cement Product and Ready-Made Garment Firms

A. Cement Product Industry. Of the 19 sample firms, 3 of them were more advanced firms,[1] 3 of them were specialized cement block-making firms and the rest of them were typical cement product firms (both large and small). Since during the survey period 1 typical and 1 specialized firm went out of business and another specialized firm refused to cooperate, the number of firms in the sample dropped to 16. Of these 16 firms, all 3 more advanced firms, the specialized firm and a typical firm in Roi Et Province provided incomplete data. Therefore, the sample size of cement product firms dropped down to 11 firms and all of them were typical cement product firms.

B. Ready-Made Garment Industry. At the beginning of the survey period, the Project planned to collect information from 31 ready-made garment firms. Since 5 of the firms refused to provide data after the survey started for 2 or 3 months, then the actual sample reduced to 26 firms. Five of these firms were in Khon Kaen and the rest of them were in Chiang Mai. Since this study required data from many sets of questionnaires (see the following section), the number of firms having complete data dropped to 17 firms. Four of them were in Khon Kaen and the rest of them were in Chiang Mai. The four firms in Khon Kaen correspond to type III of ready-made garment firm (provincial level mass consumption) and the 13 firms in Chiang Mai correspond to the type I (provincial level export quality) and type II (provincial level, medium quality) or ready-made garment firms as classified by Onchan (1980).

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[1] See Aungsumalin (November 1980) for the detailed characteristics of the more advanced, specialized, and typical cement product firms.

1.5.7 Types of Questionnaires

Besides a monthly questionnaire, the Project has 5 other special sets of questionnaires, i.e., labor force questionnaire, entrepreneurship questionnaire, marketing questionnaire, profitability (production cost) questionnaire, and finance questionnaire. However, the data used in this study were drawn from the monthly questionnaire and the last three sets of special questionnaires just mentioned.

The monthly questionnaire was designed to provide information on the pattern of the seasonality of production, sales, prices, labor used and wages.

The other special sets of questionniares were designed to capture detailed information about particular aspects of the firm. A brief description of the contents of each of the special sets of questionnaires follows:

A. Marketing: input procurement pattern, and problem associated with obtaining needed inputs. Marketing pattern for products and marketing problems. This set of questionnaires was administered in August, 1980.

B. Profitability: raw material, labor and machinery costs per unit of producing each up to four specific products made by the firm. Overhead costs for the month of September. This set of questionnaires was administered in October, 1980.

C. Finance: constraints to expand production, whether finance or otherwise. Fixed assets, current assets, and debt outstanding at the time of the survey. Barriers to entry, goals of the firms, government assistance received by the firm, and regulations which affect them. This set of questionnaires was administered in March, 1981.

1.6 Organization of the Study

The remainder of the thesis will be presented in the following order. The generalized analytical model to be used in this study will be described in Chapter 2. The following three chapters deal with the cement product industry. The first chapter (Chapter 3) describes the production, marketing and financial characteristics of the industry. This information will be used to provide coefficients for the activities, constraints, and objective function for the basic model described in the first part of Chapter 4. Another part of Chapter 4 presents the results of the basic linear programming model. The basic model will then be used to evaluate the consequences of changes in level of demand and product mix, with the results of the analysis presented in Chapter 5.

The analysis of the ready-made garment industry will follow the same ordering as that used for the cement product industry. Description of the industry appears in Chapter 6. The linear programming analysis of basic firms occurs in Chapter 7. Analysis of extensions to the basic ready-made garment firm takes place in Chapter 8.

The thesis concludes with a summary and implications of the study in Chapter 9.

CHAPTER 2

THE GENERALIZED LINEAR PROGRAMMING MODEL

2.1 Introduction

The first part of this chapter describes the generalized linear programming model regarding assumptions, the objective function, the activities, and the constraints. The second part presents the model in mathematical form followed by a matrix of the generalized linear programming model.

In this chapter, none of the specific activities for either the cement products industry or the ready-made garment industry are shown. The former will be done in Chapters 4 and 5 and the latter will be done in Chapters 7 and 8. For each case, one chapter will be devoted to a "basic" model with coefficients for the objective function and row and column activities given followed by a presentation of basic model linear programming results. A second chapter will present modifications in the basic model and corresponding results.

2.2 The Model

2.2.1 Assumptions

1. The model assumes that the market for products, raw materials, and labor are perfectly competitive, i.e., the firm can buy and sell an unlimited number of units at the going market prices.

2. Sales are made from inventory on hand at the start of any period and/or from the production of that period. However, there is no inventory of product at the beginning of the first period, and the firm does not carry any inventory of product at the end of the last period.

3. Although firms do carry raw material inventories in reality, this aspect of firm behavior is omitted from the model for lack of needed data. Therefore, the firm does not carry inventory of raw materials. Materials and supplies are purchased as needed for production.

4. There are no accounts receivable at the beginning of the first period.

5. The firm has no marketable securities and ignores short-term investment opportunities.

6. Because of the focus of this study on short-term credit needs, there are no expenditures or receipts for plant and equipment during the planning horizon.

7. The firm cannot borrow an unlimited amount of money at a constant rate of interest.

2.2.2 The Objective Function

The objective function of the firm is assumed to maximize return to fixed assets, family labor, and equity capital subject to the constraints to be identified later. This return equals the difference between revenue and expenses, including taxes. Revenue consists of sales and interest income. Sales is the result of the multiplication of constant price and variable quantity sold, for both cash and credit sales. Since the firm is assumed to put excess cash above cash requirement in a savings account, then the firm may have some interest income. This interest income equals

the rate of interest on saving account times the amount in savings. Expenses consist of raw material costs, labor costs, overhead costs and interest costs. Raw material cost is the result of the multiplication of variable raw material costs per unit and units of product produced. Labor expenses includes the expenses for skilled and unskilled labor. Labor expenses are found by multiplying amount of labor used by wages which vary by period. Besides raw material and labor costs, the firm has some other expenses; gasoline, electricity, etc. These other expenses are added together under overhead cost expenses, and are calculated as a fraction of total value of production. Since the firm is permitted to borrow from sources outside the firm, some interest cost may be incurred, which for each period is equal to rate of interest times amount of debt outstanding. The firm is assumed to pay taxes which is calculated as a percentage of gross sales.

2.2.3 The Activities

Activities are divided into four groups, i.e., production activities, selling activities, labor hiring activities and financial activities. Production activities indicate the kinds of products and amount produced (unit=1 piece) in each period. Similarly, selling activities indicate amount sold of each product in each period. However, selling activities are further divided into cash selling activities and credit selling activities. The inclusion of labor hiring activities is to permit the firm to hire both skilled and unskilled labor to do production jobs. The rest of the activities which affect cash position of the firm are gathered together under financial activities. In each period, the firm has to pay for overhead costs, dividends, taxes, interest and principal on

outstanding long-term debts. On the one hand, if beginning cash on hand, cash from sales and interest receipts is greater than cash expenses of raw materials, labor, and overhead but less than other financial expenses above, the firm has to borrow some cash from outside sources, and has to pay some interest too. On the other hand, if the surplus of cash from beginning cash balance, interest income and sales minus cash expenses for raw materials, labor, and overhead is greater than other financial expenses, the firm can deposit the excess amount in the bank and earn some interest. Therefore, in each period, the model contains all the financial activities mentioned above.

2.2.4 The Constraints

1. Inventory Constraint

Since the firm executes sales from inventory and production, there are two constraints related to inventory for each product of the firm.

a) The net addition to inventory cannot exceed the space available. Actual space available for products by firms was not available from the survey. The average monthly amount of product kept in inventory for each product was computed from the survey. The month showing the maximum average was taken as the space available constraint.

b) Cumulative sales cannot exceed cumulative production plus initial inventory.

2. Demand Constraint

Quantity sold of each product in each period cannot exceed a certain level. This constraint is to restrict the firm from producing and

selling products which have high margins but limited demand. It was established by taking the average amount sold by all firms for each product by period.

3. Credit Sales Constraint

Since credit prices are usually higher than cash prices, there is a tendency for credit sales to be greater than cash sales. But, in reality, the percentage of cash sales exceeds that of credit sales. Therefore, a restriction is imposed that credit sales be a constant proportion of cash sales.

4. Cash Needed to Hire Skilled Labor

The calculation for the cash needed to hire skilled labor consists of two steps. First, the amount of required skilled labor is determined and this requirement is then converted into monetary value. The amount of skilled labor required is found by first adding together the requirements production for all products. Then, the monetary value is the result of the multiplication of wage rate and the amount of labor needed.

5. Cash Needed to Hire Unskilled Labor

The calculation of cash needed to hire unskilled labor is done in the same way as the calculation of cash needed to hire skilled labor.

Under this construction, labor (both skilled and unskilled) is unconstrained, but since cash is needed, the amount of labor hired may be limited by the cash constraint.

6. Machinery Constraint

A machinery constraint is expressed in terms of number of units which can be produced by the machine. The constraint does not permit the units produced to exceed the maximum number of units which can be produced by the machine.

7. Cash Needed to Pay for Overhead Cost

Overhead cost is calculated separately from other kinds of production costs. It is calculated as a fixed percentage of the value of production.

8. Cash Needed to Pay for Taxes

Taxes are calculated on gross sales rather than net profit. The firm is assumed to pay taxes every period, instead of paying them entirely in the last period.

9. Cash Needed to Pay for Dividends

The firm is assumed to pay dividends every period. "Dividends" refers basically to a cash drain out of the business for household consumption. The amount paid is determined outside the model.

10. Interest Payment and Principal Repayment of Outstanding Long-Term Debt

The firm is assumed to pay interest on outstanding long-term debt in every period, and pay 1/10 of the outstanding long-term debt in the last period. (The firm is assumed to repay all their outstanding long-term debts in 10 years.)

11. Savings

In the accounting for a three month period, whenever cash on hand is greater than cash requirement, the firm would put the excess cash in a savings account. The firm can withdraw cash from this account in any period as needed. Therefore, the savings account balance in the present period would equal the carryover of that in an earlier period plus deposits minus withdrawals of the current period. Earned interest income in the present period equals the rate of interest on savings account times the ending balance in the savings account for the previous period.

12. Borrowing

Whenever cash expenses are greater than cash income generated plus withdrawals from savings account, the firm borrows at interest from outside sources. The interest cost in the present period is calculated on the outstanding debt of the previous period. The amount of the repayment can be equal to or less than the outstanding balance of the earlier period. The outstanding balance of the present period, however, equals the outstanding balance in the earlier period plus borrowings minus repayment of the present period. The amount which the firm can borrow in a period is restricted to a predetermined amount which cannot be exceeded taking into account outstanding debt of an earlier period and repayment in the present period.

13. Initial Cash on Hand

This constraint indicates the initial cash on hand at the beginning of the first period which is available to the firm for use in the first period. The amount of initial cash on hand is determined outside the model.

14. Cash Balance

In each period, cash inflows including borrowings must equal cash outflows including savings. Cash inflows in addition to borrowings, consist of cash from cash sales, interest income savings from an earlier period and collection of accounts receivable from credit sales in an earlier period. Cash outflows are raw material expenses, labor expenses, overhead costs, dividend payments, tax payments, interest payments and principal repayments of short-term and long-term debt . Whenever cash

outflows exceed cash inflows, the firm will borrow to balance the shortage. On the other hand, whenever cash inflows exceed cash outflows, the excess cash is deposited in the savings account.

2.3 The Mathematical Model

Mathematically, the linear programming model can be expressed as follows:

$$\text{Max: } -\sum_t \sum_i b_{it} X_{it} + \sum_t \sum_i p_{it} S_{it} + \sum_t \sum_i p^1_{it} T_{it} - \sum_t SC_t$$

$$- \sum_t USC_t - \sum_t OHC_t - \sum_t TAX_t - \sum_t \sum_j IP_{jt} + \sum_t IR_t - \sum_t IL_t$$

where:

t = period t

i = product i

j = source of borrowing j

X_{it} = production of product i in period t

S_{it} = cash sales of product i in period t

T_{it} = credit sales of product i in period t

SC_t = cost of hiring skilled labor in period t

USC_t = cost of hiring unskilled labor in period t

OHC_t = overhead cost expenses in period t

TAX_t = tax expenses in period t

IP_{jt} = interest payment to source j in period t

IR_t = interest income in period t

IL_t = interest payment on outstanding long-term debt in period t

b_{it} = cash cost of raw material per one unit of product i in period t

P_{it} = cash price of product i in period t

P^1_{it} = credit price of product i in period t

subject to:

(1) For each i and t: $\sum_t X_{it} - \sum_t S_{it} - \sum_t T_{it} \leq B_i - A_i$

where:

B_i = maximum amount of product i which can be kept in inventory

A_i = initial inventory of product i at the beginning of the first period

(2) For each i and t: $-\sum_t X_{it} + \sum_t S_{it} + \sum_t T_{it} \leq A_i$

(3) For each i and t: $-S_{it} + C\ T_{it} = 0$

where:

C = ratio of quantity sold of cash sales to quantity sold of credit sales

(4) For each i and t: $S_{it} + T_{it} \leq D_{it}$

where:

D_{it} = maximum quantity of product i which is expected to sell in period t

(5) For each period t: $\sum_i A_{it}\ X_{it} - SKR_t = 0$

where:

A_{it} = man-day of skilled workers required in the production of one unit of product i in period t

SKR_t = skilled labor required in period t

(6) For each period t: $-W_t\ SKR_t + SC_t = 0$

where:

W_t = wage rate per man-day of skilled workers in period t

(7) For each period t: $\sum_i A^1_{it}\ X_{it} - USKR_t = 0$

where:

A^1_{it} = man-day of unskilled workers required in the production of one unit of product i in period t

$USKR_t$ = unskilled labor required in period t

(8) For each period t: $- W^1_t \, USKR_t + USC_t = 0$

where:

W^1_t = wage rate per man-day of unskilled worker in period t

(9) For each machine in each period t: $\sum_i X_{imt} \leq MA_{mt}$

where:

X_{imt} = production of product i using machine m in period t

MA_{mt} = maximum amount which can be produced by machine m in period t

(10) For each period t: $\sum_i (ohc) p_{it} \, X_{it} - OHC_t = 0$

where:

ohc = overhead cost per one baht of value of production

(11) For each period t: $\sum_i tp_{it} \, S_{it} + \sum_i tp^1_{it} \, T_{it} - TAX_t = 0$

where:

t = tax rate

(12) For each period t: $DIV_t = C_t$

where:

DIV_t = dividend payment in period t

C_t = dividends the firm has to pay in period t

(13) For each period t: $IL_t = I_t$

where:

I_t = interest on outstanding long-term debt the firm has to pay in period t

(14) $BEC_1 = IC_1$

where:

BEC_1 = initial cash on hand at the beginning of period 1

IC_1 = cash on hand the firm has at the beginning of period 1

(15) $PLTD_n = P_n$

where:

$PLTD_n$ = principal repayment of outstanding long-term debt in period n

P_n = of outstanding long-term debt the firm has to repay in period n

(16) $SD_1 \geq 0$

where:

SD_1 = savings deposit in period 1

(17) $BOR_{j1} \leq Y_{j1}$

where:

BOR_{j1} = borrowing from source j in period 1

Y_{j1} = maximum amount of loan which the firm can borrow from source j in period 1

(18) For each t: $\sum_j BO_{jt}^{1} \leq M$

where:

BO_{jt} = short-term debt outstanding at sources j in period t

M = maximum level of outstanding short-term debt which the firm can borrow without jeopardizing financial position

---

[1] $BO_{j1} = BOR_{j1}$

(19) For each $t = 2, \ldots n$: $IR_t - (R)\ SO_{t-1}$[1] $= 0$

where:

SO_t = savings outstanding in period t

R = rate of interest on savings account

(20) For each $t = 2, \ldots n$: $SW_t - SO_{t-1} \leq 0$

where:

SW_t = savings withdrawal in period t

(21) For each $t = 2, \ldots n$: $SD_t \geq 0$

where:

SD_t = savings deposit in period t

(22) For each $t = 2, \ldots n$: $SO_t - SD_t - SO_{t-1} + SW_t = 0$

(23) For each $t = 2, \ldots n$: $IP_{jt} - r_j\ BO_{jt-1} = 0$

where:

r_j = rate of interest on capital borrowed from source j

(24) For each $t = 2, \ldots n$: $REB_{jt} - BO_{jt-1} \leq 0$

where:

REB_{jt} = repayment of short-term debt to source j in period t

(25) For each $t = 2, \ldots n$: $BOR_{jt} - REB_{jt} + BO_{jt-1} \leq Y_{jt}$

where:

BOR_{jt} = short-term borrowing from source j in period t

(26) For each $t = 2, \ldots n$: $BO_{jt} - BOR_{jt} + REB_{jt} - BO_{jt-1} = 0$

---

[1] $SO_1 = SD_1$

(27) For each t: $\sum_i d_t b_{it} X_{it} + \sum_i d^1_{t-1} b^1_{it-1} X_{it-1} - \sum_i p_{it} S_{it}$

$$- \sum_i p^1_{it-1} T_{it-1} + SC_t + USC_t + OHC_t + TAX_t + DIV_t$$

$$+ IL_t - IR_t - SW_t + SD_t + IP_{jt} + REB_{jt} - BOR_{jt} \leq 0$$

where:

d_t = percentage of cash purchases of raw materials in period t

d^1_t = percentage of credit purchases of raw materials in period t

b^1_{it} = credit cost of raw material per one unit of product i in period t

2.4 The LP Tableau

The figure has 43 rows and 34 columns. Row 1 contains coefficients (CJ's) of the activities in the objective function. Row 3 indicates all the activities of the model. Row 5 to row 43 are the constraints of the model. Each row corresponds to each equation indicated in the mathematical model which is shown in column 1. For example, row 5 and row 43 correspond to equations No. (1) and No. (27) of the mathematical model respectively.

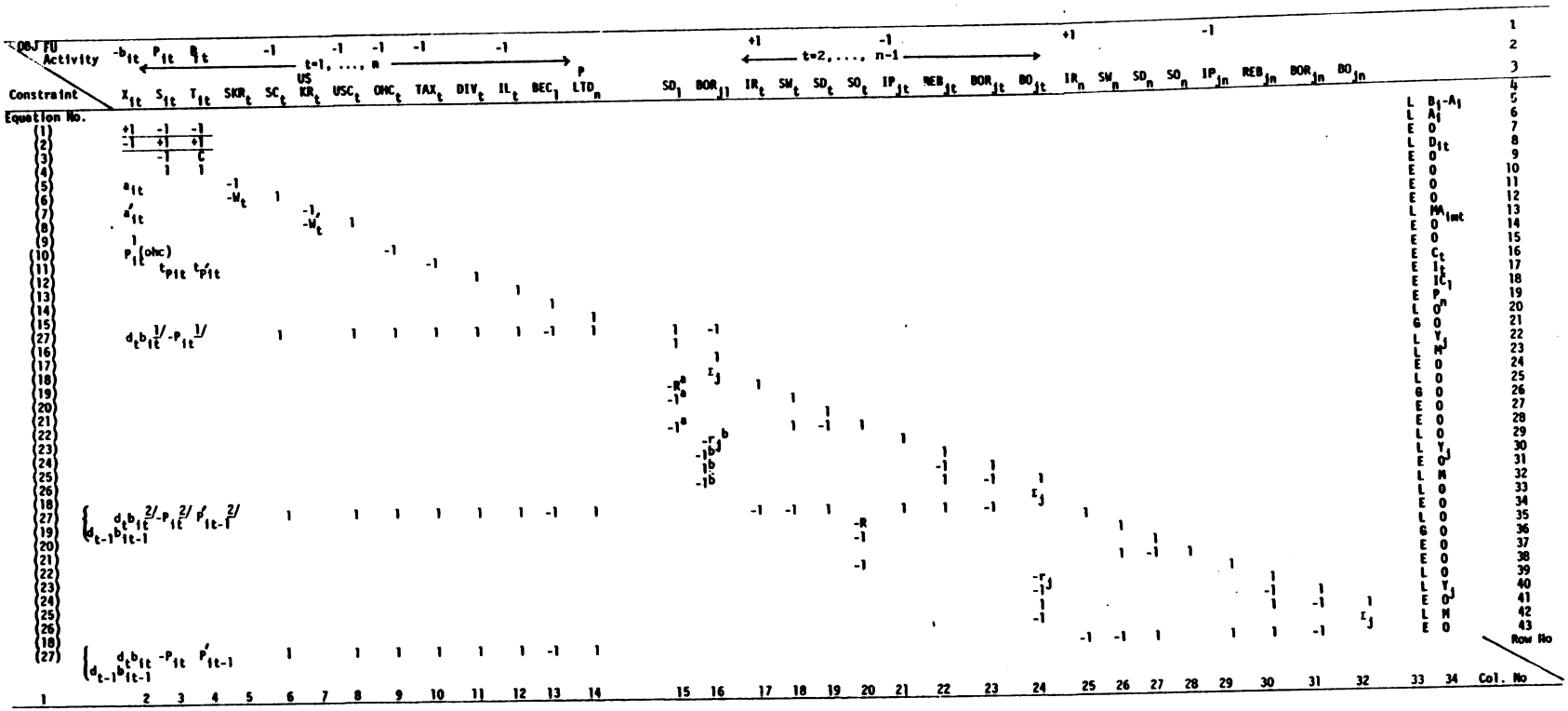
Column 2 to column 32 contain the coefficients of each activity (a_{ij}'s) indicated in row 3. Column 33 indicates the signs of the constraints. Column 34 is the right hand side values (RHS's) of the constraints.

The LP tableau presented in Figure 2.1 is very condensed and may appear to understate its actual size. Table 2.1 can be used with Figure 2.1 to facilitate the visualization of the actual size of the tableau.

The row number and column number indicated in the first column of Table 2.1 comes from Figure 2.1.

LP Tableau of the Generalized Linear Programming Model

Figure 2.1



[1/] $_{t=1}$

[2/] $_{t=2, \ldots, n-1}$

[3/] $_{t=n}$

[a] When $t \geq 3, \ldots, n-1$ these are the coefficients for column SD_{t-1}

[b] When $t \geq 3, \ldots, n-1$ these are the coefficients for column BOR_{jt-1}

Table 2.1 The Actual Number of Some Rows and Columns of Figure 2.1

	No. of Products Times No. of Periods	No. of Periods	No. of Periods Minus 2	No. of Periods-2 Times No. of Sources of Lending	No. of Sources of Lending	Types of Machinery Times No. of Periods
Column No. of Figure 2.1						
2, 3, 4	X					
5, ..., 12		X				
17, ..., 20			X			
21, ..., 24				X		
16, 29, ..., 32					X	
Row No. of Figure 2.1						
5, ..., 8	X[a]					
9, ..., 12		X				
13						X
14, ..., 17		X				
24, ..., 29, 31, ..., 33			X			
22, 40					X	
30				X		

[a]Some modifications are needed if the products have many sizes.

Table 2.1 indicates that the actual number of columns of each of columns 2, or 3, or 4 in Figure 2.1 is equal to the number of products times the number of periods. The actual number of columns of each of columns 5, 6,..., 12 is equal to the number of periods. The actual number of rows of each of rows 20, 30 and 40 is equal to the number of sources of lending. The actual number of rows 13 is equal to the number of types of machinery times the number of periods. The actual number of the remaining rows and columns can be interpreted in the same way.

CHAPTER 3

CHARACTERISTICS OF CEMENT PRODUCT INDUSTRY

3.1 Introduction

The main purpose of this chapter is to provide information about the cement product industry--some of which will be used as a basis for constructing the linear programming models to be used for further analysis. This description includes the criteria used to classify firms, the market outlets for cement product firms, the kinds of products produced, raw material used, use of labor, production, sales and other financial characteristics.

Firms, in any industry, can be classified according to several criteria. For example, the firms can be classified according to size, production characteristics, marketing characteristics, etc. Size can be measured by number of product produced, amount produced, value of production, sales, level of assets, number of workers etc. Production characteristics may be measured by types of technology used. The firm may use hand or simple machine or advanced machine or combination of them in the production of a product. Marketing characteristics may be classified according to final destination of the product, i.e., foreign markets or domestic markets, or marketing channels, etc. These characteristics do affect cash flows of the firm and therefore affect size of credit the firm should obtain as well as rate of interest the firm can afford to pay.

The main purpose of the classification of the firms is to define mutually exclusive groups which can facilitate comparative analysis. An operational classification of firms was needed also to construct basic models to be used in quantitative analysis. As one can expect, if multiple criteria, i.e., size and/or production characteristics and/or marketing characteristics are using to classify the firms, a very large sample of firms would be needed to represent each sub-class. For the purposes of this study, a single criterion, i.e., marketing characteristics will be used to classify the firms. They will be classified as to whether the firms sell all of their products in domestic markets or whether the firms sell their products in both domestic and foreign markets. Those firms which sell 100 percent of their products in domestic market is further subdivided into two groups, i.e, those which sell the majority of their products to consumers (retail sales) and those which sell the majority of their products through wholesalers and retailers.

3.2 Market Outlets for the Cement Product Firms

All 11 cement product firms studied, produced exclusively for the domestic market.[1] Even though some firms sold some products through wholesalers and retailers, the majority of their products were sold directly to consumers. Therefore, this discussion of the firms in the cement product industry will pertain to a single category; namely, the group of firms selling the majority of their products directly to consumers in domestic markets.

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[1]There were data collected from 16 firms, 5 of which were excluded for lack of complete records.

3.3 Types of Products Produced

The products produced by the cement product firms are high quality drainage pipes, ordinary drainage pipes, shallow pipes, house posts, fence posts, well pipes, cement blocks, wind blocks, toilet heads, spirit houses, stoves, table sets, water tanks, water containers, well pipe covers, bricks, roof tiles, floor slabs and connection pipes. No firm produces all of the products mentioned above (Appendix B, Table B-1). The main products produced by nearly all the firms are cement blocks, wind blocks, drainage pipes, well pipes and house posts including fence posts. Cement blocks and wind blocks are typically 3 or 4 inches thick. All firms produce the 3 inches thick blocks and the 4 inches thick are produced when there are orders for them. The drainage pipes have several sizes measured by the diameter of the pipe, which range from 20 centimeters to 100 centimeters. The length of the pipes is usually 100 centimeters. The size of house posts ranges from 4 inches x 4 inches to 8 inches x 8 inches in varying lengths, starting at 1 meter and increasing in .5 meter increments to the longest length of 4 meters. The standard length of well pipe is .5 meter with a 1 meter diameter. Some firms, however, produce well pipes which are either 80 centimeters or 120 centimeters in diameter. Of course, other products have several sizes and several forms (shapes) too.

3.4 Raw Materials

In this section, besides the description of several types of raw material used by cement product firms, there will be a description of channels through which the firms buy the raw materials, how the firms

pay for them, the terms of credit for credit purchases, and finally, a discussion of the fluctuation in raw material prices.

3.4.1 Types of Raw Materials

Raw materials used in the production of cement products are cement, sand, stone or gravel, stone dust, wire, and steel rod. The production of blocks does not need wire or steel rod. However, some firms add stone dust to the cement and sand in the production of blocks. The production of house posts needs steel rods and wire for reinforcement. Well pipes are produced without reinforcement rods but a reinforcement metal collar is used at each end of the pipe. The firms producing drainage pipe by hand do not use rods and wire to make the smaller size of drainage pipes (10-30 centimeters diameter) or the medium size drainage pipes (40-60 centimeter diameter). All other kinds of cement products have rod and wire in their ingredients for production except for shallow pipes and connection pipes which use asbestos. For those products using rods and wire, the amount needed, of course, varies with the size and shape of the products.

3.4.2 Acquisition of Raw Materials

Since data on total purchases were not available, this discussion is limited to a frequency distribution of firms. However, the section which deals with the payment for the acquisition of raw material will give some general idea on cash outflow to several sources of suppliers.

3.4.2.1 Raw Material Suppliers

Firms may buy raw materials from factories and/or wholesalers of construction materials and/or retailers of construction materials. In

other words, the firm may buy raw materials from more than one source. The frequency distribution of firms by raw material and source is shown in Table 3.1. Retailers are the source mentioned most frequently for acquiring cement and steel rods and is the least mentioned source for stone. The number of firms that purchased a particular raw material from each source is not necessarily an appropriate indicator of relative importance of each source of supplier. The percentage of total purchase from each source of supplier which is a better indicator of relative importance of each source of supplier will be shown after the following section.

3.4.2.2 The Payment for Raw Material

Table 3.1 indicates also how the firm paid for raw material purchased from each source. For example, when the firms bought cement directly from factories, they paid cash at time of purchase. For the firms which bought cement from wholesalers, most of the firms paid cash, but there was one firm which obtained trade credit from wholesalers. However, for the firms which bought cement from retailers, nearly 50 percent of the firms obtained trade credit from retailers. Around 60 percent of the firms which bought sand from factories paid cash at time of purchase. This condition occurred also with the firms purchasing sand from retailers. However around 50 percent of the firms which bought sand from wholesalers made cash purchases. Column 4 and 5, 7 and 8, and 10 and 11 of Table 3.1 present the findings for the purchase of stone and steel rod also.

Table 3.1 Acquisition of Raw Materials of Cement Product Firms

Unit:Firms

Raw Material	Total No. of Firm	Factory			Wholesaler			Retailer		
		Total	Cash	Credit + Cash	Total	Cash	Credit + Cash	Total	Cash	Credit + Cash
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cement	11	4	4	0	4	3	1	7	4	3
Sand	11	5	3	2	2	1	1	5	3	2
Stone	11	5	3	2	6	3	3	2	2	0
Steel Rod	11	0	0	0	3	2	1	9	7	2

Source: Marketing Questionnaire

3.4.2.3 Percentage of Raw Material Purchases from Each Supplier

Table 3.2 summarizes the percentage of total purchases being bought from factories, wholesalers and retailers respectively for cement, sand, stone and steel rod. It can be observed that factories and retailers were the most important sources of cement and sand. Factories and wholesalers were the most important sources of stone, and more firms purchased steel rods from retailers than from wholesalers.

Remembering that most of the firms paid cash when they purchased cement, sand, stone from factories and steel rod from retailers, it might be expected that the percentage of cash purchases to total purchases would be quite high. This question will be explored next.

3.4.3 Cash Purchases and Credit Purchases of Raw Materials

Cash purchases and credit purchases affect cash outflows as well as demand for credit of the firms. The information from this section will be used to specify the percentage that cash purchases are of total raw material costs for the firm in the linear programming models.

Table 3.3 shows that the percentage of cash purchases to total purchases of cement product firms ranged from 20 percent to 100 percent. Since the amount of total purchases of each firm was not equal, weighted average of cash purchases was calculated. Since the total purchases of each firm was not known, the weights were calculated by using value of production as a proxy of total purchases. This weighted average indicates that 82 percent of total purchases are in the form of cash leaving a residual of 18 percent of total purchases as credit purchases.

Table 3.2 Relative Importance of Raw Material Suppliers

Raw Materials	Raw Material Supplier		Unit:Percent[a]
	Factory	Wholesaler	Retailer
Cement	53	10	37
Sand	49	6	45
Stone	44	45	11
Steel Rod	--	26	74

Source: Marketing Questionnaire administered to 11 firms.

[a]Percent of all input purchased by all firms (estimated).

Table 3.3 Percent Cash Purchases of Cement Product Firms

Firms	Percent Cash Purchases to Total Purchases	Weights
241110	100	.01
241211	100	.02
242116	70	.03
243121	60	.06
243122	80	.06
242219	20	.05
241212	80	.07
241108	85	.10
242218	100	.15
242114	100	.31
242115	50	.14
Weighted Average	82	

Source: Finance and Monthly Questionnaires

3.4.4 Terms of Credit Purchases

Terms of credit refers to the length of time given the firm to make the payment and rate of interest plus carrying charges for risk of default or delay in payment. This information will be used in the specification of rate of interest the firm has to pay to input suppliers in the linear programming model, if credit purchases are made by the firm.

The information from the survey revealed that the length of time given the firm to make the payment was one month for every kind of raw material. However, the difference between cash prices and credit prices which reflect rate of interest and carrying charges for risk of default or delay in payment among raw material were not the same. Credit prices of cement, sand, stone and steel rod were 4 percent, 10 percent, 6 percent, and 5 percent higher than cash price, respectively. Therefore the firm paid 48 percent, 120 percent, 72 percent and 66 percent rate of interest plus carrying charges to input suppliers when the firms bought cement, sand, stone and steel rod on credit respectively (Table 3.4).

3.4.5 Fluctuation in Raw Material Prices

The information on raw material prices was gathered from three different special sets of questionnaires, not through the monthly questionnaires. Therefore, the information was reported only in the months of June, September and February when these questionnaires were administered.

Between June and September, the price of cement was quite stable. However, by February, the price of cement had risen 25 percent over September. For sand the price was lowest in June, 70 baht per cubic meter, increasing to the highest level in September, 112 baht per cubic meter, and decreasing to a lower level in February. Prices of stone

Table 3.4 Rate of Interest and Carrying Charges Paid to Raw Material Suppliers of Cement Product Firms

Unit:Percent

Raw Material	Percent Price Difference	Rate of Interest and Carrying Charges
Cement	.04	48
Sand	.10	120
Stone	.06	72
Steel Rod	.05	60

Source: Finance Questionnaire

increased continuously from June to February. Price in September and February were nearly the same, yet price in September was around 15 percent higher than price in June (Table 3.5).

Since it was observed that prices of raw materials varied over the year, then this variation was modeled in the linear programming model.

3.5 Technology

This section contains information on kinds of machines as well as their production capacity in the production of cement products. This information will be used in the specification of types of machine and production capacity (RHS) in the linear programming models.

3.5.1 Types of Machines

There are two basic kinds of technology in the production of cement products. They can be produced either by hand or by machine. However, machines may have various levels of sophistication. As a result, several levels of technology might exist in the production of cement products.

In rural towns of Thailand, the production of house posts, well pipes, toilet heads, spirit houses, table sets, stoves, water tanks and water containers are usually made by hand using the simplest technology. Drainage pipes can be produced either by hand or by one of many different types of machine. However, in the study survey, there was only one firm using a machine to produce drainage pipes. Therefore, for the purposes of this study, only two kinds of technology are assumed to exist in the production of drainage pipe.

The classification of levels of technology in the production of blocks is more difficult since they can be produced either by hand or by machine and several types of machines are found. If the classification

Table 3.5 Fluctuation of Raw Material Prices of Cement Product Firms

Unit:Baht

Raw Material	Month		
	June	September	February
Cement	54	56	70
Sand	70	112	95
Stone	184	211	214

Source: Marketing, Profitability, and Finance Questionnaires

of the levels of technology are made on the basis of the prices of machines, it can be concluded, from the survey, that there are four rough classes of technology in the production of cement blocks (and wind blocks) as follows: (1) by hand; (2) by simple machine; (3) by sophisticated machine; and (4) by more sophisticated machine (Table 3.6).

3.5.2 Production Capacity

Production capacity was reported under two groups: capacity per day and capacity per month. Production capacity per day was the average capacity of all the firms that reported the information. Production capacity per month was computed by multiplying production capacity per day by 26. It was assumed that the firms used the machines only 26 days a month. Both production capacity per month and production capacity per day are shown in Table 3.7.

3.6 Labor Used

This section contains the information on number, number of days worked and number of man-days worked of family members, number of man-days worked of accountants and sales workers, and production workers, labor requirement per one unit of production and wages. Even though this information is not needed in the construction of the LP model, it is included in order to let the reader have general understanding of use of labor of the firms. However, the labor requirement is used in the specification of labor needed in the production and wages is used in the calculation of labor cost in the linear programming models.

Table 3.6 Types of Machines in the Production of Cement Blocks and Wind Blocks of Cement Product Firms

Type of Machine	Price Range (baht)
Hand	300-4,000
Simple Machine	25,000-50,000
Sophisticated Machine	250,000-500,000
More Sophisticated Machine	900,000

Source: Profitability and Finance Questionnaires

Table 3.7 Production Capacity of Machines of Cement Product Firms

Unit:Pieces

Machine	Capacity Per Day	Capacity Per Month
Cement Block, Wind Block		
Mold	240.0	6,240
Simple Machine	750.0	19,500
Sophisticated Machine	3000.0	78,000
More Sophisticated Machine	6000.0	156,000
Drainage Pipe		
Small (Mold)	2.3	60
Medium (Mold)	2.4	62
Medium (Machine)	40.0	1,040
Large (Machine)	25.0	650
Well Pipe (Mold)		
Small	2.6	66
Large	2.5	65
House Post (Mold)		
Small	2.2	58
Medium	2.5	65
Large	2.2	58
Roof Tile	500.0	13,000
Toilet Head	1.0	26
Table Set	1.0	26
Spirit House	1.0	26

Source: Profitability Questionnaire

3.6.1 Family Members

The administrative functions include the decision making on production, acquisition of raw materials, selling strategies, setting prices, hiring and firing workers and managing cash flows. These are male functions usually performed by the owner or head of the family. Nevertheless, the other members of the family, including his spouse, children and sometimes his brothers or sisters, also help with jobs such as keeping records, preparing some accounts, selling, supervising workers, etc.

On the average over the year there were 2.09 family members working with the business each month (Table 3.8). The number of male family members working in the business was about twice the number of female family members. Therefore, on the average there were 1.31 male and .78 female family members participating in the business each month (Table 3.8).

During March to September there were an average of 1.36 male family members working with the business each month. During October to February the average number of males worked with the business each month was 1.27 male, except in November and December when there were just 1.18 male each month. Therefore there might be some male family members who left the business for good since October and in November some who left the business to work in other places yet come back to work at the firm again in January. The trend in number of female family members was an increase from the beginning toward the end of the survey period. On the average, there was .64 female, .82 female and .91 female family members working with the business during March to May, July to November and December to January, respectively. In other words, there were more female family

Table 3.8 Number, Number of Days, Number of Man-Days Worked of Male and Female Family Members of Cement Product Firms

	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Ave.
Number													
Male	1.36	1.36	1.36	1.45	1.36	1.36	1.27	1.18	1.18	1.27	1.27	1.27	1.31
Female	.64	.64	.64	.72	.82	.82	.73	.82	.82	.91	.91	.91	.78
Man-Days													
Male	37.27	37.09	32.82	39.09	35.55	35.45	37.27	35.73	34.09	34.36	34.73	33.36	35.57
Female	17.73	17.55	13.27	21.82	21.36	21.82	22.73	22.09	25.45	25.73	25.45	23.82	22.13
Number of Days													
Male	27	27	24	27	26	26	27	28	29	29	27	26	27
Female	28	27	21	30	26	27	31	27	31	28	28	26	27

Source: Monthly Questionnaire

members working with the business during the last nine months than the first three months of the survey period. Some of these additional female members just graduated from school and came back to help their parents.

On the average over the year the number of days worked for both male and female was around 27 days a month. The range in number of days worked by female family members was from 26 days to 31 days, and the range of number of days worked by male family members was from 26 days to 29 days. In other words, male family members took 2 days to 4 days off each month. However in some months, female family members worked every day and some months took 1 day to 4 days off.

Given the number of male and female family members and the number of days worked, the number of man-days worked in a month of male family members fluctuated between 32.82 man-days in May and 39.09 man-days in June with the average over the year of 35.57 man-days. The number of man-days of female family members fluctuated between 13.27 man-days in May and 25.73 man-days in December, with the average over the year of 22.13 man-days. The number of man-days worked was higher in December than in May because both the number of days worked in the months and the number of female members were higher as described earlier.

3.6.2 Accountants and Sales Workers

Most of the firms did not hire any permanent accountants for the following reasons: (1) Most of the firms were household firms (sole proprietors) not needing to file any accounts to the government offices. Therefore they did not need an accountant. (2) The size of business of most of the firms was not big enough to require hiring a permanent accountant. Large firms either hired permanent accountants or paid for

outside professional accountants to prepare their accounting records as the needs arose. The above discussion regarding the typical firm should not imply that accounting records for their business decisions were not kept at all. Actually the owner or other family member kept simple records which, although they might not meet certain accounting standards, do contain enough information to help the owner make some management decisions.

There were two groups of workers under the sales subcategory. The first group did "selling" without making deliveries. This group of workers might seek new customers, get in tough with old customers, try to sell the firm's products, quote prices, etc. Only big firms have this group of workers. For most of the firms, this selling function was done by the owners and their family members.

The second group of workers is composed of one or two drivers who received permanent salaries, and some unskilled workers who loaded and unloaded merchandises from the truck. These unskilled workers were not permanently hired. Their wages were paid on a daily basis or were paid based on the number of deliveries performed.

The total number of man-days worked of sales workers was more than 100 percent of annual monthly average during March to May, dropped gradually, reached the lowest level in July, increased gradually, reached the highest level in September, decreased gradually until November, then increased gradually toward the end of the year (Table 3.9). This seasonal fluctuation of total number of man-days worked of sales workers conformed to the seasonal fluctuation of sales. For example, during March to May, and August and September when sales were high, the total

Table 3.9 Number of Man-Days Worked of Sales, Skilled and Unskilled Workers of Cement Product Firms

Month	Sales Workers		Skilled and Unskilled Workers					
			Skilled		Unskilled		Total	
	Man-Day	% of Annual Average	Man-Day	% of Annual Average	Man-Day	% of Annual Average	Man-Day	% of Annual Average
March	76.7	110	73.8	86	192.7	92	266.5	91
April	68.2	102	73.3	86	186.4	89	259.6	88
May	81.3	122	73.3	86	197.4	95	270.7	92
June	61.2	91	86.5	101	138.4	66	225.0	76
July	56.6	85	85.6	100	191.3	92	276.9	94
August	71.0	106	78.6	92	213.7	102	292.4	99
September	74.4	111	84.1	98	199.7	96	283.9	96
October	63.6	95	79.4	93	184.3	88	263.6	90
November	59.2	88	76.8	90	194.1	93	270.9	92
December	63.7	95	82.9	97	217.5	104	300.4	102
January	64.8	97	112.1	131	276.0	132	388.1	132
February	60.9	91	110.2	129	308.4	148	418.5	142
Average	66.8	100	85.6	100	208.3	100	293.9	100

Source: Monthly Questionnaire

number of man-days worked were more than 100 percent of annual monthly average, during June, July and November when sales were low, the total number of man-days worked of sales workers was around 85 percent to 91 percent of annual monthly average. During December to February sales were increasing, the total number of man-days worked of sales workers was increasing too. In April and February the total number of man-days worked of this group of workers was low because there was Song Kran Festival in April and many workers stopped working during the festival, while the owner chose to close the firm during February for a few days to celebrate Chinese New Year.

3.6.3 Production Workers

The last group of workers includes the workers who did the production jobs. The owners or their family members usually did not perform the production jobs. The owner just did the demonstration, supervised and told the workers what, how and how much to produce. From direct observation, most of the production workers were men and the range of age was from teenage to middle age. Since the production of cement products requires a lot of strength, there were no elderly workers. The production workers were also classified as to whether they were skilled or unskilled. The distinction between skilled and unskilled workers was done on the basis of wage rates paid. Within a group of workers who produce the same product, skilled workers usually got higher wage rate than those who were unskilled. However, rate differed among different groups of workers who produced different products.

On the average skilled workers worked 85.55 man-days each month, while unskilled workers worked around 208 man-days each month (Table 3.9).

Therefore both skilled and unskilled workers worked around 294 man-days each month. This statistic indicated that the production of the firm relied more on unskilled workers than skilled workers.

It can be observed from Table 3.9 that the total number of man-days worked was around 90 to 99 percent of annual monthly average during the first nine months of the survey period, except in April and June. In April there was Song Kran Festival to celebrate traditional Thai New Year, and because many workers stopped working for 3-4 days or sometimes a week during the festival, the total number of man-days worked dropped to around 88 percent of annual monthly average. June was the time at the beginning of rainy season when workers who come from farm households went back to their fields to grow crops. Since there were not many workers around to be hired, production of many products dropped to the lowest level and the total number of man-days worked dropped to around 76 percent of annual monthly average. December, January, and February were the three months when the total number of man-days worked were greater than 100 percent of the annual monthly average. The reduction in the production of cement blocks and wind blocks which were produced by machine and the increment in the production of house posts, drainage pipes and some other products which were produced by hand and therefore required a lot of manual work is the explanation of such phenomenon.

3.6.4 Labor Requirement

In contrast to the above sections which indicated the total amount of labor used by the firm in its production of all products, this section indicates the amount of skilled labor and unskilled labor needed in the production of one unit of a specific product. This labor requirement in

the production of one unit of a specific product is shown in Table 3.10. However, the amount of labor needed was converted into per 1000 units of production instead of per 1 unit of production.

3.6.5 Wages

The wage rate per day of unskilled workers was around 73 percent of the wage rate per day of skilled workers. On the average over the year, wage rate per day of unskilled and skilled labor were 35 baht and 48 baht respectively (Table 3.11). The pattern of fluctuation of wage rate per day of these two groups of workers were nearly the same, except in September when wage rate per day of skilled workers went down, but wage rate per day of unskilled workers went up. Therefore, there will be only one description of the fluctuation of wage rate per day of both skilled and unskilled workers.

June and July were the months at the beginning of rainy season when farmers spent most of their time growing crops. Therefore the supply of workers in these two months for nonagricultural activities was usually lower than earlier periods. Since the production of cement products in July was higher than the production in June, demand for workers in July was greater than demand for labor in June. Given the condition above, wage rate per day of workers in July was higher than those in June. In August, demand for labor increased as a result of higher level of production, yet supply of labor might increase more than the increment in demand since the growing period had passed already, therefore wage rate per day dropped from a higher level in July to a lower level in August. In September, since the total number of man-days required dropped down and workers were still available to be hired, wage rate per day dropped

Table 3.10 Labor Requirement of Cement Product Firms

Product	Unit:Man-Day/1000 Pieces	
	Skilled	Unskilled
Cement Block, Wind Block		
Hand	5	2
Simple Machine	1	4
Sophisticated Machine	1	2
More Sophisticated Machine	.5	1.5
Drainage Pipe: Hand		
Small	41	72
Medium	92	114
Drainage Pipe: Machine		
Large	52	188
Well Pipe: Hand		
Small	36	64
Large	45	74
House Post		
Small	37	109
Medium	55	97
Large	60	130
Roof Tile	2	0
Toilet Head	49	115
Table Set	1167	333
Spirit House	1394	606

Source: Profitability Questionnaire

Table 3.11 Wage Rate per Day of Skilled and Unskilled Workers of Cement Product Firms

Unit:Baht

Month	Skilled	Unskilled
June	39	33
July	48	35
August	45	33
September	43	34
October	50	36
November	51	41
December	50	37
January	49	33
February	51	34
Average	48	35

Source: Monthly Questionnaire

down a little bit. In October, total number of man-days required decreased but supply of labor might decrease greater since workers had to spend more time to take care of their crops before the harvest period arrived, wage rate per day increased to a higher level. In November higher total number of man-days required as well as the reduction in supply of labor during harvesting season drove up wage rate per day to higher level. In December even total numbers of man-days required increased to a higher level, but some of the workers had already harvested their crops and more time could be sold out to the firms, wage rate per day dropped down below the level in December. In January more and more workers were available since most of the crops were already harvested in December, therefore wage rate per day went down even below the level in December. In February the increment in total number of man-days required drove up wage rate per day to a higher level than those of January.

3.7 Production

This section contains the information on production pattern, value of production and overhead cost. The description of production pattern tries to visualize the combination of the production of products over the survey period and therefore is not used directly in the construction of the model. Yet it can be used to compare with production pattern of the model. The usefulness of the description of value of production and overhead cost is mentioned at the beginning of their sections.

3.7.1 Production Pattern

For present purposes all products are divided into two groups: (1) the main product lines, which were the products produced by every

firm; and (2) the rest of the products which were not produced by all the firms.

Table 3.12 contains the amount produced of every product in every month and the first five products, i.e., cement block, wind block, house post, drainage pipe and well pipe are the main product lines of the cement product firm. Using the data from Table 3.12, Figure 1. is developed to facilitate the visualization of the production pattern.

For the main product line, it could be observed that the firm emphasized the production of cement blocks and well pipes during March to May. During June to August the firm emphasized in the production of drainage pipe and house post. During the last six months of the survey period there was not a clear pattern. The firm seemed to emphasize the production of cement block, wind block and house post during September to November, while during December to February the emphasis was on the production of wind block, house post and drainage pipe.

The production of the rest of the products scattered over the year. The firm did not produce concrete slab, shallow pipe, connection pipe, water tank and well pipe cover at all during the first four months of the survey period. The highest production level of these products were scattered during July to November. For brick, toilet head, roof tiles, table set and spirit house which the firm produced nearly every month, their productions were at the highest level during March to May except spirit house which was in October.

3.7.2 Value of Production

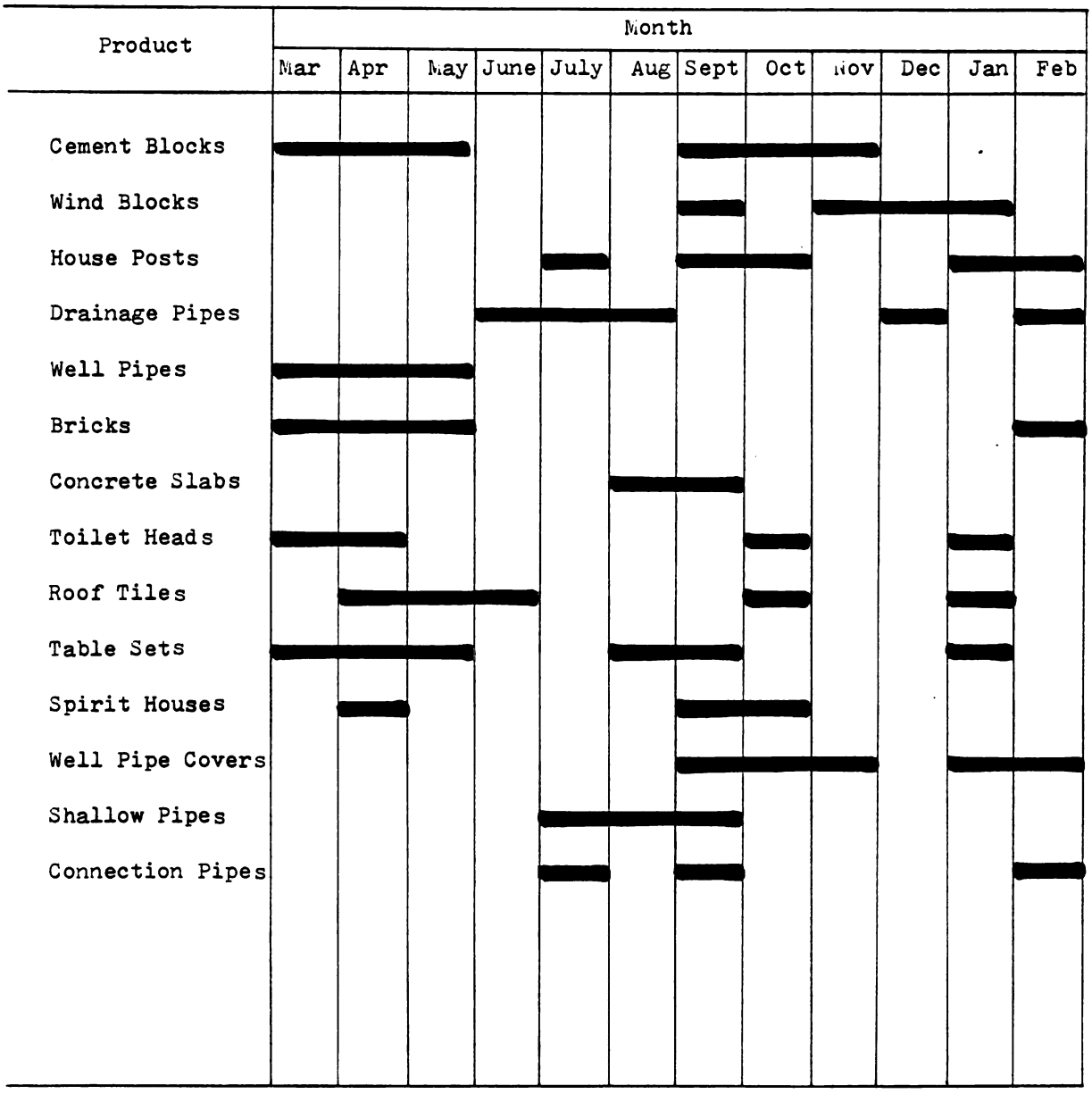
Value of production is not used directly in the construction of the linear programming model. The value of production is used in the

Table 3.12 Production Seasonality of Individual Products of Cement Product Firms, Number of Pieces and Percent of Annual Average by Month

Product	Month												
	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Ave.
Cement Blocks: pcs	14341	15009	15472	3687	11090	10454	23504	17927	15309	4236	9036	7481	12795
% of Average	112	117	121	29	87	82	184	140	120	33	71	58	100
Wind Blocks: pcs	1463	209	904	227	45	418	2609	1127	2868	3763	2463	227	1360
% of Average	106	15	66	17	3	31	192	83	210	277	181	17	100
Home Posts: pcs	223	242	223	170	308	234	289	281	170	238	273	269	243
% of Average	92	100	92	70	127	96	119	116	60	98	112	111	100
Drain Pipes: pcs	93	107	163	228	261	211	170	101	194	294	180	215	184
% of Average	50	58	89	124	142	115	92	55	105	160	98	117	100
Well Pipes: pcs	215	219	237	145	61	84	109	123	85	115	130	120	136
% of Average	158	161	174	107	45	62	80	90	63	85	96	88	100
Bricks: pcs	5909	5909	6363	3636	3636	2727	2727	2727	3272	2818	4545	6363	4219
% of Average	140	140	151	86	86	65	65	65	78	67	108	151	100
Concrete Slabs: pcs	0	0	0	318	0	545	2272	454	454	454	363	454	443
% of Average	0	0	0	72	0	123	513	102	102	102	82	102	100
Toilet Heads: pcs	19	10	1	4	0	4	0	7	4	0	5	0	4.5
% of Average	422	222	22	89	0	89	0	156	89	0	111	0	100
Roof Tiles: pcs	545	909	909	772	272	0	454	672	363	0	590	500	499
% of Average	109	182	182	155	55	0	91	135	73	0	118	100	100
Table Sets: pcs	4	4	2	0	1	3	2	1	1	1	2	1	1.8
% of Average	222	222	111	0	56	167	111	56	56	56	111	56	100
Spirit Houses: pcs	4	6	1	0	1	1	8	24	1	1	4	2	4.4
% of Average	91	136	23	0	23	23	182	545	23	23	91	45	100
Stoves: pcs	1	1	1	0	0	1	0	0	1	0	0	0	.4
% of Average	250	250	250	0	0	250	0	0	250	0	0	0	100
Well Pipe Covers: pcs	0	0	0	1	1	6	16	27	21	10	14	19	9.6
% of Average	0	0	0	10	10	63	167	281	219	104	146	198	100
Water Tanks: pcs	0	0	0	0	0	0	0	4	0	0	3	0	.6
% of Average	0	0	0	0	0	0	0	667	0	0	500	0	100
Shallow Pipes: pcs	0	0	0	0	21	35	18	6	5	2	6	0	7.8
% of Average	0	0	0	0	269	449	231	77	64	26	77	0	100
Connection Pipes: pcs	0	0	0	0	8	0	4	1	1	1	1	2	1.5
% of Average	0	0	0	0	533	0	267	67	67	67	67	133	100

Source: Monthly Questionnaire

pcs = pieces



Months when Production was at Least 10 Percent
Above Annual Average of Individual Cement Products

Figure 3.1

calculation of initial cash on hand at the beginning of the first period. Since there was no data on the amount of initial cash on hand, then the amount to be specified in the linear programming model was calculated as a percentage of the annual monthly average of value of production. This annual monthly average was shown in Table 3.13.

Production patterns as measured by value of production by period varies widely among firms (Appendix B, Table B-2). However, on the average, value of production in periods 1 and 4 (March to May and December to February) were nearly the same. Value of production was the lowest and the highest in the second (June to August) and third (September) periods, respectively. Value of production was 25 percent, 22 percent, 29 percent, and 24 percent of total value of production over the year in periods 1, 2, 3 and 4, respectively.

3.7.3 Overhead Cost

Besides raw materials, labor costs, the firms had to pay some overhead costs which included electricity, gasoline, gas, wood, coal, water, food expenses for workers who stayed and ate at the firm, insurance expenses, sales expenses, office supply expenses, salaries of accountants, secretaries, managers and communication expenses. The overhead cost per one baht of value of production is shown in Table 3.14 which ranged from .0644 to .1428, with the average of .1042.

3.8 Sales

This section contains the description of gross sales, sales and inventory pattern of individual products, distributing channels, cash sales vs. credit sales, and prices of products.

Table 3.13 Value of Production of Cement Product Firms

Unit:Baht

Month	Value of Production
March	93,947
April	100,627
May	113,261
June	74,185
July	104,182
August	88,690
September	138,966
October	103,924
November	107,481
December	95,838
January	108,150
February	89,709
Average	101,580

Source: Monthly Questionnaire

Table 3.14 Overhead Cost per 1 Baht of Value of Production of Cement Product Firms

Firm	Overhead Cost
241110	.1257
241211	.1428
242116	.1185
243121	.1363
243122	.0644
242219	.0944
241212	.0826
241108	.1138
242218	.0815
242114	.0969
242115	.0894
Average	.1042

Source: Profitability Questionnaire

3.8.1 Gross Sales

Gross sales is the result of the summation of price times quantity sold of every product. Costs of raw materials and other expenses have not been deducted. Quantity sold includes only those for which the deliveries have been made. Even if some of the sales are credit sales, gross sales still give some ideas about cash inflows into the firm in each particular period. The information on gross sales is not used in the construction of the linear programming model.

On the average, over the year, monthly gross sales of the cement product firms were around 84,500 baht (Table 3.15). It can be observed from Table 3.15 that June to October was the period when gross sales were below annual monthly average, except in September. Gross sales during the period were around 72 percent to 90 percent of the average. During March to May and November to February gross sales were around 100 percent to 120 percent and 100 percent to 118 percent of the average, respectively. Therefore there might be some possibility that the firms had difficulty balancing cash inflows to cash outflows during the middle of the survey period.

Sales by period of each of the cement product firms are shown in Appendix B, Table B-2. It can be observed that each firm has distinct sales pattern with little similarity among firms.

3.8.2 Sales and Sales Pattern of Individual Products

Sales seasonality of individual product will provide two important information in the constructions of the model. First it indicates demand for individual products in each period. Second, when sales and

Table 3.15 Sales per Firm by Month of Cement Product Firms

Month	Sales	% of Annual Average
March	81,999	97
April	85,592	106
May	101,267	120
June	65,283	77
July	60,903	72
August	72,307	86
September	97,648	116
October	76,484	90
November	92,990	110
December	83,593	99
January	90,852	108
February	100,103	118
Average	84,418	100

Source: Monthly Questionnaire

production of individual products are compared it will provide information on size of inventory as well as inventory pattern of each product.

Quantity sold of each product in each month was shown in Table 3.16. As was the case of production seasonality, Figure 2 was developed to better visualize sales pattern of each product.

Sales of well pipes were high during the first three months of the survey period. Sales of cement blocks seemed to move in opposite direction to sales of drainage pipes. Whenever sales of cement blocks were high, sales of drainage pipes were low except in September when sales of both products were high. Since sales of cement blocks were high during March to May and September to November, therefore sales of drainage pipes were high during June to September and December to February. Sales of wind blocks were high during the second half of the survey period except in October. Sales of house posts were at the highest level in May and there were two other periods, i.e., July and January and February, when sales of house posts were also high.

For the products which were produced nearly all year round, such as toilet heads, roof tiles, table sets, and spirit houses, there seemed to have three periods when sales were high. The first period was during March and April, except roof tiles which high level of sales continue into May. The second and third periods were during August to November and in January, respectively.

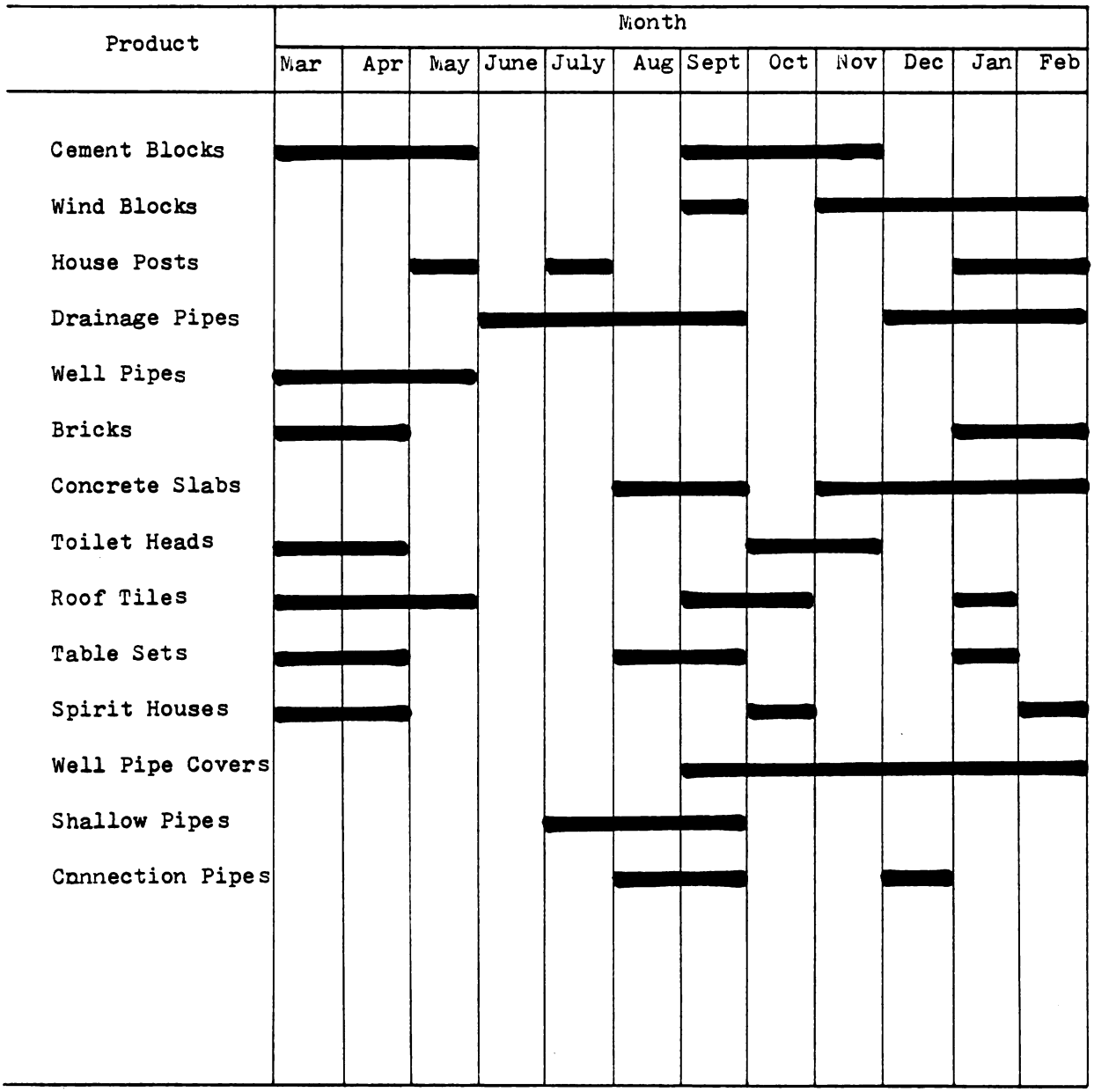
For the products not produced during the first four months of the survey period: shallow pipes and connection pipes was a product group which high level of sales occurred during July to September, and concrete slabs and well pipe covers was another product group which high level of sales occurred during the second half of the survey period.

Table 3.16 Sales Seasonality of Individual Products of Cement Product Firms, Number of Pieces and Percent of Annual Average by Month

Product	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Ave.
Cement Blocks	12360	13672	14209	2654	6327	4501	17959	13372	16013	4661	6400	8854	10082
	122[a]	136	141	26	63	45	178	133	159	46	63	88	100
Wind Blocks	600	663	636	354	163	420	2054	627	2736	3254	2404	2045	1329
	45	50	48	27	12	31	154	47	206	245	181	154	100
House Posts	193	211	274	132	236	175	209	224	132	204	253	257	208
	93	101	132	63	113	84	100	108	63	98	122	123	100
Drainage Pipes	83	71	131	217	184	190	114	87	138	227	172	206	152
	55	47	86	143	121	125	75	57	91	149	113	135	100
Well Pipes	224	228	204	126	63	73	85	85	72	94	117	119	124
	181	184	164	102	51	59	68	68	58	76	94	96	100
Toilet Heads	18	7		2		2		4	4		5		3.5
	514	200		57		57		114	114		143		100
Roof Tiles	545	909	909	272	181		454	672			590	363	408
	133	222	222	67	44		111	165			145	89	100
Table Sets	3	3	1	2	1	3	3	1	2	1	3	2	2
	150	150	50	100	50	150	150	50	100	50	150	100	100
Spirit Houses	3	3			1			12		1	1	3	2
	150	150			50			600		50	50	150	100
Well Pipe Covers	--	--	--	--	--	5	14	27	13	9	13	17	8
						62	175	337	162	112	162	212	100
Shallow Pipes	--	--	--	--	14	30	15	6	2	2	3	--	6
					223	500	250	100	33	33	50		100
Connection Pipes						7	4	1	1	2	1	1	1.4
						493	282	70	70	141	70	70	100
Bricks	5909	5909	1818	3636	1364	1818	2727	1818	3773	2818	4545	6364	3500
	169	169	52	104	39	52	78	52	108	80	130	182	100
Concrete Slabs	--	--	--	318		545	909	273	454	454	364	454	314
				101		173	289	87	144	144	116	144	100

Source: Monthly Questionnaire

[a]The second line of each product is percent of annual average



Months when Sales were at Least 10 Percent
Above Annual Average of Individual Cement Products

Figure 3.2

3.8.3 Inventory and Inventory Pattern of Individual Products

Inventory of a product in any period is the difference between production and sales of the product in that particular period. Cumulative inventory of a product is the summation of inventory of the product over the periods. The comparison of inventory of a product in a period to the annual monthly average will tell inventory pattern, i.e., over the year it will indicate those months when the firm seems to be accumulating inventory the most. The information on cumulative inventory tells the maximum level of inventory of the product carry over by the firm. This maximum level would be used to specify the right hand side of inventory of products in the linear programming model.

Cumulative inventory of each product is shown on the second line of each product in Table 3.17.

To facilitate visualization of the inventory pattern, Figure 3 was developed using information on the third line of each product from Table 3.17.

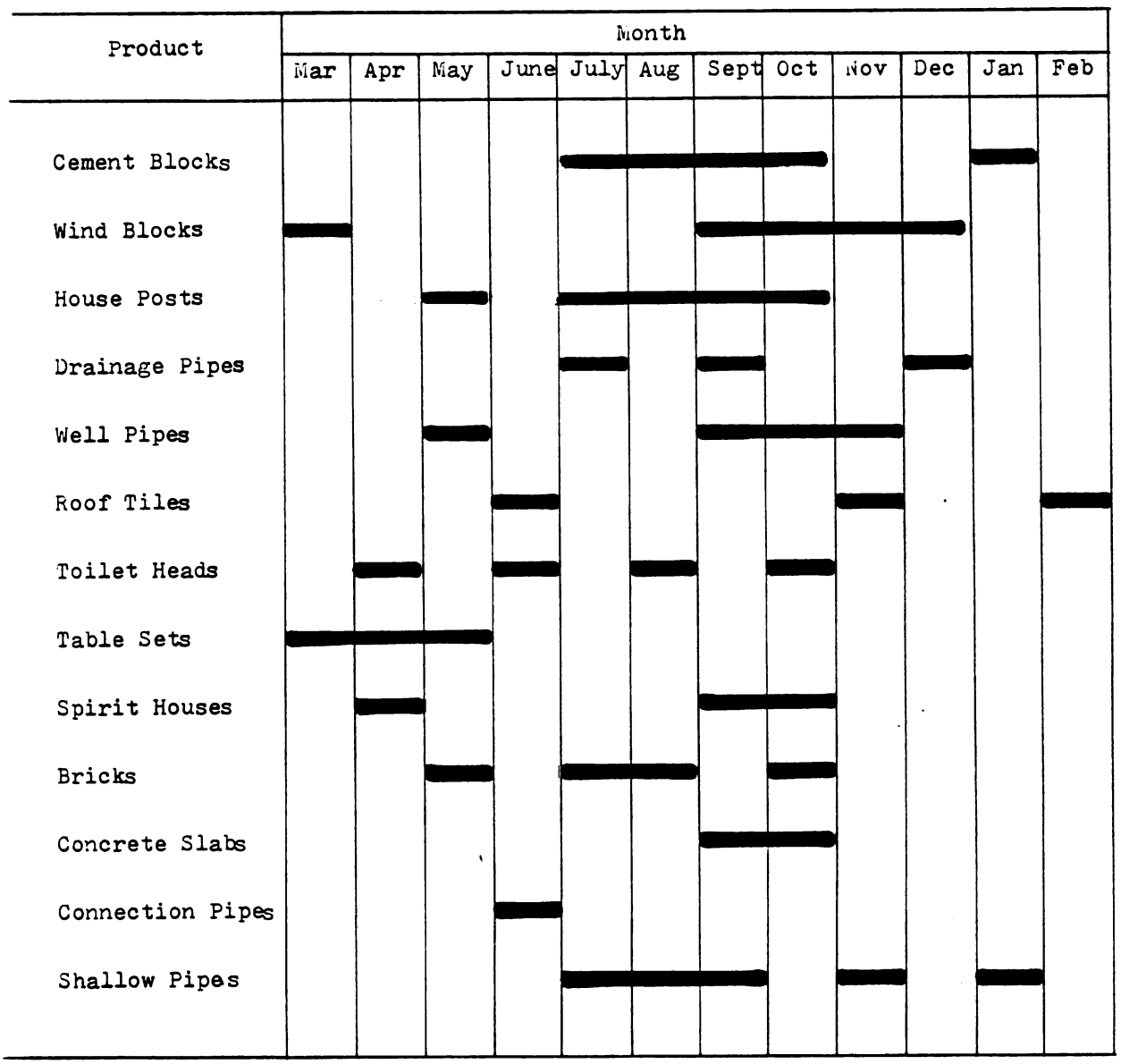
For the main product lines of the firm, i.e. cement blocks, wind blocks, house posts, drainage pipes and well pipes, July to December seemed to be the period when the firm accumulated inventory the most. During this period the accumulation of inventory was at least 10 percent percent above the annual monthly average.

The accumulation of inventory for the remaining products was high during June to November, except for table sets. For this item, March to May was the period when the accumulation of inventory was high. The accumulation of inventory of bricks was high in May too.

Table 3.17 Inventory and Cumulative Inventory of Individual Products of Cement Product Firms, Number of Pieces and Percent of Annual Average, by Month

Product		Month											Ave.
		Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	
Cement Blocks	a	1981	1337	1263	1033	4763	5953	5545	4555	-704	-425	2636	-1373	2213.67
	b	1981	3318	4581	5614	10377	16330	21875	26430	25726	25301	27937	26564	
	c	89	60	57	47	215	269	250	206	-32	-19	119	-62	
Wind Blocks		863	-454	268	-127	-118	-2	555	500	132	509	59	-2178	.58
		863	409	667	550	432	430	985	1485	1617	2126	2185	7	
		1479	-778	459	-218	-202	-3.4	951	857	226	872	101	-3734	
House Posts		30	31	-51	38	72	59	80	57	38	34	20	12	35.00
		30	61	10	48	120	179	259	316	354	388	408	420	
		85	88	146	109	206	169	229	163	109	97	57	34	
Drainage Pipes		10	36	32	11	77	21	56	14	56	67	8	9	33.08
		10	46	78	89	166	187	243	257	313	380	388	397	
		30	109	97	33	233	63	169	42	169	202	24	27	
Well Pipes		-9	-5	27	19	-2	11	24	38	113	21	13	1	20.92
		-9	-14	13	32	30	41	65	103	216	237	250	251	
		43	24	129	91	-10	53	115	182	540	100	62	5	
Toilet Heads		1	3	1	2	0	2	0	3	0	0	0	0	1.00
		1	4	5	7	7	9	9	12	12	12	12	12	
		100	300	100	200	0	200	0	300	0	0	0	0	
Roof Tiles		0	0	0	0	91	0	0	0	363	0	0	137	49.25
		0	0	0	0	91	91	91	91	454	454	454	591	
		0	0	0	0	185	0	0	0	737	0	0	278	
Bricks		0	0	4545	0	2772	909	0	909	0	0	0	0	719.00
		0	0	4545	4545	6817	7726	7726	8635	8635	8635	8635	8635	
		0	0	632	0	316	126	0	126	0	0	0	0	
Concrete Slabs		-	-	-	0	0	0	1363	181	0	0	0	0	128.67
		-	-	-	0	0	0	1363	1544	1544	1544	1544	1544	
				0	0	0	0	1059	140	0	0	0	0	
Table Sets		1	1	1	-2	0	0	-1	0	-1	0	-1	-1	-.25
		2	2	3	1	1	1	0	0	-1	-1	-2	-3	
		400	400	400	800	0	0	-400	0	-400	0	-400	-400	
Spirit Houses		1	3	1	0	0	1	8	12	1	0	3	-2	2.24
		1	4	5	5	5	6	14	26	27	27	30	29	
		41	124	41	0	0	41	330	496	41	0	124	41	
Well Pipe Covers		0	0	0	1	1	1	2	0	8	1	1	2	1.42
		0	0	0	1	2	3	5	5	13	14	15	17	
		0	0	0	70	70	70	141	0	565	70	70	141	
Connection Pipes		0	0	0	0	8	-7	0	0	0	-1	0	1	.08
		0	0	0	0	8	1	1	1	1	0	0	1	
		0	0	0	0	9600	-8400	0	0	0	-8400	0	1200	
Shallow Pipes		0	0	0	0	7	5	3	0	3	0	3	0	1.75
		0	0	0	0	7	12	15	15	18	18	21	21	
		0	0	0	0	400	285	1.71	0	1.71	0	1.71	0	

a = production - sales; b = cumulative inventory; c = percent of annual average = a/annual average



Months when Inventory were at Least 10 Percent
Above Annual Average of Individual Cement Products

Figure 3.3

Since production and sales patterns vary among firms, one can expect inventory patterns of the firms to be dissimilar. The accumulation of inventory, in monetary terms, of each individual firm by period is shown in Appendix B, Table B-2. On the average, however, the accumulation of inventory in period 3 was the highest (83,000 baht) and was around 20 percent higher than the accumulation of inventory in period 2. While the average accumulation of inventory in period 1 was around 1/2 of that in period 2, it was nearly 2 times greater than the accumulation of inventory in period 4.

3.8.4 Output Channel and Implication on Cash Sales

This section identifies the channels through which cement products pass and describe the nature of sales as to whether they are cash or credit for each channel. However, the presentation is in terms of number of firms rather than in terms of monetary value.

Table 3.18 shows that all 11 of the cement products firms sold their cement blocks or wind blocks, directly to consumers of these, 3 firms sold some of the products through retailers, six sold some of their products through building contractors and six firms sold some of the products to institutions such as temples, schools, government offices, etc. Columns 3, 6, 9, and 12 in Table 3.18 can be interpreted in the same way for other products. In general, for a particular product few firms sold the products through retailers, about half of the firms sold the product through building contractors and/or institutions, and all the firms sold some of the products directly to consumers.

Table 3.18 indicates also that when the products are sold directly to consumers, most of the firms asked their customers to pay cash

Table 3.18 Distribution and Types of Sales of Products, Number of Firms, by Channel

Product	Total Number of Firms	Channel											
		Consumer			Retailer			Contractor			Institution		
		Total	Cash	Credit + Cash	Total	Cash	Credit + Cash	Total	Cash	Credit + Cash	Total	Cash	Credit + Cash
Cement Blocks, Wind Blocks	11	11	8	3	3	-	3	6	3	3	6	1	5
Drainage Pipes	11	11	8	3	3	-	3	6	3	3	8	1	7
Well Pipes	11	9	8	1	1	-	1	6	4	2	5	1	4
House Posts	11	11	8	3	3	-	3	6	3	3	6	1	5
Other[a]	11	7	5	2	3	-	3	1	-	1	5	1	4

Source: Marketing Questionnaire

[a]7 firms out of 11 firms produce some other products.

immediately and only a few firms provided trade credit to consumers. However, all of the firms provided trade credit to retailers. About half of the firms which sold their products through building contractors, asked the contractors to pay cash immediately and the other half of the firms provided them with trade credit. More than 80 percent of the firms provided trade credit when they sold to institutions.

From Table 3.18 it can be concluded that the more the sales to consumers, the faster cash flows into the firms.

Table 3.19 indicated that depending on product, sales as a percent of total sales ranged from 58-64 percent being sold to consumers from 7 to 9 percent were sold through retailers and from 10 to 14 percent and 16 to 21 percent of total sales were sold through contractors and to institutions respectively.

3.8.5 The Percentage of Credit Sales

The percentage of credit sales to total sales for each firm ranged from 0 percent to 80 percent (Table 3.20). However, when weighted by total sales of each firm, which was not equal, the percentage of credit sales was around 40 percent of total sales. This information is used to specify the ratio of cash sales to credit sales in the construction of the linear programming model.

3.8.6 Prices of Products

Prices of products were collected from cooperating firms monthly as part of the year-round research activities. This information will be used in the specification of prices of products in each period in the linear programming model.

Table 3.19 Percentage of Sales by Channel of Cement Product Firms

Product	Output Channel			
	Consumer	Retailer	Contractor	Institution
Cement Blocks Wind Blocks	64	7	13	16
House Posts	64	7	13	16
Drainage Pipes	58	7	14	21
Well Pipes	64	7	13	16
Other	60	9	10	21

Source: Marketing Questionnaire

Table 3.20 Total Sales, Credit Sales and Percent of Credit Sales by Firm

Firm	Total Sales (฿)	Credit Sales	
		Baht	% of Total
241110	83,425	0	0
241211	198,898	19,890	10
242116	236,833	11,841	5
253121	676,066	33,803	5
253122	744,083	0	0
242219	383,501	115,050	30
241212	1,066,805	53,340	5
241108	1,248,190	624,095	50
222218	1,525,870	1,120,696	80
242114	3,307,115	1,984,269	60
242115	1,672,581	501,774	30
Total	11,143,367	4,564,758	
Percent	100	41	

Source: Monthly and Finance Questionnaires

Prices of products reported in the following table are weighted average price. Mathematically the weighted average prices can be expressed as follows:

$$pa = \sum_{i=1}^{n} pai\ qai \Big/ \sum_{i=1}^{n} qai$$

= value of sales of product A/summation of quantity sold of product A

where:

pa = weighted average price of product A

pai = price of product A size i

qai = quantity sold of product A size i

Practically the firm kept the price of a specific product constant over the period of a year. Any change in price usually occurred after Chinese New Year, in the middle of February. In some cases there were producer associations which specified prices of products for their member firms. For those firms which were not members of the producer associations or which were located in other areas, the firms usually had a fixed price per unit varying according to size. For example 4 x 4 house posts would be priced at 40 baht per meter, while a 5 x 5 post would be priced at 50 baht per meter. From direct observation, the firm tried to maintain these prices even if there were some changes in demand and in the cost of production over the year.

The evidence from the survey data, more or less, supports this observation. For example, the prices of the following products, i.e., brick, connection pipe, concrete slab, well pipe cover, roof tile and cement block for which each product has only one size had nearly the same

prices all year round. If prices of some of these products fluctuated at all the prices remained within ± 10 percent of the yearly average prices (Table 3.21).

Given this observation, the changes in weighted average prices from month to month of the rest of the products which have different sizes or design would reflect the change in the combination of the quantity sold of the product of different sizes rather than the change in product prices.

3.9 Financial Characteristics

This section contains the information on outstanding short-term and long-term debt at various sources, rate of interest paid to lenders, size of loan, collateral and assets.

The information on long-term debt outstanding will be used to calculate the principal repayment of long-term debt as well as interest on outstanding long-term debt. These were some of the financial commitments the firm had to keep and therefore were specified in the linear programming model.

The information on debt outstanding at commercial bank, both short-term and long-term, was used to specifiy the size of loan the firm could borrow from commercial bank.

The information of current assets and current liabilities would be used to specify the maximum amount of outstanding short-term debt from commercial bank the firm could make in each period.

The information on fixed assets and equity are presented in order to have a full picture of financial structure of the firm.

Information on rate of interest is used directly in the construction of the model to calculate interest payment in each period.

Table 3.21 Prices of Individual Products by Month of Cement Product Firms

Unit:Satang(1 Baht=100 Satang)

Product	Month												
	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Ave.
Cement Blocks	240	245	245	250	230	240	240	235	240	240	250	270	244
Wind Blocks	275	255	280	235	255	280	290	275	315	325	300	300	282
House Posts	8900	9888	9920	9470	7967	6450	10440	10127	11596	10328	10580	10310	9665
Drainage Pipes	11025	13600	13450	9877	8770	10827	12827	8677	13436	13845	16062	13381	12148
Well Pipes	5900	6275	6270	6316	9417	5975	5187	5944	5085	5680	5580	5570	6100
Toilet Heads	10500	10500	18000	3000	-	4125	-	5400	15000	-	10000	-	9565
Roof Tiles	80	75	75	75	75	-	75	70	-	-	80	80	76
Bricks	30	30	30	25	25	25	30	25	25	25	25	25	27
Concrete Slabs	-	-	-	600	-	550	550	550	550	550	550	550	556
Table Sets	63333	63333	60000	60000	75000	79600	45000	64000	76666	73333	48950	75000	65434
Spirit Houses	32500	32500	32500	-	36100	30000	40000	48733	25000	91600	40000	57600	40366
Well Pipe Covers	-	-	-	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
Connection Pipes	-	-	-	-	-	1500	1500	1500	1500	1500	1500	1500	1500
Shallow Pipes	-	-	-	-	3620	4050	3800	4300	4400	3600	2500	-	3753
Stoves	30000	30000	32500	-	35000	40000	-	-	45000	50000	-	40000	37812

Source: Monthly Questionnaire

Information on size of loan is not used in the construction of the model. This information is provided in order to have some idea on the supply side of loan.

The collateral section will provide some idea of what the firm can use to pledge as collateral in their borrowings.

3.9.1 Debt Outstanding

Outstanding short-term and long-term debt was measured at the end of the survey period. The maturity of the debt or the length of time the firm expected to repay the debt was used as a criteria to classify whether the debt was short-term debt or long-term debt. If the debt was due within one year, it was a short-term debt, otherwise it was a long-term debt. Under this definition long-term debt might become short-term debt if the maturity date is less than a year.

At the end of the survey period, February, the total debt outstanding was 670,364 baht (Table 3.22). Of this amount, 47.84 percent or 320,727 baht was short-term debt. Surprisingly, only .28 percent of the outstanding short-term debt, 909 baht, was owed to commercial banks. Nearly 80 percent of the outstanding short-term debt, 288,182 baht, was borrowed from credit association and the rest of the outstanding short-term debt was borrowed from friends and relatives, and input suppliers.

Of total debt outstanding, 349,637 baht (52 percent) was long-term debt. Two sources of outstanding long-term debt were commercial banks and friends and relatives. However, commercial banks were the major source of long-term debt. At the end of the survey 75 percent of total outstanding long-term debt, 263,273 baht, was borrowed from commercial

Table 3.22 Debt-Assets Structure (February 1981) of Cement Product Firms

Assets		Liabilities and Owner's Equity	
Current Assets		Short-Term Debt	
Accounts Receivable	135,000	Commercial Banks	909
Inventories		Credit Associations	288,182
Finished Products	359,182	Friends and Relatives	15,454
Raw Materials	63,147	Input Suppliers	16,182
Total Current Assets	557,329	Total Short-Term Debt	320,727
Fixed Assets		Long-Term Debt	
Land	545,371	Commercial Banks	263,273
Building	225,421	Friends and Relatives	86,364
Vehicle	335,577	Total Long-Term Debt	349,637
Machinery	318,932		
Total Fixed Assets	1,425,301	Total Debt	670,364
		Equity	1,312,266
Total	1,982,630	Liabilities and Equity	1,982,630

Source: Finance Questionnaire

banks. The outstanding short-term, long-term and total debt of each individual firm is shown in Appendix B, Table B-2.

It should be mentioned that term loans provided by commercial banks or other financial institutions are rarely available to small firms in rural areas.

It is common procedure for the commercial banks to lend money to firms by letting them open overdraft accounts at the banks. The banks and the firms will negotiate the size of the overdraft account, i.e., the maximum amount of money the firms are allowed to withdraw from the account. There is no specification on the repayment date. However, the firms have to pay interest every month based on the amount outstanding at the end of that month. Neither is there any restriction on the use of the money. The firms can use the borrowed money either for investment in fixed assets or for working capital or in household consumption or combination of them. Originally the overdraft account was designed to help release the short-term operating capital needed of the firms. Since there are no restrictions, the firms then also use money available from overdraft accounts for long-term investment. Since there is no attempt or intention from the bank to force the firms to repay the principal as long as the firm keeps on paying interest and since the firms invest some of the money in fixed assets which cannot generate enough additional profit to repay the amount borrowed within a short period of time, a large percentage of money borrowed from commercial banks cannot be repaid within a one-year period and therefore is classified as long-term debt.

It should be observed also that capital borrowed from credit association is classified as short-term debt only. The reasons may be: (1)

the rate of interest is very high (information on rate of interest will be discussed later); and (2) credit association is usually organized within a group of few close friends only. Every month a group of these few close friends put a specified amount of money in a pot and each of them can bid for the money in the pot. Those who have won the bids cannot bid again in later months, yet they have to put the specified amount of money in the pot every month until everyone gets the pot. Since it is organized within a circuit of few close friends, money borrowed from this kind of association is usually classified as short-term debt. Actually when the first round of bidding ends (when everyone gets the pot), a new round can be started again and again, unless the majority of the members agree to break the association. The cycle of the bidding may last more than a year if more than 12 members are involved. If this is the case the debt would become long-term debt when they started playing. As the bidding goes on, the number of times each member has to put in the pot becomes smaller and smaller. The long-term debt earlier, therefore, becomes short-term debt when time goes on. Coincidently when the interview occurred, the final payment is due within one year, and the outstanding was classified as short-term debt.

3.9.2 Rate of Interest

Commercial banks charged their customers an annual rate of 18 percent interest, the maximum rate allowed by the law. This rate was applied to both short-term and long-term loans. As mentioned earlier, there was no sharp distinction between short-term and long-term loans borrowed from commercial banks because the long-term loans were actually the short-term loans which the firms were unable to pay all of the

principal outstanding back within a year. Therefore, there was no surprise when the firms reported that they paid 18 percent rate of interest for both short-term and long-term loans borrowed from commercial banks. It should be mentioned also that the firm may pay just 14 percent rate of interest if the firms use saving deposit in the bank to pledge as collateral and the amount of loans do not exceed the amount of saving deposit. However, it was surprising to learn that the firms pay 18 percent rate of interest to their parents, friends, or relatives from whom they borrowed money. If the opportunity cost of money of parents, friends or relatives was equal to the saving rate of interest, the interest rate to be paid should be 8 percent to 14 percent which were the rates of interest of saving or time deposits (Onchan, 1981). The reason that the firm paid 18 percent rate of interest to this group of lenders may be because if the firm was unable to borrow more from commercial banks, for whatever reasons, then the firms might ask their parents, or relatives, or friends to borrow from commercial banks and relend to them. Therefore, the firms had to pay the same rate as what was being charged by the banks. However, the firms did not have to pledge any fixed assets as collateral against the borrowings.

Rate of interest charged by input suppliers varied from zero percent to 72 percent, with the average rate of 33.26 percent. The firms had the privilege to pay no interest to input suppliers because they had been regular customers of the input suppliers for a long time. Good reputation and credit worthiness had been established and maintained at very high levels. Not every firm could enjoy this special privilege. Nor was this special privilege provided by every supplier either. If the firms which paid zero rate of interest to input suppliers were not

counted in the calculation of the average rate of interest, the average rate of interest charged by input suppliers would be around 55 percent.

The rate of interest charged by credit associations was much more difficult to calculate, and depended on how the members organized the bidding. Unfortuantely data collected was inadequate to do the calculation. Of course, the rate should be higher than the rate charged by commercial banks. However, it was very difficult to estimate the average rate on the upperside. On the one hand, it might be argued that the rate should not be higher than that charged by input suppliers; because, if so why would the firms not borrow from input suppliers. On the other hand, if good reputation or credit worthiness have not been created, it is very difficult to get credit from input suppliers. Under this condition, if the firms were really short of money and had access to credit association, they might bid the pot at a higher rate of interest than the average rate being charged by input suppliers. Therefore, the rate of interest charged by credit association was left undetermined.

3.9.3 Size of Loan

Loans from commercial banks: the maximum size of loan which the firm can borrow from commercial banks is determined from size of the bank and value of collateral. Maximum size of loans which local banks can offer without asking for approval from the main office in Bangkok varies from 50,000 baht for the smallest bank (total lending is less than 50 million baht) to 1,000,000 baht for the largest banks (total lending is more than 150 million baht). However, whether the banks would lend up to the maximum limit or not, depends also on the value of collateral the firms use to pledge against the borrowings. The larger

banks are more liberal as they will provide credit at higher percentage of the value of the collateral, 60-70 percent. Small and medium size banks give only 30-50 percent of total value of the asset (Onchan, June 1981). The maximum size of loans which can be borrowed from parents, relatives or friends depends on the financial position of these people and their willingness to help the firms. The maximum size of loan which can be borrowed from credit associations depends on the number of members and the amount of money the members agree to put in the pot for the bidding. The maximum size of loan which can be borrowed from input suppliers depends on financial position of the suppliers, the length of time they have been doing business together and the credit worthiness of the firms. Given the data at hand, maximum size of loans from the last three groups of lenders cannot be quantified.

3.9.4 Collateral

Of the various sources of credit mentioned above, only the borrowing from commercial banks needs tangible assets to be pledged as collateral (to guarantee the security of loans). Land and buildings are the most important types of collateral. Deposits within the bank, government bonds, stocks, letter of credit and construction contracts are other forms of collateral. For small loans, a person with good reputation may also guarantee the loans (Onchan, June 1981). The cement product firms do not have difficult access to commercial banks. Yet the firms sometimes mentioned that the maximum amount of money allowed to withdraw from overdraft accounts was not enough.

3.9.5 Assets

Assets to be described in this section are the assets as of the end of February, 1981. Assets are divided into two groups, i.e., current assets and fixed assets. Current assets are inventory of raw materials, inventory of products,[1] and accounts receivable. There is no information on cash in hand, bank accounts, or investment in securities. Investment in securities is not an important item in current assets since securities are rarely traded or not available outside Bangkok. Fixed assets are land, building, vehicle and machinery. The value of fixed assets reported is the book value of the assets adjusted by an inflation index to reflect more realistic (current) book values. Straight line depreciation method is used in the calculation. The useful life of the assets are those reported by the firms.

At the end of February 1981, the total assets of the firms, on the average, were valued at 1.98 million baht. Current assets were .56 million baht or 28.11 percent of total assets. Within the group of current assets, 64.45 percent of current assets or .36 million baht was inventory of finished product. Values of accounts receivable and inventory of raw materials were 135,000 baht and 63,147 baht or 22.22 percent and 11.33 percent of current assets, respectively (Table 3.22).[2]

The firms invested around 1.42 million baht or 72 percent of total investment in fixed assets. Even though some firms rented some or all

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[1]The value of inventory were those reported by the firms. The firms made the estimation by multiplying the quantity left by current prices. The firm did not use either LIFO or FIFO method in the estimation of inventories.

[2]See page 87.

of their land, this form of investment was still the largest item in fixed assets. Land value averaged .545 million baht or 38 percent of the total investment in fixed assets. The second biggest item in fixed assets was vehicle. All firms had at least one vehicle to transport their merchandise; some had 5 or 6 vehicles. The investment in vehicles was around .33 million baht or 23.45 percent of total value of fixed assets. Building represented the smallest value among the fixed assets. Buildings, here, included only the house where the owner stayed and a section of the house where the owners used as their business offices. The firms did not construct storage to store finished products because they were stored at the appropriate places on an open ground. The sample firms included in this study did not have a separated business office either as may have been reported in other studies. The average value of building was around .225 million baht or 15.81 percent of total investment in fixed assets.

Machinery owned by the firms can be classified as follows: (1) the machine to mix cement, sand, stones and water together; (2) various kinds of cement product molds; and (3) machines to produce specialized products. Most of the products are produced by using molds with the exceptions of cement blocks, wind blocks and drainage pipes. Also there are many kinds of block making machines. However, the number of cement block making machines averages less than 1 machine per firm with an average value of 156,931 baht. Just one firm had the machine to make drainage pipes the average value of this machine was 6471 baht. The average value of the rest of the machines (molds) are reported in Table 3.22. Altogether the average value of machines was 318,932 baht, or

22.39 percent of total investment in fixed assets. Total assets of individual firms are shown in Appendix B, Table B-2.

CHAPTER 4

THE BASIC MODEL OF CEMENT PRODUCT INDUSTRY

This chapter has three parts. The first part deals with the modification of the generalized linear programming model presented in Chapter 2 to fit the circumstances in the cement product industry. The second part is the presentation of the basic model and the last part presents the results of analysis.

4.1 Modification of the Generalized LP Model

The modification includes a definition of the credit constraint (sources and level of credit) based on the findings of the previous chapter and the specification of number of periods to be used in the model.

4.1.1 Sources of Credit

It was shown in section 3.8.1 that the firm borrows capital from four sources, i.e., commercial banks, credit associations, friends and relatives, and input suppliers. The borrowing from friends and relatives was found to have the same interest charge as for money borrowed from the commercial bank (18%), but they do not require collateral. This form of credit is activated after the firm has already borrowed to its limit from the commercial bank. Since the borrowing from friends and relatives is assumed to be an indirect form of borrowing from the commercial bank, no special category is defined in the model for this credit source.

The borrowing from credit associations is also excluded from the model because of the difficulty in specifying it. Even though the firm makes repayment with equal payments for a certain period of time, it differs from installment borrowing in that the firm makes some installment payments to the association in advance of borrowing any money at all. The amount to be paid is determined by the members, and is a constant proportion of amount to be borrowed which is unknown. The rate of interest depends on when the firm wants to borrow and therefore changes over time. Since it is very difficult to specify these uncertain conditions, credit associations as a source of credit are excluded from the linear programming model. However, if the firm borrows from all sources up to the maximum limits, the model will indicate the shadow price for additional borrowings from any credit source, including credit associations.

Therefore in the model, the firm is allowed to borrow from two sources, i.e., commercial banks and input suppliers.

4.1.2 Level of Credit

The determination of the amount of credit the firm will borrow from commercial banks depends on whether trade credit is obtained from input suppliers or not. If the firm obtains as much trade credit as it can from input suppliers, then additional loans will be obtained from the commercial bank as needed. The amount the firm borrows from the commercial bank under this condition, then, is the minimum amount of credit the firm would obtain from the commercial bank. The maximum amount is determined by letting the firm borrow from the commercial bank only.

The amount of credit the firm needs also depends on whether the firm sells all the products in cash or whether credit is extended to its customers. Everything else being held constant, cash inflow into the firm is less when the firm provides trade credit than when the firm sells everything in cash. Therefore, a firm needs more credit if it extends trade credit than if it sells everything in cash.

Therefore at one extreme, the minimum amount of credit the firm should obtain from the commercial bank is determined when the firm obtains trade credit as much as it can from input suppliers and when it sells everything in cash. This alternative is named "the conservative approach."

On the other extreme, the maximum amount of credit the firm will obtain from the commercial bank occurs when the firm does not receive any trade credit from input suppliers (borrows only from the commercial bank) and when it provides trade credit to its customers. This alternative is named "the liberal approach."

Therefore there will be two basic models. One is under the conservative approach and another one is under the liberal approach.

4.1.3 Number of Periods to be Used in the Model

The survey period of one year was divided into four three month periods. The first period is from March to May, the second, third and fourth periods are from June to August, September to November, and December to February, respectively. These quarterly periods correspond very roughly to the peaks and troughs for production of the major cement products.

4.2 The Basic Model

As mentioned earlier, the basic model is decomposed into the basic model under the conservative approach and the basic model under the liberal approach. This section will first specify types of product produced and sold by the basic firm. Then the basic model under both approaches will be described.

4.2.1 Products Produced and Sold

It is assumed that the basic firm, under both the conservative and the liberal approaches, produced the following products: cement blocks, wind blocks, small and medium drainage pipes, small and large well pipes, and small, medium and large house posts. These are the cement products found under production by every firm. Other products will be introduced into the "extended" model in the following chapter. Cement blocks and wind blocks are assumed to be produced by simple machine and the rest of the products are assumed to be produced by hand.

4.2.2 Constraints

4.2.2.1 Inventory Constraint

This constraint is to restrict the net addition to inventory of every product so that it will not exceed available space in inventory. The available space is the difference between maximum space available and initial inventory. Initial inventory is assumed to be zero for every product. The maximum space available is the maximum level of cumulative inventory the firm has had (see section 3.7.3). The information on maximum inventory for every product is shown in Table 4.1.

Table 4.1 Inventory, Expected Demand and Machinery Constraints of the Basic Cement Product Firm

Product	Period	Constraint		
		Inventory	Expected Demand	Machinery
Cement Block	1	28,000	40,500	
	2	28,000	13,500	
	3	28,000	47,400	
	4	28,000	20,100	58,500
Wind Block	1	2,200	1,950	58,500
	2	2,200	1,050	58,500
	3	2,200	5,400	58,500
	4	2,000	7,800	58,500
Small Drainage Pipe	1		129	1,260
	2		258	1,260
	3		155	1,260
	4	350	258	1,260
Medium Drainage Pipe	1	350	138	1,330
	2	350	276	1,330
	3	350	166	1,330
	4		276	1,330
Small Well Pipe	1		383	1,200
	2		157	1,200
	3		139	1,200
	4	250	191	1,200
Large Well Pipe	1	250	277	1,200
	2	250	113	1,200
	3	250	98	1,200
	4		139	1,200
Small House Post	1		338	1,700
	2		265	1,700
	3		279	1,700
	4	400	353	1,700
Medium House Post	1	400	304	2,000
	2	400	238	2,000
	3	400	251	2,000
	4		317	2,000
Large House Post	1		48	1,700
	2		38	1,700
	3		40	1,700
	4		50	1,700

4.2.2.2 Expected Demand Constraint

The maximum quantity of any product which the firm is expected to sell in any period is also shown in Table 4.1. This expected demand is equal to the average observed quantity sold of the products as described in section 3.7.2.

4.2.2.3 Machinery Constraint

The maximum units of product which can be produced by machines or molds in any period is shown in Table 4.1. These maximum units of product are calculated by using the production capacity per month reported in section 3.4.2 times the average number of machines or molds the firm has and to convert production capacity per month to production capacity per period, this product is multiplied by 3.

4.2.2.4 Fixed Financial Commitments

4.2.2.4.1 Dividends

Dividends are considered to be the cash drain from the business for household consumption. It was assumed that the firm would withdraw from business proceeds, 2000 baht per month or 6000 baht per period in the form of dividends (Table 4.2). Such information was not available from the small scale industry study. It was based on studies of consumption expenditure by farm households in the area (Priebprom, 1982 and Jaisaad 1981).

4.2.2.4.2 Principal Repayment on Long-Term Debt

It is assumed that the firm will repay all its outstanding long-term debt within ten years. This led to an estimated 32,000 baht loan

Table 4.2 Fixed Financial Commitments, Borrowing Constraint and Credit Sales of the Basic Cement Product Firm

	Level of Constraint
Fixed Financial Commitments	
1. Interest on Long-Term Debt	13,950
2. Principal Repayment of Long-Term Debt	32,000
3. Dividends	6,000
Borrowing Constraint	
1. Commercial Bank	60,000
2. Total Outstanding	160,000
Credit Sales	
1. Percentage of Credit Sales to Total Sales	40

repayment in the last period (Table 4.2). Debt-assets structure of the basic cement product firm is shown in Appendix A, Table A-1.

4.2.2.4.3 Interest Payment on Long-Term Debt

Even though it was assumed that the firm would repay principal of outstanding long-term debt once a year in the last period, payment of interest on the outstanding debt was assumed payable every period at a rate of interest of 18 percent a year. The interest payment on long-term debt was set at 13,950 baht in each period (Table 4.2).

4.2.2.5 Borrowing Constraint

4.2.2.5.1 Commercial Bank

In any period the firm is allowed to borrow not greater than 25 percent of total debt outstanding at the bank (both long-term and short-term) at the beginning of the year. This amount was established at 60,000 baht (Table 4.2). The amount of total loan outstanding at the bank can be observed from Appendix A, Table A-1.

4.2.2.5.2 Input Suppliers

The firm following the conservative approach would seek credit first from input suppliers with a limit on this credit source not to exceed 20 percent of total raw material costs. This limit is equal to the percentage of credit purchases indirectly mentioned in section 3.3.3. Firms following the liberal approach would borrow none from input suppliers.

4.2.2.5.3 Total Short-Term Credit Outstanding

In any period, the total amount borrowed from commercial bank cannot exceed 50 percent of total current liabilities which is equal to 160,000 baht (Table 4.2).

4.2.2.6 Credit Sales Constraint

It is assumed that credit sales are 40 percent of total sales. This is the level which was observed in section 3.7.3.

4.2.3 The Objective Function

The firm is assumed to maximize net return to fixed assets, family labor and equity capital. The net return equals the difference between sales, both cash and credit and expenses such as raw material expenses, labor expenses, overhead cost expenses, interest expenses, and taxes.

The information on cash prices which would be used to calculate cash sales is shown in Table 4.3. The information on cash price is drawn from section 3.7.6 of Chapter 3 and profitability questionnaire. Since there was no information collected with respect to credit prices, it was assumed that credit prices are higher than cash prices at least to the opportunity cost of capital. In Thailand, if the firm puts money in savings account, the firm will receive 4.5 percent rate of interest. Rate of interest on time deposits is higher than rate of interest on saving deposit. The firm will get 8 percent and 12 percent rate of interest on time deposits under the condition that the firm has to keep money in the bank without withdrawing for six months and twelve months respectively. Given these rates of interest, it is assumed that credit prices are 10 percent higher than cash prices. Credit prices of products are shown in Table 4.3 too. In keeping with the results presented in Chapter 3, it is assumed that the firm keeps prices of products constant over the year.

It is assumed that the physical combination of raw materials is the same in every period for all products based on data obtained from the profitability questionnaire which was administered in September. Cost of

Table 4.3 Raw Material Costs per Unit Cash Price and Credit Price of the Basic Cement Product Firm

Product	Period	Raw Material Cost	Cash Price	Credit Price
Cement Block	1	1.32	2.42	2.48
	2	1.15	2.42	2.48
	3	1.27	2.42	2.48
	4	1.51	2.42	2.48
Wind Block	1	1.71	2.85	2.92
	2	1.55	2.85	2.92
	3	1.71	2.85	2.92
	4	1.88	2.85	2.92
Small Drainage Pipe	1	29.94	47.86	49.06
	2	27.84	47.86	49.06
	3	31.04	47.86	49.06
	4	33.87	47.86	49.06
Medium Drainage Pipe	1	80.71	132.50	135.81
	2	71.44	132.50	135.81
	3	79.93	132.50	135.81
	4	89.38	132.50	135.81
Small Well Pipe	1	31.90	51.07	52.35
	2	28.92	51.07	52.35
	3	31.47	51.07	52.35
	4	34.87	51.07	52.35
Large Well Pipe	1	76.49	130.00	133.25
	2	70.53	130.00	133.25
	3	76.67	130.00	133.25
	4	82.45	130.00	133.25
Small House Post	1	60.78	86.87	89.04
	2	57.25	86.87	89.04
	3	60.19	86.87	89.04
	4	64.32	86.87	89.04
Medium House Post	1	72.71	99.86	102.35
	2	68.60	99.86	102.35
	3	71.70	99.86	102.35
	4	76.83	99.86	102.35
Large House Post	1	68.24	114.57	117.43
	2	63.47	114.57	117.43
	3	67.75	114.57	117.43
	4	73.62	114.57	117.43

production per unit could vary seasonally, however, because the price of raw materials might vary from period to period (see section 3.5). The information on cost of raw materials for each product in each period is shown in Table 4.3.

4.2.4 Other Coefficients

This section provides the information on the coefficients (a_{ij}'s) which are not equal to plus one or minus one for production, selling and other activities. The coefficients which are equal to plus one or minus one can be observed directly from linear programming tableau (Figure 2.1).

4.2.4.1 Production Activities

Labor requirement and overhead cost per one unit of product produced are the a_{ij} coefficients of the production activities which are not equal to $\pm$ 1. The coefficients of labor requirement and overhead cost per one unit of each product in each period are shown in Table 4.4. The information on labor requirement and overhead cost are drawn directly from section 3.5.4 and 3.6.3 respectively.

4.2.4.2 Selling Activities

The firm is assumed to pay 2.2 percent tax on gross sales, for both cash sales and credit sales. The information on tax rate is drawn from Sangwanruang, et. al. (1978). The amount of tax the firm has to pay per one unit of each product in each period is shown in Table 4.4.

4.2.4.3 Cost of Hiring Labor Activities

The information on wage rate per man-day the firm has to pay to skilled and unskilled workers is shown in Table 4.5. This information is

Table 4.4 Labor Requirement, Overhead Cost and Tax Expenses per Unit of Product of the Basic Cement Product Firm

Product	Period	Labor Requirement		Over-head Cost	Tax Expenses	
		Skilled	Un-Skilled		Cash Sales	Credit Sales
Cement Block	1					
	2	.001*	.004*	.23*	.048*	.054*
	3					
	4					
Wind Block	1					
	2	.001*	.004*	.30*	.063	.064*
	3					
	4					
Small Drainage Pipe	1					
	2	.041*	.072*	4.99*	1.052*	1.080*
	3					
	4					
Medium Drainage Pipe	1					
	2	.092*	.114*	13.81*	2.950*	2.990*
	3					
	4					
Small Well Pipe	1					
	2	.036*	.064*	5.32*	1.123*	1.150*
	3					
	4					
Large Well Pipe	1					
	2	.045*	.074*	13.55*	2.860*	2.930*
	3					
	4					
Small House Post	1					
	2	.037*	.109*	9.05*	1.910*	1.950*
	3					
	4					
Medium House Post	1					
	2	.055*	.097*	10.40*	2.200*	2.250*
	3					
	4					
Large House Post	1					
	2	.060*	.130*	11.94*	2.520*	2.580*
	3					
	4					

*The same in each period

drawn from section 3.5.5 of Chapter 3. Wage rate in the first period is the average of wage rates in the second and fourth period.

4.2.4.4 Interest Payment and Interest Receive Activities

Rate of interest the firm has to pay to its lenders and rate of interest the firm receives from its savings account is shown in Table 4.5. Information on rate of interest paid to lender is drawn from section 3.3.4 and 3.8.2. Some information on rate of interest on deposits is described in section 4.2.3.

4.2.4.5 Pattern of Cash Flows Under the Liberal and the Conservative Approaches

It should be mentioned again that under the liberal approach the firm provides trade credit to customers, pays for raw materials in cash and borrows only from commercial bank , while under the conservative approach the firm does not provide any trade credit to customers (sales are 100 percent cash), receives trade credit from a raw material supplier as well as borrows from a commercial bank. When the firm operates under different situations, the pattern of cash inflows and cash outflows of the two situations differ. The pattern of cash inflows and cash outflows under both approaches are shown in Table 4.6.

4.3 The Result

This section presents some expectations and results from the analysis of the basic model firm under the conservative and the liberal approaches.

4.3.1 Some Expectations

1. The amount borrowed from the commercial bank under the liberal approach is greater than that for the conservative approach.

Table 4.5 Wage Rate per Man-Day and Interest Rate of the Basic Cement Product Firm

	Period			
	1	2	3	4
Wage Rate per Day				
Skilled	47	44	48	50
Unskilled	34	33	37	35
Interest				
Borrowing	.045	.045	.045	.045
Bank	.12	.12	.12	.12
Input Suppliers	.011	.011	.011	.011
Savings				

Table 4.6 Coefficients of Cash Flow Constraint of the Basic Cement Product Firm Under the Liberal and the Conservative Approaches

		Liberal			Conservative		
			Cash Inflow from Sales		Raw Material		
Product	Period	Raw Material	Cash	Credit	Cash	Credit	Cash Inflow from Sales
Cement Block	1	1.32	2.42*	-	1.06		2.42*
	2	1.15		2.48*	.92	.29	
	3	1.27			1.02	.26	
	4	1.51			1.21	.28	
Wind Block	1	1.71	2.85*	-	1.37		2.85*
	2	1.55		2.92*	1.55	.38	
	3	1.71			1.37	1.24	
	4	1.88			1.50	.38	
Small Drainage Pipe	1	29.84	47.86*	-	23.95		47.86*
	2	27.84		49.06*	22.27	6.71	
	3	31.04			24.83	6.24	
	4	33.87			27.10	6.95	
Medium Drainage Pipe	1	80.71	132.50*	-	64.57		132.50*
	2	71.44		135.81*	57.15	18.08	
	3	79.93			63.94	16.00	
	4	89.38			71.50	17.90	
Small Well Pipe	1	31.90	51.07*	-	25.52		51.07*
	2	28.92		52.35*	23.14	7.14	
	3	31.47			25.18	6.48	
	4	34.87			27.90	7.05	
Large Well Pipe	1	76.49	130.00*	-	61.19		130.00*
	2	70.53		133.25*	56.42	17.13	
	3	76.67			61.34	15.80	
	4	82.45			65.96	17.17	
Small House Post	1	60.78	86.87*	-	48.62		86.87*
	2	57.25		89.04*	45.80	13.61	
	3	60.19			48.15	12.82	
	4	64.32			51.46	13.48	
Medium House Post	1	72.71	99.86*	-	58.17		99.86*
	2	68.60		102.35*	54.88	16.29	
	3	71.70			57.36	15.37	
	4	76.83			61.46	16.06	
Large House Post	1	68.24	114.57*	-	54.59		114.57*
	2	63.47		117.43*	50.78	15.28	
	3	67.75			54.20	14.22	
	4	73.62			58.90	15.18	

*The same in each period

2. The level of available credit may be more of a constraint for the firm under the liberal approach than for the firm under the conservative approach. Consequently, in a period when credit from the commercial bank is a constraint, shadow price of borrowed capital of the firm under the liberal approach is greater than that of the firm under the conservative approach.

3. The second and third periods of both approaches are the periods when credit from commercial bank might be a binding constraint since sales are low in both periods and the firm has to keep production at high level to fulfill expected demand in the periods as well as to accumulate inventory to be sold in the fourth period.

4. Net return of the firm under the liberal approach is higher than net return of the firm under the conservative approach since expected demand and amount produced under the two approaches are the same, yet rate of interest on borrowed capital of the firm under the conservative approach is higher than that of the firm under the liberal approach.

4.3.2 LP Results for the Basic Model

Under the conservative approach, the firm requires trade credit from input suppliers in every period (Table 4.7).

In the first period since the firm sells every product in cash and receives trade credit from input suppliers, cash inflow from sales and beginning cash on hand is greater than cash outflow. The firm does not borrow from the commercial bank. Instead, the firm has a balance of about 71,000 baht for savings (Table 4.7). In the second period, even though the firm still utilizes trade credit from input suppliers, cash inflow from sales and interest income is less than cash expenses

Table 4.7 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Basic Cement Product Firm, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	248,409	158,200	232,801	215,560
Credit Sales				
Interest Income		782		
Beginning Cash	10,000			
Total	258,409	158,982	232,801	215,560
Cash Outflows				
RM[a]: Cash	120,657	152,953	97,660	31,808
Credit		33,784	42,827	27,345
Skilled Worker	5,583	7,778	4,925	1,393
Unskilled Worker	10,622	13,669	10,251	2,648
Subcontract Worker				
Overhead Cost	25,034	35,296	20,304	5,920
Tax	5,465	3,480	5,122	4,742
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,950	13,950	13,950	13,950
Repayment of LTD				32,000
Interest on STD[c]			1,657	302
Total	187,311	266,910	202,696	126,108
Balance				
Borrowing		36,830	6,725	
Repayment			36,830	6,725
Outstanding[d]	0	36,830	6,725	0
Savings Deposit	71,098			82,727
Savings Withdrawal		71,098		
Savings Outstanding	71,098	0		82,727
Shadow Price	0	0	0	0
Net Return				120,704
Accounts Payable				8,906

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 60,000 baht

including the repayment of trade credit from the earlier period. The firm withdraws all of the money saved in the first period and borrows around 37,000 baht from the commercial bank. In the third period, cash inflow from sales is greater than cash outflow including repayment of trade credit. The firm repays some of the outstanding debt at the commercial bank, but there is around 6,700 baht still outstanding at the end of the third period. In the fourth period, cash inflow from sales is much greater than cash expenses including the payment on long-term debt. The firm repays all outstanding debt at the commercial bank and has around 83,000 baht for savings. It should be noted that in this fourth period the firm still obtains around 9,000 baht of trade credit from input suppliers. At the end of the year, net return to fixed assets, family labor and equity capital is around 120,000 baht.

Under the liberal approach, the firm pays for all expenses in cash and provides some trade credit to customers. In the first period, cash inflow from sales and beginning cash on hand is less than cash expenses and the firm borrows nearly 53,000 baht from the commercial bank (Table 4.8). In the second period cash inflow from sales and collection of accounts receivable is less than cash expenses and the firm is unable to repay outstanding debt. Instead it borrows up to the maximum limit. In this second period the shadow price of capital indicates that if the firm wants additional borrowings the firm can pay up to 36 percent rate of interest. In the third period, cash expenses exactly equal cash inflow from sales and collection of accounts receivable. Outstanding debt at the commercial bank is still at the maximum level. The shadow price for borrowed capital is .08 baht. In other words, the firm can pay around 32 percent rate of interest for an additional 1 baht of borrowing. In the

Table 4.8 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Basic Cement Product Firm, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	150,257	95,737	140,774	130,403
Credit Sales		100,171	63,824	93,850
Interest Income				
Beginning Cash	10,000			
Total	160,257	195,908	204,598	224,253
Cash Outflows				
RM[a]: Cash	146,458	136,380	135,962	88,420
Credit				
Skilled Worker	5,583	5,976	5,285	3,064
Unskilled Worker	10,622	9,799	12,093	4,948
Subcontract Worker				
Overhead Cost	25,034	25,011	23,445	13,064
Tax	5,509	3,510	5,162	4,781
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,950	13,950	13,950	13,950
Repayment of LTD				32,000
Interest on STD[c]		2,380	2,700	2,700
Total	213,156	203,009	204,598	168,927
Balance				
Borrowing	52,899	7,101	60,000	4,674
Repayment			60,000	60,000
Outstanding[d]	52,899	60,000	60,000	4,674
Savings Deposit				
Savings Withdrawal				
Savings Outstanding				
Shadow Price	0	.09	.08	0
Net Return				124,734
Accounts Receivable				86,935

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 60,000 baht

fourth period, cash inflow from sales and collection of accounts receivable is greater than cash expenses, and the firm is able to repay some of the outstanding debt. At the end of the fourth period around 4,700 baht is outstanding at the commercial bank, and the firm has around 87,000 baht outstanding as accounts receivable too. Net return to fixed assets, family labor and equity capital is around 125,000 baht.

Results from the analysis of the two approaches with the basic model indicate that all expectations were confirmed. These basic LP results will be used to compare with the results of its extensions in the following chapter.

CHAPTER 5

THE EXTENDED MODEL

The features of the basic model of the cement product firm and the results of the linear programming results were presented in Chapter 4. This chapter will explore what would happen to: (1) the net return to family labor, to fixed assets, and to equity capital; (2) the demand for short-term credit; (3) the timing of the demand for credit; and (4) the shadow price of borrowed capital, if the following changes occur: (1) the firm produces more products; (2) the demand for products included in the basic model increases by 10 percent; and (3) the demand for products in the extended model increases by 10 percent.

The discussion starts with the extensions and needed modifications to the basic model followed by a comparison of the above situations in terms of expectations and results.

5.1 Extensions to the Basic Model

Given certain marketing characteristics of the firm, the demand for short-term credit of the firm might vary when the firm adopts new technology to produce some of its products or when size of the firm expands.

The adoption of new technology might be in the form of new machines which use less labor and/or reduce raw material costs. It can be expected that when a new technology is adopted, the demand for short-term credit will decrease and its net return will increase. In other words,

demand for credit when the firm uses old, or less advanced technology is higher than for demand for credit when the firm adopts new technology. The data base for analyzing the advanced technology are rather sketchy. Therefore, for this study firm expansion analysis is restricted to increasing number of products, increasing demand and increasing the labor force for a given plant capacity for the typical small scale firm.

Expansion of the firm can occur with: (1) an increase in the level of production as the demand for products increases; (2) an increase in the number of products produced/sold; and (3) a combination of both (1) and (2). Since each expansion option affects the demand for credit of the firm, all three options will be analyzed as reasonable extensions of the basic model. Each will differentiate between the conservative approach and liberal approach as defined earlier. Situation 1 is the basic model with a 10 percent increase in demand across the board (Figure 5.1). Situation 2 is an addition in the product line from the basic model with no change in demand. The additional products include large drainage pipe, roof tile, toilet head, table set and spirit house.

Situation 3 is the basic model expanded to include a 10 percent increase in demand plus the additional products proposed for Situation 2.

5.2 Modifications in the Basic Model

5.2.1 Constraints

5.2.1.1 Demand Constraints

For Situation 1, the level of demand for all products in the basic model are increased by 10 percent. The revised RHS values for these products are shown in Table 5.1.

Experiment	Basic Model		Situation 1		Situation 2		Situation 3	
Approach	C	L	C	L	C	L	C	L
Demand	0	0	+10%	+10%	0	0	+10%	+10%
Products	A	A	A	A	B	B	B	B

C = Conservative

L = Liberal

A = The products included in the basic model (see Chapter 4).

B = The products included in the basic model plus roof tile, toilet head, table set, and spirit house.

Figure 5.1

Cement Product Firm Situations for Analysis

Table 5.1 Demand Increased 10 Percent for Basic Model Products[1]

Product	Period			
	1	2	3	4
Cement Block	44,550	14,850	52,140	22,110
Wind Block	2,145	1,155	5,940	8,580
Small Drainage Pipe	142	284	170	284
Medium Drainage Pipe	152	304	183	304
Small Well Pipe	421	173	153	210
Large Well Pipe	305	124	108	153
Small House Post	372	291	307	388
Medium House Post	334	262	276	349
Large House Post	53	42	44	55

[1]These demand constraints apply to Situation 1 and 3 for these products.

The initial expected demand for the five products added to the basic model are shown in Table 5.2. These are the constraints imposed for Situation 2. When demand is increased by 10 percent for these products, we have the constraints for Situation 3 (Table 5.3).

5.2.1.2 Inventory and Machinery Constraints

For the products added to the product line of the basic model, RHS values for the inventory constraint and the machinery capacity constraint were developed from survey data and are presented in Table 5.2. These constraints apply to both Situation 2 and Situation 3.

5.2.1.3 Other Constraints

No further modifications on the RHS of the basic model are required.

5.2.2 The Objective Function

Extension of the basic model to include additional products requires c_j values for raw material cost and selling price (both cash and credit sales) by period for each product respectively. These are shown in Table 5.4

5.2.3 Activities

5.2.3.1 Production Activities

Extension of the basic model to include additional products requires a_{ij} coefficients for labor requirements and overhead cost per unit of output by period for each product respectively. These are presented in Table 5.5. These coefficients apply to Situations 2 and 3.

Table 5.2 Inventory, Expected Demand and Machinery Constraints of the Products Added to the Basic Cement Product Model[1]

Product	Period	Inventory	Expected Demand	Machinery
Large Drainage Pipe	1	350	33	1,260
	2	350	66	1,260
	3	350	39	1,260
	4	350	66	1,260
Roof Tile	1	6,500	26,000	39,000
	2	6,500	5,000	39,000
	3	6,500	12,400	39,000
	4	6,500	10,500	39,000
Toilet Head	1	44	90	156
	2	44	15	156
	3	44	30	156
	4	44	18	156
Table Set	1	5	13	156
	2	5	11	156
	3	5	11	156
	4	5	11	156
Spirit House	1	44	16	156
	2	44	3	156
	3	44	33	156
	4	44	14	156

[1]Expected demand represents the initial demand for these products and are the demand constraints for Situation 2. The inventory and machinery capacity constraints apply to both Situations 2 and 3.

Table 5.3 Relaxed Demand Constraints for Products Added to the Basic Model (Situation 3)[1]

Product	Period			
	1	2	3	4
Large Drainage Pipe	36	72	42	72
Roof Tile	28,600	5,500	13,640	11,550
Toilet Head	99	16	33	20
Table Set	14	12	12	12
Spirit House	18	3	36	15

[1] 10 percent higher than the demand constraints shown in Table 5.2.

Table 5.4 Raw Material Cost per Unit, Cash Prices and Credit Prices of the Products Added to the Basic Cement Product Model

Product	Period	Raw Material Cost	Cash Price	Credit Price
Large Drainage Pipe	1	235.04	300.00	307.50
	2	213.66	300.00	307.50
	3	230.20	300.00	307.50
	4	256.43	300.00	307.50
Roof Tile	1	.34	.75	.77
	2	.29	.75	.77
	3	.34	.75	.77
	4	.39	.75	.77
Toilet Head	1	19.85	30.00	30.75
	2	17.19	30.00	30.75
	3	19.30	30.00	30.75
	4	22.53	30.00	30.75
Table Set	1	274.75	600.00	615.00
	2	267.00	600.00	615.00
	3	274.75	600.00	615.00
	4	282.59	600.00	615.00
Spirit House	1	296.45	900.00	922.50
	2	276.69	900.00	922.50
	3	287.43	900.00	922.50
	4	316.22	900.00	922.50

Table 5.5 Labor Requirement, Overhead Cost and Tax Expenses per Unit for the Products Added to the Basic Cement Product Model

Product	Period	Labor Requirement		Overhead Cost	Tax Expenses	
		Skilled	Unskilled		Cash Sales	Credit Sales
Large Drainage Pipe	1	.052	.188	31.26	6.60	6.76
	2	.052	.188	31.26	6.60	6.76
	3	.052	.188	31.26	6.60	6.76
	4	.052	.188	31.26	6.60	6.76
Roof Tile	1	.002	0	.08	.02	.02
	2	.002	0	.08	.02	.02
	3	.002	0	.08	.02	.02
	4	.002	0	.08	.02	.02
Toilet Head	1	.049	.115	3.13	.66	.67
	2	.049	.115	3.13	.66	.67
	3	.049	.115	3.13	.66	.67
	4	.049	.115	3.13	.66	.67
Table Set	1	.630	1.620	62.52	13.20	13.53
	2	.630	1.620	62.52	13.20	13.53
	3	.630	1.620	62.52	13.20	13.53
	4	.630	1.620	62.52	13.20	13.53
Spirit House	1	.606	1.349	94.05	19.80	20.29
	2	.606	1.349	94.05	19.80	20.29
	3	.606	1.349	94.05	19.80	20.29
	4	.606	1.349	94.05	19.80	20.29

5.2.3.2 Selling Activities

The payment of tax by the firm is a function of the level of sales. The amount of tax paid per unit of product sold in each period for each of the products is added to the basic model product line as shown in Table 5.5

5.2.3.3 Cash Balance (Row) Activity

This activity manages the cash flow equation for each period. All elements in the equation carry either +1 or -1 a_{ij} coefficient (depending on whether the column activity subtracts from or adds to the cash balance) except for the raw materials purchasing activity which reduce the period cash balance and the selling activities which increase the period cash balance.

The amount that the cash balance is effected by raw material purchases depends on whether the firm follows the liberal or the conservative approach. For the liberal approach, raw materials are purchased without borrowing from the input supplier. Consequently, the a_{ij} coefficients are identical to the c_j coefficients for this activity. (Compare Table 5.4 with Table 5.6). For the conservative approach, the a_{ij}'s for raw material cash purchase activity are 20 percent less than the corresponding values for the liberal approach, indicating the proportion of purchases made with credit provided by the input supplier (Table 5.6). However, this proportion carries with it a penalty for a credit purchase resulting in a higher cost per unit of raw material for the conservative approach than for the liberal approach. The credit component of raw material purchases enters the cash flow equation in a period later than cash purchases.

Table 5.6 Cash Flow Constraints for Products Added to the Basic Model for both the Liberal and the Conservative Approaches

Unit:Baht

Product	Period	Liberal			Conservative		
			Cash Inflow From		Raw Material		Cash
		Raw Material	Cash Sales	Credit Sales	Cash Purchases	Credit Purchases	Inflow From Sales
Large Drainage Pipe	1	235.04	300.00		188.03		300.00
	2	213.66	300.00	307.50	170.93	52.65	300.00
	3	230.20	300.00	307.50	184.16	47.86	300.00
	4	256.43	300.00	307.50	205.14	56.16	300.00
Roof Tile	1	.34	.75		.27		.75
	2	.29	.75	.77	.23	.08	.75
	3	.34	.75	.77	.27	.06	.75
	4	.39	.75	.77	.31	.07	.75
Toilet Head	1	19.85	30.00		15.88		30.00
	2	17.19	30.00	30.75	13.75	4.45	30.00
	3	19.30	30.00	30.75	15.44	3.85	30.00
	4	22.53	30.00	30.75	18.02	4.32	30.00
Table Set	1	274.75	600.00		219.80		600.00
	2	267.00	600.00	615.00	213.60	61.54	600.00
	3	274.75	600.00	615.00	219.80	59.81	600.00
	4	282.59	600.00	615.00	226.07	61.64	600.00
Spirit House	1	296.45	900.00		237.16		900.00
	2	276.69	900.00	922.50	221.35	66.40	900.00
	3	287.43	900.00	922.50	229.94	61.98	900.00
	4	316.22	900.00	922.50	252.98	64.38	900.00

The cash balance by period is also effected by the selling strategy of the firm. The conservative approach has all sales made in cash, while the liberal approach sells with both cash and credit. The a_{ij}'s for the cash sales component for the liberal approach are the same as those for all sales made under the conservative approach for all products and periods respectively. The a_{ij}'s for the credit component of the sales under the liberal approach are 2 1/2 percent higher than the cash component and are advanced one period.

5.3 Some Expectations

5.3.1 Net Return

Assuming that the net return should increase with firm expansion, we should expect Situation 3 to generate the greatest increase in net return compared with the basic model because it contains expansion from an increased product line and from an increased demand. However, it is difficult to say in advance whether an increased demand for a given product line (Situation 1) or an increase in product line with given demand (Situation 2) would yield the highest net return.

These generalizations apply for both the conservative and liberal approaches.

5.3.2 Timing of Credit Needs

Because the basic model contains all of the main products with a high level of year-round production, there is no reason to expect the timing of credit needs to be altered with an increase in demand, an increased product line or a combination of both.

This conclusion should hold for both the conservative and the liberal approaches.

5.3.3 Amount of Credit Needs

5.3.3.1 Conservative Approach

Raw materials are purchased on credit and products are sold entirely for cash. The basic model credit needs were directed largely toward inventory accumulation (in periods 2 and 3). Inventory levels are constrained by period and by product. An increase in demand for a given product line (Situation 1) would estimate sales from current production resulting in a higher cash inflow level and a reduction in credit needs.

For the situation where the firm expands its product line with no change in demand (Situation 2) one might expect minimum inventory accumulation for the additional products. If this is the case, cash inflows would be increased and the firm's dependence on credit would be decreased accordingly. Therefore, comparing this situation with the basic model, credit needs are expected to be less.

If credit needs are expected to decrease for Situation 1 and Situation 2 taken separately, it is reasonable to expect that credit needs would decrease for Situation 3 where their respective conditions are combined.

5.3.3.2 Liberal Approach

When production is increased from increased demand for a given product line (Situation 1) it is expected that the need for credit would increase in period 1 because the credit needs per unit of product do not change. Therefore, when the quantity produced increases, the amount of credit needed should increase. However, in the case where the firm expands its product line for a given demand level (Situation 2) it is difficult to say whether the amount of needed credit would increase or

decrease in period 1 since the firm under the liberal approach provides a lot of trade credit. Therefore, it is difficult to say whether the amount of credit needs in period 1 would increase or decrease when both demand and production line increase (Situation 3).

In periods 2, 3 and 4 it is expected that the amount of credit needs of the firm in Situation 1, 2 and 3 would be less than that of the basic firm based on the same reasoning given for the conservative approach.

5.3.4 Savings

5.3.4.1 Conservative Approach

When the firm expands either by an increased production of the existing product line by increasing demand, or by adding more product lines or both, it is expected that savings would increase.

5.3.4.2 Liberal Approach

It is expected that the firm in Situations 1, 2 or 3 may have some savings in period 4.

5.4 LP Results for Alternative Situations

5.4.1 Results for Situation 1

5.4.1.1 Conservative Approach

The firm under the conservative approach asks for trade credit from input suppliers and sells every product in cash. In the first period, cash inflows from sales exceed cash expenses and the firm deposits about 80,000 baht in savings (Table 5.7).

In the second period, sales decrease while the firm increases production to take the advantage of low wages and raw material costs resulting in inventory accumulations, cash inflow becomes less than cash

Table 5.7 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Cememt Product Firm, Situation 1, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	273,305	175,411	256,140	237,190
Credit Sales				
Interest Income		871		55
Beginning Cash	10,000			
Total	283,305	176,282	256,140	237,245
Cash Outflows				
RM[a]: Cash	132,746	161,220	112,043	39,065
Credit		37,169	45,141	31,372
Skilled Worker	6,143	8,182	5,641	1,739
Unskilled Worker	11,685	14,302	11,752	3,240
Subcontract Worker				
Overhead Cost	27,543	37,194	23,381	7,256
Tax	6,013	3,859	5,635	5,218
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,950	13,950	13,950	13,950
Repayment of LTD				32,000
Interest on STD[c]			1,186	
Total	204,080	281,874	224,731	139,840
Balance				
Borrowing	0	26,367		0
Repayment			26,367	
Outstanding[d]	0	26,367	0	0
Savings Deposit	79,225		5,042	102,447
Savings Withdrawal		79,225		5,042
Savings Outstanding	79,225	0	5,042	102,447
Shadow Price	0	0	0	0
Net Return				138,590
Accounts Payable				10,938

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 60,000 baht

expenses, all money in savings is withdrawn, and borrowed money from the commercial bank amounts to 26,000 baht.

In the third period, sales increase to a higher level and the production level decreases to a lower level than that in the second period. This results in more cash inflow than cash expenses. The firm repays all of its debt outstanding at a commercial bank, and has some cash left to deposit in a savings account.

In the fourth period, sales remain high while production drops to the lowest level. This results in more cash inflow than cash expenses with additional deposits made to savings. At the end of the fourth period, the firm has approximately 102,500 baht in the savings account.

At the end of the year, the firm under the conservative approach has approximately 138,000 baht as net return to fixed assets, family labor and equity capital. This firm owes a little less than 11,000 baht to input suppliers.

5.4.1.2 Liberal Approach

The firm using the liberal approach pays for all expenses in cash while providing some trade credit to customers. For this case, the LP results show that cash expenses exceed cash receipts from sales and the firm borrows about 57,000 baht from a commercial bank (Table 5.8). Because the firm accumulates inventory with a reduction in sales, cash inflows from sales and collection of accounts receivable are less than cash in the 2nd period. It must then increase borrowing from the commercial bank up to the maximum limit. Since wages and raw material costs are lower in the third period than in the fourth period, the firm will accumulate as much inventory as possible. Therefore, cash inflow from sales

Table 5.8 Quarterly Cash Flow Statement, Shadow Prices of Borrowed Capital, Accounts Receivable and Net Return: Cement Product Firm, Situation 1, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	165,316	105,340	154,887	143,488
Credit Sales		110,211	70,226	103,258
Interest Income				
Beginning Cash	10,000			
Total	175,316	215,551	225,113	246,746
Cash Outflows				
RM[a]: Cash	161,132	147,658	151,527	98,139
Credit				
Skilled Worker	6,143	6,386	5,981	3,417
Unskilled Worker	11,685	10,847	13,171	5,501
Subcontract Worker				
Overhead Cost	27,543	27,076	26,105	14,510
Tax	6,061	3,862	5,679	5,261
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,950	13,950	13,950	13,950
Repayment of LTD				32,000
Interest on STD[c]		2,574	2,700	2,700
Total	232,514	218,353	225,113	181,518
Balance				
Borrowing	57,198	2,802	60,000	
Repayment			60,000	60,000
Outstanding[d]	57,198	60,000	60,000	0
Savings Deposit				5,228
Savings Withdrawal				
Savings Outstanding				5,228
Shadow Price	0	.10	.08	0
Net Return				143,006
Accounts Receivable				95,659

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 60,000 baht

and collection of accounts receivable is all used up as cash expenses and the debt outstanding at commercial banks still remains at the maximum limit. Shadow prices of borrowed capital in the second and third periods indicate that additional borrowed money at the margin would return around 40 percent and 32 percent in the second and third periods respectively. In the fourth period, when production drops to the lowest level, cash inflows from sales and collection of accounts receivable are enough to pay for all cash expenses, repay outstanding debts at the commercial bank, and yield an excess of around 5,000 baht for deposit in the savings account. The net return to fixed assets, family labor and equity capital of the firm under the liberal approach is nearly 143,000 baht. This firm has 95,659 baht outstanding as accounts receivable.

5.4.2 Results for Situation 2

5.4.2.1 Conservative Approach

The firm under the conservative approach asks for trade credit from input suppliers and sells every product in cash. Cash inflows exceed cash outflows in period 1 and the firm deposits nearly 92,000 baht in the savings account (Table 5.9). In the second period when sales drop and the firm tries to fulfill expected demand as well as accumulate inventory, cash inflows from sales are not enough to meet cash expenses including repayment of outstanding trade credit from the first period. The firm must withdraw all the money from savings and borrow a little more than 28,000 baht from a commercial bank. In the third period, sales again increase to a higher level. Cash inflow exceeds cash outflow and the firm repays the commercial bank loan with a surplus of around 14,000 baht for savings. Some of the products sold in the

Table 5.9 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Cement Product Firm, Situation 2, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	302,118	191,387	290,719	262,736
Credit Sales				
Interest Income		1,009		153
Beginning Cash	10,000			
Total	312,118	192,396	290,719	262,889
Cash Outflows				
RM[a]: Cash	141,549	182,768	120,104	35,976
Credit		39,634	51,175	33,629
Skilled Worker	8,796	9,124	8,088	2,027
Unskilled Worker	12,657	15,323	13,871	3,165
Subcontract Worker				
Overhead Cost	30,745	41,266	27,850	6,944
Tax	6,647	4,210	6,396	5,780
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,950	13,950	13,950	13,950
Repayment of LTD				32,000
Interest on STD[c]			1,265	
Total	220,344	312,275	248,699	139,471
Balance				
Borrowing	0	28,105		0
Repayment			28,105	
Outstanding[d]	0	28,105	0	0
Savings Deposit	91,774		13,915	137,333
Savings Withdrawal		91,774		13,915
Savings Outstanding	91,774	0	13,915	137,333
Shadow Price	0	0	0	0
Net Return				174,080
Accounts Payable				10,073

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 60,000 baht

fourth period were produced in the second and third periods making it possible for cash inflows to exceed cash outflow by as much as 137,000 baht. Net return to fixed assets, family labor and equity capital of the firm under the conservative approach are around 174,000 baht at the end of the year, with around 10,000 baht owed to input suppliers.

5.4.2.2 Liberal Approach

The firm under the liberal approach pays for all expenses in cash and provides some trade credit to customers. Cash inflow is less than cash expenses in the first period and the firm borrows about 57,000 baht from the commercial bank (Table 5.10). In the second and third periods, with product inventory accumulating, sales and collection of accounts receivable are still less than cash expenses. The firm borrows from the commercial bank up to the maximum limit of 60,000 baht. Shadow prices indicate a marginal return to borrowed money of 36 percent and 32 percent in the second and third periods respectively. It should be noted that the shadow price does not tell how much should be borrowed nor what returns would be obtained with large additions. In the fourth period, sales and collection of accounts receivable are much greater than cash expenses. The firm can repay all outstanding debts at the commercial bank and still have about 33,000 baht left for savings. At the end of the year, the firm under the liberal approach has about 106,000 baht outstanding as accounts receivable.

Net return to fixed assets, family labor and equity capital of the firm under the liberal approach is 180,000 baht in round numbers.

Table 5.10 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Cement Product Firm, Situation 2, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	182,112	116,017	176,307	159,034
Credit Sales		121,408	77,345	117,538
Interest Income				
Beginning Cash	10,000			
Total	192,112	237,425	253,652	276,572
Cash Outflows				
RM[a]: Cash	171,096	164,049	171,713	97,789
Credit				
Skilled Worker	8,768	7,665	7,691	4,054
Unskilled Worker	12,305	11,707	14,547	6,231
Subcontract Worker				
Overhead Cost	30,463	30,081	30,587	15,336
Tax	6,677	4,254	6,464	5,831
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,950	13,950	13,950	13,950
Repayment of LTD				32,000
Interest on STD[c]		2,572	2,700	2,700
Total	249,259	240,278	253,652	183,891
Balance				
Borrowing	57,147	60,000	60,000	
Repayment		57,147	60,000	60,000
Outstanding[d]	57,147	60,000	60,000	0
Savings Deposit				32,681
Savings Withdrawal				
Savings Outstanding				32,681
Shadow Price	0	.09	.08	0
Net Return				180,225
Accounts Receivable				106,022

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 60,000 baht

5.4.3 Results for Situation 3

5.4.3.1 Conservative Approach

In the first period, cash inflow from sales under the conservative approach is greater than cash outflow by about 102,000 baht (Table 5.11). In the second period cash expense exceeds cash inflow because of inventory accumulation and reduced sales causing the firm to withdraw all money from savings and borrow around 17,000 baht. In the third period, when inventory and production are both high and when sales increase to a higher level, cash inflow is greater than cash expenses. The surplus is sufficient to repay the loan obtained in period 2 and to have around 29,000 baht left for savings. In the fourth period, when sales are still high and production is at the lowest level, cash inflow from sales is 133,000 baht greater than cash expenses providing a savings balance at the end of the fourth period of around 162,000 baht.

At the end of the year, net return to fixed assets, family labor and equity capital of the firm under the conservative approach is 196,391 baht.

The firm owes roughly 12,600 baht to input suppliers at the end of the year.

5.4.3.2 Liberal Approach

In the first period, the value of sales of the firm under the liberal approach is less than cash expenses requiring a bank loan up to the maximum limit. Yet this borrowing is insufficient for the firm to produce enough of every product to satisfy the demand. Production is curtailed for some products. A shadow price of 100 percent for borrowed capital in this period indicates the severity of this constraint (Table 5.12).

Table 5.11 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Cement Product Firm, Situation 3, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	332,371	210,545	319,850	289,056
Credit Sales				
Interest Income		1,122		321
Beginning Cash	10,000			
Total	342,371	211,667	319,850	289,377
Cash Outflows				
RM[a]: Cash	155,523	193,283	135,638	45,146
Credit		43,546	54,119	37,978
Skilled Worker	9,874	9,587	9,056	2,577
Unskilled Worker	13,923	16,097	15,681	3,875
Subcontract Worker				
Overhead Cost	33,824	43,553	31,429	8,697
Tax	7,312	4,632	7,037	6,359
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,950	13,950	13,950	13,950
Repayment of LTD				32,000
Interest on STD[c]				
Total	240,406	330,648	273,676	156,582
Balance				
Borrowing	0	17,016		0
Repayment			17,016	
Outstanding[d]	0	17,016	0	0
Savings Deposit	101,965		29,158	132,795
Savings Withdrawal		101,965	-	-
Savings Outstanding	101,965	0	29,158	161,953
Shadow Price	0	0	0	0
Net Return				196,391
Accounts Payable				12,640

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 60,000 baht

Table 5.12 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Cement Product Firm,Situation 3, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	196,778	127,631	193,973	174,873
Credit Sales		131,186	85,087	129,316
Interest Income				
Beginning Cash	10,000			
Total	206,778	258,817	279,060	304,189
Cash Outflows				
RM[a]: Cash	183,705	177,881	190,663	108,657
Credit				
Skilled Worker	9,598	8,241	8,568	4,567
Unskilled Worker	13,411	12,769	16,115	6,861
Subcontract Worker				
Overhead Cost	32,899	32,596	33,952	17,053
Tax	7,215	4,680	7,112	6,412
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,950	13,950	13,950	13,950
Repayment of LTD				32,000
Interest on STD[c]		2,700	2,700	2,700
Total	266,778	258,817	279,060	198,200
Balance				
Borrowing	60,000	60,000	60,000	
Repayment		60,000	60,000	60,000
Outstanding[d]	60,000	60,000	60,000	
Savings Deposit				45,989
Savings Withdrawal				
Savings Outstanding				45,989
Shadow Price	.25	.09	.08	0
Net Return				203,647
Accounts Receivable				116,582

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 60,000 baht

In the second period, sales are lower than that of the first period, while the firm accumulates products in inventory. Therefore, debts outstanding at the commercial bank remain at the maximum limit and the firm accumulates inventory as much as capital permits. In the third period, sales increase to a higher level, but since products are still being accumulated in inventory, debts outstanding at the commercial bank stay at the maximum limit. Shadow prices indicate that the firm can afford to pay 36 percent and 32 percent rates of interest for additional borrowed money at the margin in the second and third periods respectively. Since sales are still at a high level and production drops to the lowest level in the fourth period, cash inflow from sales and collection of accounts receivable are greater than cash expenses. The firm can repay all the outstanding debts at a commercial bank and have nearly 46,000 baht for savings. The net return to fixed assets, family labor and equity capital for the firm under the liberal approach is approximately 203,000 baht. End of year accounts receivable were computed at 116,582 baht for this situation.

5.5 Comparison of the Basic Model with Expanded Firm Models

5.5.1 Comparison of the Basic Model with Expanded Demand Model (Situation 1)

This comparison will show what would happen to borrowing, saving, lending, and net return if the firm keeps the same product line, but with the condition that demand for the product lines increases 10 percent across the board.

From the comparison, it can be seen that the firm in Situation 1 has more savings in the first period, and therefore less borrowing in the second period (Table 5.13). In the third period, the firm in Situation

Table 5.13 Saving, Lending and Net Return for the Cement Product Firm: The Basic Model Compared with Increased Demand and Product Line Situations

	Period	Basic Model C	Basic Model L	Situation 1 C	Situation 1 L	Situation 2 C	Situation 2 L	Situation 3 C	Situation 3 L
1. Borrowing									
1.1 Commercial Bank Borrowing[a]	1	-	52,899	-	57,198	-	57,147	-	60,000
	2	36,830	60,000	26,367	60,000	28,105	60,000	17,015	60,000
	3	6,725	60,000	-	60,000	-	60,000	-	60,000
	4	-	4,674	-	-	-	-	-	-
Shadow Price[b]	1	-	-	-	-	-	-	-	.25
	2	-	.09	-	.10	-	.09	-	.09
	3	-	.08	-	.08	-	.08	-	.08
	4	-	-	-	-	-	-	-	-
1.2 Input Supplier Borrowing	1	30,164	-	33,186	-	35,387	-	38,880	-
	2	38,238	-	40,305	-	45,692	-	48,320	-
	3	24,415	-	28,010	-	30,026	-	33,909	-
	4	7,952	-	9,766	-	8,994	-	11,286	-
2. Savings	1	71,098	-	79,925	-	91,774	-	101,965	-
	2	-	-	-	-	-	-	-	-
	3	-	-	5,041	-	13,915	-	29,158	-
	4	82,726	-	102,447	5,228	137,323	32,681	161,952	45,989
3. Accounts Receivable	4	-	82,588	-	95,659	-	106,022	-	116,582
4. Net Return	4	120,704	124,735	138,590	143,006	174,080	180,225	196,391	203,647

C = Conservative; L = Liberal

[a]Maximum borrowing limit = 60,000 baht.

[b]When maximum borrowing limit was doubled, period 2 is the only period when borrowed capital was a constraint, and the shadow price was reduced about a half.

1 can repay all debts outstanding from the earlier period and still have savings. This is not possible for the basic model firm. In the fourth period, the firm in Situation 1 has higher net return and higher savings, accompanied with higher debt outstanding to input suppliers, than is the case for the basic model firm.

Under the liberal approach when demand increases, the firm needs to increase production in the first period and therefore has to borrow more money from a commercial bank. In the second and third periods, both the basic model firm and the firm in Situation 1 borrows from a commercial bank up to the maximum limit. However, the shadow price in the second period indicates that capital constraint is more serious for the expanded firm than for the basic model firm. In period four, the firm in Situation 1 can repay all debts outstanding at the commercial bank and have cash remaining in savings while the basic model firm cannot repay all of its outstanding debts. Since expected demand in Situation 1 is higher than that in the basic model, net return and outstanding accounts receivable of the firm in Situation 1 are higher than those of the basic model.

5.5.2 Comparison of the Basic Model with Firm Expanded Through Increased Product Line (Situation 2)

Under the conservative approach it can be observed that when the firm expands its product line, savings in the first period are higher than in the basic model (Table 5.13). Therefore borrowing in the second period is less. Furthermore, in the third period, instead of borrowing some cash from a commercial bank, the firm has some cash for savings. In the fourth period, for Situation 2 there are more savings and higher net return than the basic model, yet it owes more to input suppliers.

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Under the liberal approach, it can be observed that when the firm expands its product line, it needs to borrow more in the first period. In the second and third periods, both the basic model firm and the firms under Situation 2 borrow from the commercial bank up to the maximum limit, and their shadow prices are identical. In period 4, with more products to sell by the firm than by the basic model firm, the former can repay all debts outstanding at the commercial bank and have some cash for savings, while the basic model firm does not have enough cash to repay all debts outstanding. The firm in Situation 3 has a higher net return and a higher outstanding accounts receivable than the basic model firm.

5.5.3 Comparison of Basic Model with Firm Expanded Through Both Increased Demand and Increased Product Line (Situation 3)

This comparison shows what would happen to borrowing, saving, lending and net return if the firm expands its product lines and at the same time expected demands for its products increases.

It was observed that when the firm under the conservative approach expands either by adding more product lines or by increasing demand, there is more saving in the first period, less borrowing in the second period, some saving in the third period, more saving in the fourth period and higher net return. Therefore, it can be expected that the above borrowing and saving pattern are magnified when both demand and product line are increased together. In other words, there is a higher level of savings in the first, third and fourth periods, less borrowing in the second period, and a higher level of net return in the fourth period.

The firm in Situation 3 under the liberal approach borrows from commercial banks in the first period up to the maximum limit, while the basic model firm borrows around 88 percent of the maximum limit. However,

the shadow prices of borrowed capital in the second and third periods indicate that the problem of capital constraint is the same for the firm under Situation 3 as in the basic model firm. In the fourth period, the Situation 3 firm has some savings, while the basic model firm has none. It can be seen that both net return and outstanding accounts receivable of the firm in Situation 3 are higher than those of the basic model firm.

5.6 Constraints Facing the Cement Product Firms

Under the conservative approach, LP results indicate that demand is a constraint in every period. Inventory is a constraint in periods 2 and/or 3. Machine capacity is not fully utilized in any period; nor is credit from the commercial banks.

Under the liberal approach, LP results indicate that demand is a constraint in every period. The firms keep some product in inventory, yet inventory is rarely a constraint. Periods 2 and/or 3 are the most likely periods when inventory may become a constraint. Machine capacity is not fully utilized in any period except the machine to produce blocks which becomes a constraint in period 3 under the situation where demand for basic product increases by 10 percent (Situation 1). Credit from commercial banks is a constraint in periods 2 and 3. However when both product mix and demand increase together credit becomes a constraint in period 1 also.

5.7 Summary of Findings

5.7.1 Level of Credit

The analysis above indicates that a 60,000 baht ceiling for bank credit is enough for any firm under the conservative approach.

If the firm operates under the liberal approach, however, a higher credit limit would be advantageous. The above analysis however, does not indicate what that upper limit should be. It becomes apparent that if sufficient credit cannot be obtained from the commercial bank the firm should seek financing from other sources.

5.7.2 Seasonal Credit Needs

Under the conservative approach, the second period is when the firm needs the most credit. Some is needed in the third period, but none is needed in the first or the fourth periods.

Under the liberal approach, credit is needed in the first three periods, but is not needed in the fourth period. The need for credit is (most) pronounced in the second and third periods.

5.7.3 Rate of Interest

It should be reminded that capital is not a constraint under the conservative approach, assuming that the firm pays 18 percent and 48 percent rate of interest respectively, to input suppliers.

Under the liberal approach, capital is a constraint in that money is borrowed up to the assumed maximum for all firm situations analyzed resulting in a shadow price for borrowed money as high as 36 percent and 32 percent in the second and third periods respectively. For the case when the firm expands the product lines accompanied by an increased demand for all products, the shadow price rose to 100 percent in the first period for the credit limits assumed.

CHAPTER 6

CHARACTERISTICS OF THE READY-MADE GARMENT INDUSTRY

6.1 Introduction

The main purpose of this chapter is to describe the ready-made garment industry with special attention to those aspects needed to construct the linear programming model which will be used for further analysis. The description of the industry corresponds to that undertaken for the cement product industry and includes a classification of ready-made garment firms, a description of products produced, raw material used, use of labor, production, sales and other financial characteristics of the firms in the sample survey.

6.2 Classification and Distribution of Ready-Made Garment Firms

Altogether there are 17 ready-made garment sample firms used in this study. When these firms are classified according to marketing characteristics, there are 8 exporting ready-made garment firms, 5 firms selling most of their products directly to final consumers (retail sales) and 4 firms selling the majority of their products through wholesalers and retailers. Henceforth, the firms which sell most of their products to final consumers will be called "D-C ready-made garment firms" and the firms which sell most of their products through wholesalers and retailers will be called "D-W/R ready-made garment firms."

The classification above is based on the channel through which the majority of the products for individual firms pass. The exporting ready-made garment firms will sell a large percentage of its sales to other countries. Yet some of their products may be sold in domestic markets directly to final consumers and/or through wholesalers and retailers. The D-C ready-made garment firms sell also some of their products through wholesalers and retailers and the D-W/R ready-made garment firms sell also some of their products directly to consumers. In other words, no firms are confined to a single market outlet.

6.3 Types of Product Produced

6.3.1 Products of the Exporting Ready-Made Garment Firm

There is a wide range of products produced by this group of firms. They include products for men, women and children but most of them are produced for women. Men's products are chiefly short sleeved shirts. Children's products include shirts, blouses and dresses. A kind of pants which resemble those used by native people who live on the mountains is made for use by either men or women. There are many different products made for women. They include short and long sleeved shirts or blouses, winter coats, short midi and maxi skirts, short and long dresses and night gowns.

All these products for men, women and children have many sizes and designs. Sometimes the style or pattern is the same but different fabric or colors are used. Most of the products are embroidered. If not embroidered, the products are dyed or painted with different colors and patterns; sometimes with different dyeing techniques. Thus, products of the same design and that use the same kind of fabric might have different

styles of dyeing or different embroidery works. Besides making specialized garments for men, women and children, the firms also produce many other kinds of cloth products such as bags, scarves, hats, pillowcases, dolls, etc. These miscellaneous products are usually made from small pieces of fabric left unused from the production of men, women and children garments.

6.3.2 The D-C Ready-Made Garment Firm

The main product line of this group of firms is several kinds of men's shirts. These men's shirts can be classified into three groups. The first group is comprised of nondenim shirts made in several designs and sizes and most of them have short sleeves. The second group of men's is denim shirts. Most of the shirts in this group are of a certain design called "safari," and therefore from now on will be called safari shirts. The last group is the locally-made denim shirts. Besides men's shirts, the firms diversify their production into other product lines such as pants, long skirts, short dresses, children shirts, children dresses and T-shirts.

6.3.3 The D-W/R Ready-Made Garment Firm

This group of firms also produce several kinds of products, but the number is much less than those of the exporting ready-made garment firms. There are products for men, women and children. The men's products are short sleeved shirts and pants, both for work and dress. The work shirts and pants are called "farmers" shirts and "farmer" pants. The women's products are skirts and shirts. Children products can be divided into two groups: school uniforms and other garments for children. School uniforms include shirts, pants and skirts. The other garments include

children's shirts and dresses. Since the products are produced from inexpensive fabric, products produced by this group of firms are considered as being of low quality (Onchan, 1980).

6.4 Raw Materials

In this section, types of raw materials will be described first. Next, there will be a description of how the firm acquires the raw materials and pays for them. Finally, the price variation of raw material over the year will be discussed.

6.4.1 Type of Raw Materials

Fabric is the most important raw material in the production of ready-made garments. The firms use several designs and colors of fabric. Fabric prices vary widely by type of textile such as calico, cotton, linen, silk, cotton and polyester, denim, etc. Other raw materials used in the garment industry include thread, zippers, buttons, dyeing paints, dyeing threads for embroidery work, etc.

6.4.2. Acquisition of Raw Materials

This discussion of the raw materials acquisition is concerned with their source and manner of payment for the acquisition. The type of data available limits the description to number of firms, rather than in terms of money. However, the section dealing with raw materials payment (section 4.3) will give some general idea on cash outflow to several sources of suppliers.

For simplicity, raw materials are divided into two groups: fabric and accessories. Sources of raw materials include factories which produce raw materials, wholesalers, retailers and those who order merchandise from the firms.

6.4.2.1 The Exporting Ready-Made Garment Firm

6.4.2.1.1 The Acquisition of Fabric

Of the eight exporting ready-made garment firms, six (or 75 percent) purchased fabric from wholesalers and four (or 50 percent) purchased fabric from retailers (Table 6.1). One firm received fabric from those who placed orders and two firms made their purchases directly from factories. The total number of firms purchasing fabric when added by source was greater than the total number of the exporting ready-made garment firms because a firm could buy fabric from one or more sources.

6.4.2.1.2 The Acquisition of Accessories

All firms bought needed accessories from retailers. Five firms out of eight bought some from wholesalers and one firm bought accessories from a factory. Those who placed orders for merchandise did not supply accessories to the firm.

6.4.2.2 The D-C Ready-Made Garment Firm

6.4.2.2.1 The Acquisition of Fabric

Of the five D-C ready-made garment firms, three bought fabric from factories while four bought from wholesalers (Table 6.1). The number of firms purchasing fabric from retailers was the same as those purchasing from wholesalers. None of the firms acquired fabric from those who placed orders.

6.2.2.2.2 The Acquisition of Accessories

Four out of five firms bought some of their accessories from retailers, two bought from wholesalers and only one bought directly from the factory.

Table 6.1 Acquisition of Raw Materials of Ready-Made Garment Firms

Type of Firm	Raw Material	Number of Firm	Unit:Number of Firms Channel			
			Factory	Wholesaler	Retailer	Order
A) Exporting		8				
	Fabric		2	6	4	1
	Accessories		1	5	8	0
B) D-C		5				
	Fabric		3	4	4	0
	Accessories		1	2	4	0
C) D-W/R		4				
	Fabric		4	0	0	0
	Accessories		2	2	4	0

Source: Marketing Questionnaire

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6.4.2.3 The D-W/R Ready-Made Garment Firm

6.4.2.3.1 The Acquisition of Fabric

All four firms in this group purchased their fabrics exclusively from factories (Table 6.1). None of their fabric needs were purchased from retailers or wholesalers.

6.4.2.3.2 The Acquisition of Accessories

All four D-W/R ready-made garment firms bought some of their accessories from retailers and half of them also bought from factory or wholesalers.

The source of raw materials has been indicated but the relative importance of each source is not indicated because the available information does not show the amount or value purchased from each source.

6.4.3 The Payment For Raw Materials

6.4.3.1 The Exporting Ready-Made Garment Firm

6.4.3.1.1 Fabric

For the two firms which purchased fabric from the factory, one of them paid cash for the merchandise in advance, and the other firm used both cash and credit to pay for fabric purchased (Table 6.2). All firms which purchased some fabric from wholesalers received trade credit. Three out of the four firms which purchased fabric from retailers used trade credit.

6.4.3.1.2 Accessories

The firms which purchased accessories from either factories or wholesalers indicated that they paid for all the merchandise in cash (Table 6.2). Six out of eight firms which purchased accessories from retailers

Table 6.2 Payments for Raw Materials of Ready-Made Garment Firms

Unit:Number of Firms

Types of Firm and Types of Raw Material	Number of Firm	Channel									
		Factory				Wholesaler			Retailer		
		Advance	Cash	Credit	Cash + Credit	Cash	Credit	Cash + Credit	Cash	Credit	Cash + Credit
A) Exporting	8										
Fabric		1			1		2	4	1	3	
Accessories			1			5			6	2	
B) D-C	5										
Fabric		1	2			2	2		4		
Accessories			1			1	1		4		
C) D-W/R	4										
Fabric			1		3						
Accessories			1	1		2			4		

Source: Marketing Questionnaire

also indicated that they paid for the merchandise in cash. However, two firms out of eight firms asked for trade credit from retailers.

Therefore, the exporting ready-made garment firm usually asked for trade credit when they purchased fabric and usually paid cash when they purchased accessories.

6.4.3.2 The D-C Ready-Made Garment Firm

6.4.3.2.1 Fabric

One out of three firms which purchased fabric from factories paid for its merchandise in advance and the other two firms paid for the merchandise in cash when the deliveries were made (Table 6.2). For the firms which purchased some of their fabric from wholesalers, half of them paid for the fabric in cash and half of them obtained trade credit from wholesalers. When the firm purchased some of their fabric from retailers, all the firms paid for the fabric in cash and half of them obtained trade credit from wholesalers. Those firms that purchased some of their fabric from retailers paid for the fabric in cash.

6.4.3.2.2 Accessories

Half of the firms which purchased accessories from wholesalers paid for the merchandise in cash and the other half of the firm used trade credit (Table 6.2). When the firms purchased accessories either from factory or retailers, the firms always paid cash for the merchandise.

Therefore the D-C ready-made garment firms tended to pay for both fabric and accessories in cash.

6.4.3.3 The D-W/R Ready-Made Garment Firm

6.4.3.3.1 Fabric

All the firms purchased their fabric from factories. One out of four firms paid cash for the fabric purchased while the other firms used both cash and credit for their purchases (Table 6.2).

6.4.3.3.2 Accessories

All the firms which purchased accessories either from wholesalers or retailers paid for them in cash. Half of the firms which purchased accessories from factories paid cash immediately, while the other half asked for extensions for the payment.

Therefore the D-W/R ready-made garment firm usually used trade credit when they purchased fabric and usually paid in cash when they purchased accessories.

6.4.4 Percentage of Cash Purchases

The second column in Table 6.3 indicates the percentage that cash purchases were of the total purchases for all kinds of raw materials. Since total purchases vary by firm, a weighted average is used to indicate the ratio of cash purchases to total purchases instead of using a simple average. The calculation of weights should be done by using the total purchases of each firm. But since, the information on total purchases were not available, weights were calculated on the basis of value of production as a proxy for total purchases. These weights are shown in column 3, Table 6.3

Although the range was from zero to 100 percent, the weighted average for exporting ready-made garment firms was 47 percent of total

Table 6.3 Percentage of Cash Purchases of Ready-Made Garment Firms

Types of Firm	Firm	Percent Cash Purchases	Weights
A) Exporting	581216	0	.18
	571218	80	.36
	571221	20	.08
	581222	25	.22
	561223	75	.07
	561224	50	.03
	561225	20	.04
	571227	100	.04
	Weighted Average	47	
B) D-C	511103	50	.08
	521105	50	.20
	521106	40	.51
	521107	100	.07
	521208	15	.14
	Weighted Average	43	
C) D-W/R	562101	100	.18
	562102	10	.45
	562103	90	.27
	562104	100	.09
	Weighted Average	56	

Source: Finance Questionnaire and Monthly Questionnaire

purchases of raw materials in cash. The D-C and D-W/R ready-made garment firms averaged 43 percent and 56 percent of total purchases in cash payment for raw materials respectively.

This information will be used to specify the percentage of total raw material costs to be paid in cash by the firm in the linear programming model.

6.4.5 Rate of Interest Charged by Input Suppliers

Input suppliers usually charged some carrying charges and interest to the firms obtaining trade credit. The rates of interest including carrying charges which were included in the purchase price by input suppliers are shown in Table 6.4. The term of trade credit received was from one to three months. This information will be used in the specification of rate of interest to be paid by the firm to input suppliers in the linear programming model for the cases where credit is employed for purchasing raw materials.

6.4.6 Raw Material Prices

Information on fabric prices was obtained from a questionnaire administered in June, September and February (Table 6.5). Other information on prices of other raw materials was incomplete.

It can be observed that for all three groups of ready-made garment firms, the price of fabric was slightly lower in September than in either June or February. A low level of demand for fabric might be the factor which explains the lower price level in September.

The seasonal variation in fabric price will be reflected in the production cost per unit of output in the linear programming model.

Table 6.4 Carrying Charge and Rate of Interest Charged by Input Suppliers

Types of Firm	Raw Material	Unit:Percent Rate of Interest and Carrying Charge
Exporting	Fabrics	53
	Accessories	52
D-C	Fabric	54
	Accessories	89
D-W/R	Fabric	47
	Accessories	22

Source: Finance Questionnaire

Table 6.5 Seasonal Variation of Price of Fabric of Ready-Made Garment Firms

Unit=Baht/Yard

Type of Firm	Raw Material	Month		
		June	September	February
Exporting	Fabric	15	13	13
D-C	Fabric	22	22	23
D-W/R	Fabric	16	14	15

Source: Marketing Questionnaire, Profitability Questionnaire and Finance Questionnaire.

6.5 Technology

This section provides information on different types of machines, machinery requirement per unit of product, and production capacity of machinery. This information will be used to specify types of machines, coefficients of production activities, and right hand side for the machinery constraint in the linear programming model.

6.5.1 Types of Machines

The difference in technology used in the production of ready-made garments may be explained by the difference in the complication of different kinds of machines used. There were four kinds of machines involved in the production of ready-made garments; ordinary sewing machine, machine to make button holes, sewing machine to finish edge of the fabric and electric scissors. All of the ordinary sewing machines are the same, although some are operated manually while others are operated electrically. There are two kinds of machines to make button holes. The first is simply a button hole attachment to the sewing machine. The second one is a specialized machine designed specifically to make button holes and cannot be used for any garment. Similarly there are two kinds of machines to finish edge of the fabric. That is, either an attachment to a sewing machine or a specialized machine. However, most of the firms used specialized machines in their production. Either ordinary scissors or electric scissors can be used to cut fabric. Firms producing many garments, however, usually use electric rather than ordinary scissors.

6.5.2 Machinery Requirement

It can be argued that since the ready-made garment firms used several kinds of machines in the production process, they should all be specified

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in the linear programming model. However, for the following reasons, only the machine to finish edge of the fabric was specified in the model.

1. Sewing machine: Most of the sewing machines were owned by the workers. The firms owned only a few machines but there was no accurate data on number of workers (especially those subcontracted) or number of sewing machines owned by workers, it is not possible to specify the maximum capacity of the right-hand side of the machine in the linear programming model.

2. Machines to make button holes: The main reason to drop this machine from the linear programming model was incomplete data which were available on only some products. It would be inappropriate to develop the linear programming model showing machinery requirement for some but not all products.

3. Electric scissors: Electric scissors were used by the owners of the firms. Their use was not related to the use of hired labor. Therefore, the use of electric scissors was not involved in the management of cash flow of the model and could be left unspecified in the model without disturbing the determination of demand for credit.

The information on the amount of time needed to finish edge of fabric of specific products of all three groups of ready-made garment firms is presented in Table 6.6.

6.5.3 Capacity of Machine

Capacity of machines to finish edge of fabric is presented in terms of the total amount of time available to be used in each period (Table 6.7). It is assumed that the machines could work 60 minutes an hour, 8 hours a day, and 25 days a month.

Table 6.6

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Nightgo
Local J
Bags
Farmer'
Women's
School
School
Jean S
Safari
Pants
Short

Table 6.6 Machinery Requirement, Time Required to Finish Edge of the Fabric per Unit of Product of Ready-Made Garment Firms

Unit:Minute/10 Pieces

Product	Types of Firms		
	Exporting	D-C	D-W/R
Women's Shirts	35	50	
Long Dresses	75	100	
Men's Shirts	30	50	26
Children's Shirts	17		
Nightgowns	50		
Local Jean Shirts	24		
Bags	-		
Farmer's Shirts			24
Women's Skirts			60
School Girls' Skirts			50
School Girls' Shirts			30
Jean Shirts		55	
Safari Shirts		60	
Pants		100	25
Short Dresses		62	

Table 6.7 Production Capacity of Machine to Finish Edge of the Fabric of Ready-Made Garment Firms

Unit:Minute

Types of Firm	Capacity	
	Per Month	Per Period
Exporting	36,000	108,000
D-C	12,000	36,000
D-W/R	24,000	72,000

Source: Profitability Questionnaire

6.6 Labor Used

This section contains information on the number of days worked and employment levels for family members and hired accountants and sales workers, production workers and subcontract workers. The number of workers, number of working days per month and number of man-days worked per firm per month are not used in the construction of the model because it is assumed that employment levels are not constrained. However, the reported labor wages and requirements will be used for the specification of labor cost in the linear programming model.

6.6.1 Family Members

There were more female than male family members participating in the business. However, available data did not permit a detailed breakdown of activities of the division of labor according to sex. These family members performed administrative jobs including the acquisition of input, marketing output, hiring and firing workers and subcontractor agents, keeping records, managing cash flows, and performing some steps in the production process such as designing the pattern, cutting the fabric, controlling the quality of the products, etc.

6.6.1.1 The Exporting Ready-Made Garment Firm

On the average, over the year there were .8 male and 1.8 female family members participating in the business each month. The number of male family members fluctuated between 1.2 males during March to May and .4 male in November and January, while the number of female family members fluctuated between 2.2 females during March to May to 1.4 females in December (Table 6.8).

Table 6.8 Number, Number of Days and Number of Man-Days Worked by Family Member of Ready-Made Garment Firms

		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
A) Exporting														
Number	M	1.2	1.2	1.2	.9	.9	.9	.6	.6	.4	.5	.4	.5	.8
	F	2.2	2.2	2.2	2.0	1.7	1.7	1.5	1.5	1.5	1.4	1.6	1.6	1.8
Number of Days	M	25.0	24.0	25.0	24.0	25.0	25.0	22.0	24.0	26.0	22.0	19.0	19.0	24.0
	F	27.0	30.0	27.0	28.0	28.0	28.0	26.0	25.0	27.0	27.0	25.0	24.0	27.0
Number of Man-Days	M	31.2	30.5	31.1	21.2	21.9	21.9	13.7	15.0	9.4	11.2	7.2	9.7	16.9
	F	61.7	67.0	61.7	55.2	48.5	48.5	39.0	37.4	39.9	37.7	40.5	39.5	48.1
	T	93.0	97.5	92.9	76.5	70.4	70.4	52.7	52.4	49.3	49.0	47.7	49.2	65.0
B) D-C														
Number	M	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	F	.6	.6	.6	.4	.8	.6	.4	.4	.6	.8	.8	.6	.6
Number of Days	M	28.0	23.0	28.0	30.0	30.0	30.0	30.0	28.0	28.0	29.0	30.0	25.0	27.0
	F	29.0	28.0	29.0	30.0	30.0	30.0	30.0	28.0	29.0	30.0	30.0	26.0	29.0
Number of Man-Days	M	33.4	27.2	33.4	36.0	36.4	36.4	36.6	33.8	34.0	35.0	36.6	29.6	34.5
	F	17.2	16.6	17.2	12.0	24.0	18.0	12.0	11.2	17.6	24.2	24.2	15.6	17.5
	T	50.6	43.8	50.6	48.0	60.4	54.4	48.6	45.0	51.6	59.2	60.8	45.2	52.0
C) D-W/R														
Number	M	1.2	1.2	1.2	1.7	1.2	1.2	1.5	1.2	1.2	1.2	1.2	1.2	1.3
	F	1.7	1.5	1.7	1.5	1.7	1.7	1.5	1.5	1.5	1.5	1.5	1.5	1.6
Number of Days	M	26.0	25.0	26.0	21.0	26.0	26.0	25.0	30.0	30.0	30.0	30.0	25.0	27.0
	F	27.0	26.0	27.0	24.0	27.0	27.0	25.0	29.0	30.0	30.0	29.0	24.0	27.0
Number of Man-Days	M	32.5	31.2	32.5	37.5	32.5	32.5	37.5	37.5	37.5	37.5	37.5	31.2	34.8
	F	47.5	38.8	47.5	36.5	47.5	47.5	37.5	43.7	45.0	45.0	43.7	36.7	43.1
	T	80.0	70.0	80.0	74.0	80.0	80.0	75.0	81.2	82.5	82.5	81.2	68.0	77.9

M = Male; F = Female; T = Total Man-Days

Source: Monthly Questionnaire

On the average, male family members worked around 24 days a month while female family members worked around 27 days a month.

Given the number of males and females and the number of days worked a month, on the average, female family members per firm averaged 48 man-days of work a month while male family members averaged 17.

6.6.1.2 The D-C Ready-Made Garment Firm

In contrast to the exporting ready-made garment firm, the number of male family members participating in the business in this D-C ready-made garment firm was higher than the number of female family members. On the average, there was an average of 1.2 male family members participating in the business each month while the number of female family members average was .6 (Table 6.8). Days of work per month averaged 27 days for males and 29 days for females. Converting the number of family members and number of days worked into number of man-days, the total man-days for family members was 34.5 man-days a month and for female family members 17.5 man-days a month.

6.6.1.3 The D-W/R Ready-Made Garment Firm

Ordinarily there were 1.3 males and 1.6 females working with the business each month (Table 6.8). However, in some months when production was high, the number of male or female family members increased. For example the number of male family members increased to 1.7 males and 1.5 males in June and September, while the number of female family members increased to 1.7 females in March, May, July and August.

The average number of days worked a month for both male and female family members was 27. Converting the number of family members and

the number of days worked a month into the number of man-days worked, the male family member average was 35 man-days a month and the female family member average was 43 man-days a month.

6.6.2 Sales Workers

The D-C ready-made garment firms did not hire sales workers and the D-W/R ready-made garment firms did not hire any sales workers during the first half of the survey period (Table 6.9). Sales workers were, however, hired during the second half of the survey period when sales were generally low. The exporting ready-made garment firms were the only group of ready-made garment firms hiring sales workers all year round. The number of sales workers varied according to sales. There were around .5 sales workers during March to May, becoming even fewer from then to November, increasing gradually to January and February. On the average these sales workers worked around 20 days a month, except for November when only 15 days were worked. These sales workers might have been involved in the crop harvesting activities of their family.

6.6.3 Production Workers

6.6.3.1 The Exporting Ready-Made Garment Firm

The firm used an average of 289 man-days of work from production workers, both skilled and unskilled, each month (Table 6.10). Of this total 95 percent was provided by skilled workers with the remaining 5 percent being provided by unskilled workers. Therefore this group of ready-made garment firms relied primarily on skilled workers for garment production.

Table 6.9 Number of Sales Workers, Number of Days and Number of Man-Days Worked by Type of Ready-Made Garment Firms

	Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
A) Exporting													
Number	.5	.5	.5	.4	.2	.2	.2	.4	.1	.2	.4	.4	.3
Number of Days	22.0	19.5	19.5	20.0	20.0	20.0	20.0	22.0	15.0	20.0	23.0	23.0	20.3
Number of Man-Days	11.2	9.7	9.7	7.5	5.0	5.0	5.0	8.2	1.9	5.0	8.7	8.7	6.7
B) D-C													
Number	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Days													
Number of Man-Days													
C) D-W/R													
Number	0	0	0	0	0	0	.2	1.2	1.2	1.2	1.2	1.2	.5
Number of Days								25.0		25.0		25.0	25.0
Number of Man-Days							6.2	31.2	31.2	31.2	31.7	31.7	13.6

Source: Monthly Questionnaire

Table 6.10 Number of Man-Days Worked of Skilled and Unskilled Workers of Ready-Made Garment Firms

	Man-Days Per Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
A) Exporting													
Skilled	322	319	318	335	239	239	214	335	127	198	385	269	275
Unskilled	20	20	20	31	0	0	5	25	9	25	0	14	14
Total	342	339	338	366	239	239	219	360	136	223	385	283	289
% of Annual Ave.	118	117	117	126	83	83	76	124	47	77	133	98	100
B) D-C													
Skilled	59	42	43	61	103	109	41	47	45	62	63	69	62
Unskilled	0	0	0	0	0	0	0	0	0	0	0	20	2
Total	59	42	43	61	103	109	41	47	45	62	63	89	64
% of Annual Ave.	92	65	67	96	160	171	64	74	69	97	98	138	100
C) D-W/R													
Skilled	53	53	58	82	58	58	84	119	112	144	109	122	88
Unskilled	183	204	225	58	209	209	177	86	81	86	175	185	157
Total	236	257	283	140	267	267	261	205	194	230	284	307	244
% of Annual Ave.	97	105	116	57	110	110	107	84	79	94	116	126	100

Source: Monthly Questionnaire

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During March to May when production was very high the number of man-days worked by both skilled and unskilled production workers was around 117 percent of monthly annual average. In June this index rose to 126 when women's shirts (the main product line) was in full production. During July to December production was generally low, as indicated by man-day monthly indices from 47 to 83, except for October when the total number of man-days worked was around 124 percent of annual average. During January, production was 33 percent higher than average whereas February was an average month. It can be observed that while production levels in October and January were less than that from March to May, the total number of man-days worked was higher. One possible explanation is that in October and January the number of subcontract workers was much lower than that during March to May. In other words, the firms substituted production workers for subcontract workers in October and January.

6.6.3.2 The D-C Ready-Made Garment Firm

This group of ready-made garment firms used only skilled workers in their production during the first 11 months of the survey period. Some unskilled workers were employed, however, in February, the last month of the survey period (Table 6.10).

On the average, over the year, the firm used 62 man-days of skilled workers each month. The seasonal index of number of man-days worked for skilled workers was 95 in March, 68 in April and May. It increased to 98 in June to 166 in July and 176 in August. It dropped to the range of 66 to 75 in the period of September to November and rose to 100 in December and further to 111 in February.

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This pattern of the fluctuation of the total number of man-days worked by skilled workers seemed to correlate directly with the level of production, except during March to May. In general, the level of production was higher at that time than in June, and at least as high as the level of production in July and August; yet the total number of man-days worked during the period was lower than during June to August. Again, the explanation may be based on a larger number of subcontract workers being utilized during March to May than during June to August.

6.6.3.3 The D-W/R Ready-Made Garment Firm

Contrary to other groups of ready-made garment firms, the D-W/R ready-made garment firms relied more on unskilled workers than skilled workers. Of the total monthly average of 244 man-days of production workers employed by these firms, 64 percent was contributed by unskilled workers (Table 6.10).

The total number of man-days worked of both skilled and unskilled workers was 97 percent of annual monthly average in March, was 105 percent and 116 percent of annual monthly average during April and May, respectively, dropped to 57 in June and rose 110 percent during July to August, and fell to 79 percent to 94 percent in October and December, respectively. Above-average production was found in January and February with 116 and 126 indices for these months respectively. This pattern of fluctuation correlated directly with the pattern of production. However, on the basis of production level the total number of man-days worked in June was lower than might be expected.

It can be observed from Table 6.10 that the number of man-days worked by unskilled workers are at low levels during the months when

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farming activities are high, i.e., in June, November and December. During these months the firm might have resolved the shortage of unskilled labor by using more skilled workers. In those months, the ratio of man-days worked of skilled labor to unskilled workers was greater than 1 while in other months it was less than 1.

6.6.4 Subcontract Workers[1]

6.6.4.1 The Exporting Ready-Made Garment Firm

The firms used many subcontract workers to do embroidery work. However, it was very difficult to get accurate data on the number of subcontract workers since the firm did not have direct contact with them (Onchan, 1980). The firms arranged for workers through agents. The firms know how many agents they had, but they did not know exactly how many workers were working with each agent. Given this difficulty, the data reported in Table 6.11 may be only rough estimates. Mead estimated that the number of subcontract workers was around five to ten times the number of workers employed in the factory. All subcontract workers who worked with this group of ready-made garment firms resided in villages.

6.6.4.2 The D-C Ready-Made Garment Firm

Some firms hired subcontract workers only for sewing, yet some firms hired subcontract workers for all production processes. In the latter case, the firms specified the pattern and size of the garment and provided the fabrics to the workers. When the product was finished, it was delivered to the firm, at which time the workers received their wages.

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[1]For more details, see Mead 1981.

Table 6.11 Number of Subcontract Workers of Ready-Made Garment Firms by Month and Type of Firm

		Month												
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
A) Exporting														
Subcontract:	Town	0	0	0	0	0	0	0	0	0	0	0	0	0
	Village	6.9	6.9	6.7	6.0	.2	.2	1.1	1.6	1.2	1.0	1.6	.5	2.8
	Total	6.9	6.9	6.7	6.0	.2	.2	1.1	1.6	1.2	1.0	1.6	.5	2.8
B) D-C														
Subcontract:	Town	1.4	1.4	1.4	1.0	.6	0	3.2	2.8	.4	1.6	1.6	0	1.3
	Village	1.6	1.6	1.6	.2	0					.6			.4
	Total	3.0	3.0	3.0	1.2	.6	0	3.2	2.8	.4	2.2	1.6	0	1.7
C) D-W/R														
Subcontract:	Town	1.5	1.5	1.5	3.2	2.2	2.2	1.5	2.5	0	.5	3.0	3.0	1.9
	Village	0	0	0	4.5	0	0	1.5	0	0	0	0	0	.5
	Total	1.5	1.5	1.5	7.7	2.2	2.2	3.0	2.5	0	.5	3.0	3.0	2.4

Source: Monthly Questionnaire

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On the average, over the year the firm hired 1.7 subcontract workers each month of which 73 percent resided in town and the rest of them resided in a village (Table 6.11). The number of reported subcontract workers during the first five months seemed consistent with the production of the firm. Yet the number of subcontract workers seemed unreasonably high in September, October and December and was inconsistent with the production pattern of the firm during these months.

6.6.4.3 The D-W/R Ready-Made Garment Firm

The subcontract workers who worked with this group of ready-made garment firms usually performed only the sewing, while the rest of the production processes were done by the owners of the firms and workers located at the factories.

On the average over the year the firms hired 2.4 subcontract workers each month of which 80 percent resided in towns while the rest resided in villages. The numbers of subcontract workers hired by the firms seemed consistent with the production pattern of the firm except in June. June is one of the months when agricultural activities were at the highest level and it would be very difficult to find subcontract workers, especially in the village. Yet the information available indicates that the firm hired 4.5 subcontract workers who resided in villages in June.

6.6.5 Wage Rate Per Day of Skilled and Unskilled Workers

6.6.5.1 The Exporting Ready-Made Garment Firm

The average wage rate per day of skilled workers for most of the year was at least two times the average wage rate per day of unskilled workers. Skilled workers received an average daily wage of 35 baht while unskilled workers received 15 baht (Table 6.12).

Table 6.12 Wage Rate per Day of Skilled and Unskilled Workers of Ready-Made Garment Firms

	Month									
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
A) Exporting										
Skilled	39	33	34	26	30	40	40	38	38	35
Unskilled	20	15	15	15	15	15	15	15	15	15
B) D-C										
Skilled	64	66	45	30	N.A	50	56	51	75	55
Unskilled	N.A									
C) D-W/R										
Skilled	23[E]	23[E]	23[E]	23[E]	24[E]	24[E]	26[E]	27	27	25
Unskilled	16	16	16	16	17	17	18	18	19	17

E = estimate: wage rate of skilled labor in month i = wage rate of unskilled labor in month i $\times$ $\frac{\text{average wage rate of skilled workers in January and February}}{\text{average wage rate of unskilled workers in January and February}}$

Source: Monthly Questionnaire

N.A. = Not Available

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The wage rate of skilled labor was high in June because demand for labor was high for both agricultural and small scale industry production. In July and August the wage rate decreased despite a high production level because more workers were free from agricultural activities. During September and October, wage rate of skilled labor was at the lowest level because production level was low and more workers were available to be hired. In November and December production increased, when agricultural activity was also high, and wage rate increased to the highest level. During January and February, production was still high, yet more workers were free from agricultural activities; thus, the wage rate decreased a little bit from the highest level in the previous period.

The wage rate of unskilled workers was 20 baht in June and remained at 15 baht for the rest of the survey period.

6.6.5.2 The D-C Ready-Made Garment Firm

Over the year, the average wage rate per day of skilled workers was 55 baht (Table 6.12). During June and July when both industrial and agricultural activity was high, wage rate per day of skilled workers was nearly at the highest level, 64-66 baht a day. During August and September, since production decreased and more workers were free from agricultural activities, wage rate dropped to 30 baht to 45 baht a day for these months respectively. During November and December when production was still at a low level and agricultural activities were high again, wage rate rose to at least 50 baht a day. Since more workers were free from agricultural activities in January, the wage rate dropped slightly to 51 baht a day. In February, high production level drove wage rates up to an average of 75 baht a day.

Since this type of firm rarely used unskilled labor in its production, the data collected was not enough to trace out the seasonal variation of wage rate per day of this group of workers.

6.6.5.3 The D-W/R Ready-Made Garment Firm

On the average, wage rate per day of skilled workers was nearly 1 1/2 times the wage rate per day of unskilled workers. On the average unskilled workers received 17 baht and skilled workers received 25 baht a day (Table 6.12). Reported wage rates per day of workers for this group of firms shows little variation from month to month.

Since wage rate per day of skilled and unskilled workers of all these three groups of ready-made garment firms varied over the year, wage rate per day of skilled and unskilled labor to be used in the model were adjusted accordingly.

6.6.6 Labor Requirement

The number of man-days required per one unit of output of the products produced by the exporting ready-made garment firms does not include the number of man-days worked of subcontract workers to do embroidery work. (The project did not collect this kind of data.) However, the cost per unit of product for subcontract work in baht is presented.

The number of man-days required per one unit of output for the other two groups of ready-made garment firms cover the whole production process which was done by either workers who worked at the factories or by subcontract workers at home. Since they have already been noted there is not a separate column to show the numbers of man-days required or unit cost for subcontract workers in Table 6.13. It should be mentioned that

Table 6.13 Labor Requirements per Unit of Product in the Production of Some Ready-Made Garments by Type of Firm

Unit:Man-Days/100 Pieces

Product	Type of Firm						
	Exporting			D-C		D-W/R	
	Skilled	Unskilled	Sub-Contract*	Skilled	Unskilled	Skilled	Unskilled
Women's Shirts	9		6	31		1	1
Long Dresses	16	1	12	33			
Men's Shirts	9		4	36		5	3
Children's Shirts	4		2.5				
Nightgowns	10		6				
Local Jean Shirts	9		0				
Bags	6						
Farmer's Shirts						4	5
Women's Skirts						4	3
School Girls' Skirts							7
School Girls' Shirts							6
Jean Shirts				25			
Safari Shirts				30			
Pants				33			
Short Dresses				31			

*Unit = baht/piece

Source: Profitability Questionnaire

this study paid more attention to the labor required to finish a whole production process than to the number of man-days performed by individual groups of workers.

6.7 Production

6.7.1 Production Pattern of Individual Products

This information on the production patterns for individual products will not be used directly in the construction of the LP model because it will determine its own production behavior. As was the case for the cement product industry, diagrams were prepared to facilitate the visualization of the pattern.

6.7.1.1 The Exporting Ready-Made Garment Firm

The firms produced pants only in November, and October was the only month when girls' skirts were produced (Table 6.14, Figure 6.1). The production of short dresses for women occurred only in July, August and October. Excepting men's shirts and denim shirts production was at the highest level for all products during March to May and lowest during June to August. Production levels were very low during the rest of the survey period. For men's shirts, June to August and February were the periods when production was lower than the annual monthly average and was above average in other months. The production of denim shirts was at a low level at the beginning of the survey period and increased gradually toward the end of the survey period. However, none were produced during July to August and November to December.

Table 6.14 Monthly Production of Individual Products of the Exporting Ready-Made Garment Firms

Unit:Pieces

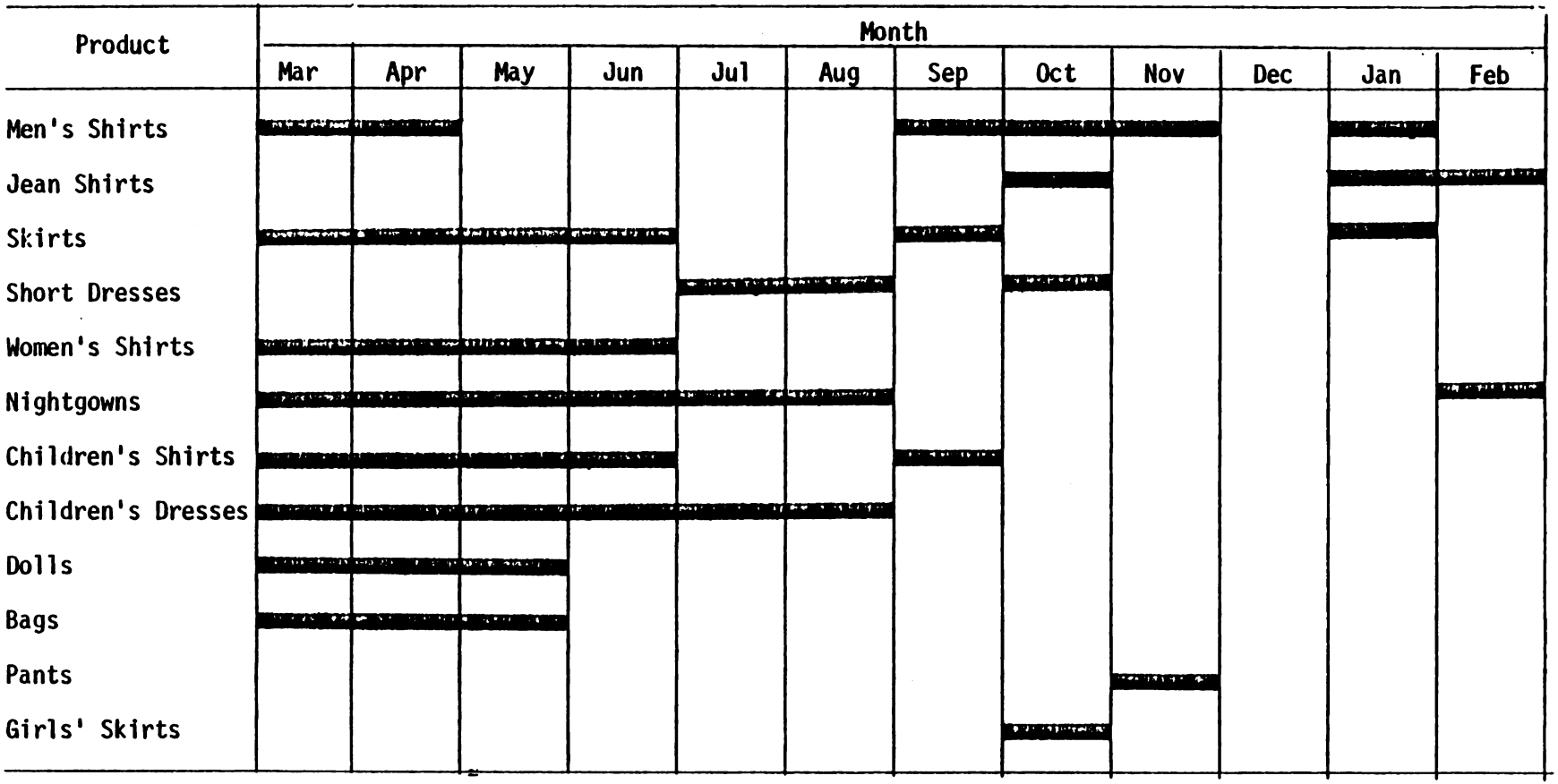
Table 6.14 Monthly Production of Individual Products of the Exporting Ready-Made Garment Firms

Unit:Pieces

Product	Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
Men's Shirts	94	112	87	62	0	0	125	112	112	87	125	70	82
Index	113	136	106	75	0	0	151	136	136	106	151	84	100
Jeans Shirts	50	75	87	62	0	0	37	125	0	0	375	437	104
Index	48	72	84	60			36	120			360	420	100
Skirts	500	500	500	500	143	143	375	25	0	62	375	0	232
Index	215	215	215	215	61	61	161	10		26	161		100
Short Dresses					75	75	0	125					23
Index					327	327		545					100
Women's Shirts	1,450	1,462	1,418	2,837	1,006	1,006	875	812	412	0	125	0	950
Index	152	153	149	298	105	105	92	85	43		13		100
Nightgowns	62	62	62	62	62	62	37	12	0	12	12	75	43
Index	142	142	142	142	142	142	85	28		28	28	171	100
Children's Shirts	387	387	387	375	125	0	250	12	125				170
Index	226	226	226	219	73		146	7	43				100
Children's Dresses	125	125	125	125	125	125	0	0	62	62	0	37	76
Index	164	164	164	164	164	164			82	82		49	100
Dolls	875	850	875	46	40	40	40	56	20	106	85	43	256
Index	341	331	341	18	15	15	15	21	7	41	33	17	100
Bags	687	812	625	18	18	18	37	37	37	125	75	93	215
Index	318	376	289	8	8	8	17	17	17	57	34	43	100
Pants									12				1
Index									1,201				100
Girls' Skirts								43					3
Index								12					100
Other	75	75	75	87	75	75	0	200	93	643	1,350	2,262	417
Index	17	17	17	20	17	17		47	22	154	323	541	100

Index for each product is $\frac{\text{monthly sales}}{\text{annual monthly average}} \times 100$

Source: Monthly Questionnaire



Months when Production was at Least 10 Percent Above
Annual Monthly Average of the Exporting Ready-Made Garment Firms

Figure 6.1

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6.7.1.2 The D-C Ready-Made Garment Firm

The production of ready-made garments of this group of firms can be divided roughly into two groups according to output level. One group includes the production of men's shirts, safari shirts, denim shirts, pants and short dresses in large quantity and the other includes a limited production of long skirts, children's shirts, children's dresses and T-shirts.

The production of products which were produced in large quantity seemed to have three different patterns. The first pattern was where, in the production of men's shirts and denim shirts, the production was high during the first five to six months, was low during the next five to six months and was high again in the last month of the survey period (Table 6.15, Figure 6.2). The second pattern was where in the production of safari shirts and pants, the production was low during the first seven months and was high during the last five months of the survey period. The last pattern was where in the production of short dresses, they were produced only during the first seven months of the survey period.

The production of the rest of the products which were not produced in large quantity were scattered over the periods as can be observed directly from Table 6.15.

6.7.1.3 The D-W/R Ready-Made Garment Firm

The production pattern for men's shirts and farmer's shirts moved in opposite directions. While the production of men's shirts was low during the first six months and was high during the last six months of the survey period, the production of farmer's shirts was high during the first seven months and was low during the last five months of the survey

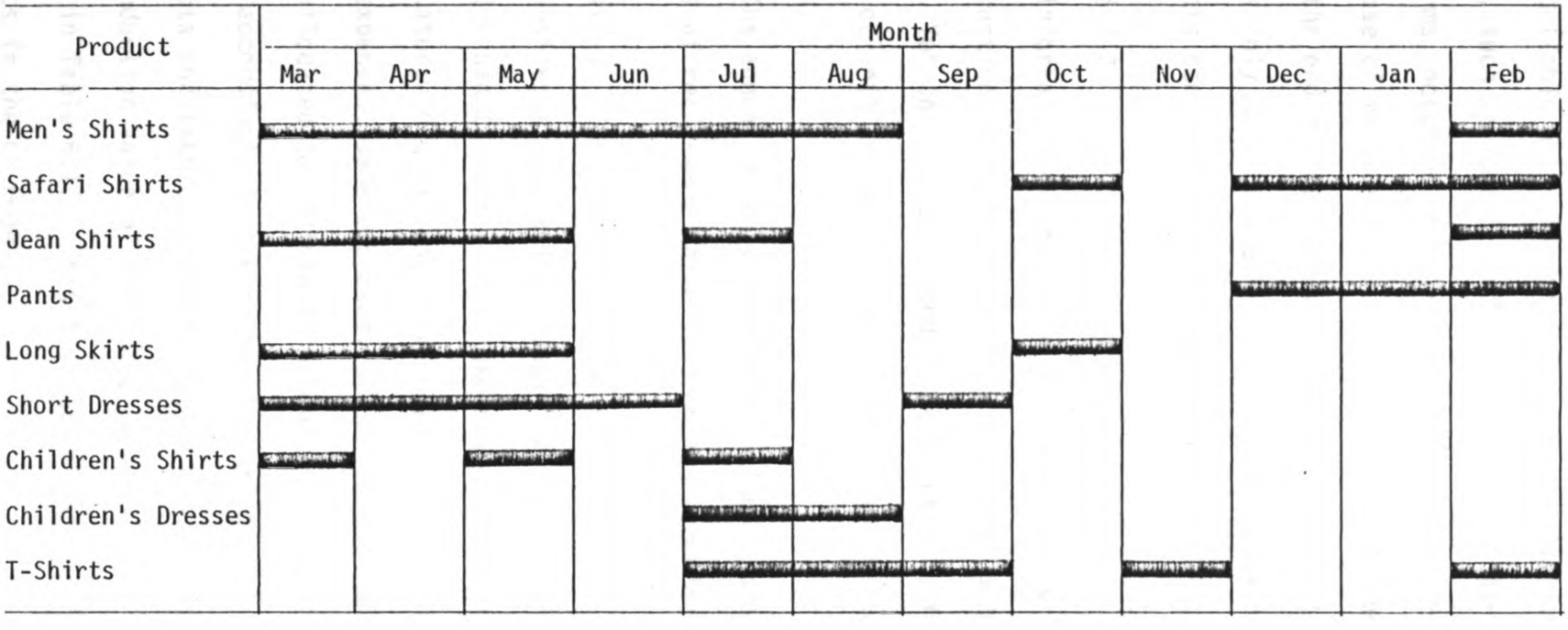
Table 6.15 Monthly Production of Individual Products of the D-C Ready-Made Garment Firms

Unit:Pieces

Product	Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
Men's Shirts	142	102	113	121	106	140	30	42	46	89	60	100	90
Index	156	112	124	133	117	154	33	46	51	98	66	11	100
Safari Shirts				3	2	2	20	46	21	58	88	50	24
Index				12	8	8	83	190	87	240	364	207	100
Jean Shirts	73	74	73	42	54	36	32	36	0	20	46	50	44
Index	163	166	163	94	121	81	72	81	0	45	103	112	100
Pants	9	6	9	0	20	20	20	22	14	32	62	40	21
Index	43	28	43	0	94	94	94	104	66	151	293	189	100
Long Skirts	14	11	14					6					3
Index	373	293	373					16					100
Short Dresses	28	24	28	16	10	10	24						11
Index	240	206	24	137	86	86	206						100
Children's Shirts	4	0	4	0	6								1
Index	342		342		513								100
Children's Dresses					16	16							2
Index					599	599							100
T-Shirts					6	6	6	0	14			20	4
Index					139	139	139	0	323			462	100
Other										30	36	12	6
Index										462	554	185	100

Index for each product is $\frac{\text{monthly sales}}{\text{annual monthly average}} \times 100$

Source: Monthly Questionnaire



Months when Monthly Production was at Least 10 Percent Above
Annual Monthly Average of the D-C Ready-Made Garment Firms

Figure 6.2

period (Table 6.16, Figure 6.3). The production of student-related products, such as school girls' skirts, school girls' shirts, and students' uniforms, occurred only in the first half of the survey period. As was the case of men's shirts, the production of women's shirts was high toward the end of the survey period. Actually, the firm produced women's shirts only during December to February. The production pattern of other products can be observed directly from Table 6.16.

6.7.2 Value of Production

Information on the value of production is not used directly in the construction of the model because the model generates its own product flow. Yet the value of production is used to figure out the assumed value of initial cash on hand by the firm at the beginning of the first period.

The annual monthly average of value of production of the three groups of ready-made garment firms are reported in Table 6.17.

6.7.3 Nonallocatable Costs of Production

Besides raw material costs, labor costs, interest cost, and taxes, the firm had to defray other expenses, such as electricity, gasoline, gas, water, food expenses for those workers who ate at the firm, insurance expenses, sale expenses, office supply expenses, etc. These costs were allocated to individual products by weighting the annual total costs accordingly to the respective value of production for individual products and then converting them to unit costs. These costs per baht of production value of the three groups of ready-made garment firms is shown in Table 6.18. This information is to be used as one of the components in the LP model.

Table 6.16 Monthly Production of Individual Products of the D-W/R Ready-Made Garment Firms

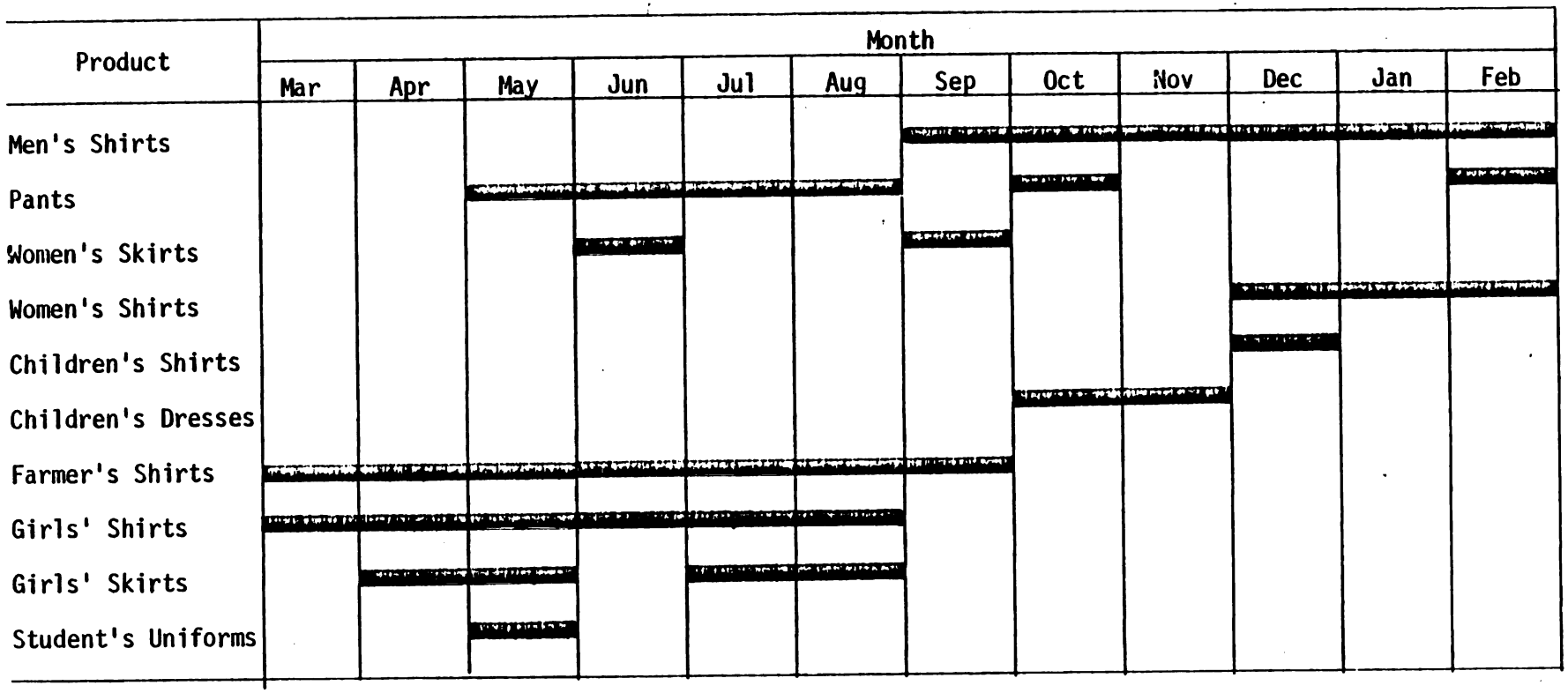
Unit:Dozen

Product	Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
Men's Shirts	0	2	10	0	2	2	48	27	28	42	67	66	18
Index		12	57		12	12	267	153	155	233	372	367	100
Pants			11	5	5	5	0	4				6	3
Index			375	160	160	160		128				215	100
Women's Skirts				1	0	0	2	0					.35
Index				486			714						100
Children's Shirts										5			.42
Index										119			100
Children's Dresses								24	40				5
Index								45	75				100
Farmer's Shirts	82	81	81	129	82	80	82	36	20	13	5	2	58
Index	142	140	140	223	142	137	142	62	35	23	8	4	100
Girls' Shirts	7	10	7	7	10	10							4
Index	171	228	171	171	228	228							100
Girls' Skirts		5	3	0	5	5							1
Index		32	237		32	32							100
Student's Uniforms			5										.44
Index			1,193										100
Other									75	100	70	114	29
Index									251	334	235	381	100

Index for each product is $\frac{\text{monthly production}}{\text{annual monthly average}} \times 100$

Source: Monthly Questionnaire

Month



Months when Monthly Production was at Least 10 Percent Above
Annual Monthly Average of the D-W/R Ready-Made Garment Firms

Figure 6.3

Table 6.17 Monthly Value of Production of the Ready-Made Garment Firms

Month	Type of Firm		
	Exporting	D-C	D-W/R
March	165,523	33,012	33,870
April	171,296	26,882	36,123
May	162,973	29,518	42,545
June	184,395	21,930	56,685
July	76,477	30,420	33,917
August	75,352	27,400	32,987
September	66,052	16,820	46,411
October	91,548	16,120	31,699
November	45,923	11,670	30,886
December	55,349	32,960	35,878
January	141,539	43,220	50,540
February	153,407	32,740	46,970
Average	115,819	26,891	39,876

Table 6.18 Overhead Cost per One Baht of Value of Production of Ready-Made Garment Firms

Type of Firm	Firm	Overhead Cost
A) Exporting	581216	.0185
	571218	.0465
	571221	.0085
	581222	.0288
	561223	.1193
	561224	.1364
	561225	.0876
	571227	.0640
	Average	.0637
B) D-C	511103	.0455
	521105	.0563
	521106	.0425
	521107	.0091
	521208	.1031
	Average	.0513
C) D-W/R	562101	.0569
	562102	.0715
	562103	.0435
	562104	.0837
	Average	.0639

Source: Profitability Questionnaire

6.8 Sales

This section contains the information on gross sales, sales and inventory patterns of individual products, output channels, percentage of cash sales, and prices of products.

6.8.1 Gross Sales

As was mentioned in Section 3.7.1, gross sales was computed as the summation of quantity sold times cash price of every product in every period. The information on gross sales is not being used directly in the construction of the model. However, it provides some idea about what would likely be the pattern of cash inflow into the firm in each period. One should be reminded that some of the sales include credit sales. The deliveries of the products may have been made yet the firm may not have received cash from the sales until a later period. In other words, if there were some credit sales, gross sales might overestimate cash inflow into the firm for a particular period.

6.8.1.1 The Exporting Ready-Made Garment Firm

The annual monthly average of gross sales of the exporting ready-made garment firms was slightly less than 116,000 baht (Table 6.19). Seasonally, gross sales were highest during March to June, averaging about 140 percent of the annual monthly average. July to December sales were light, dropping to around 38 percent to 64 percent of annual monthly average, excepting October when gross sales were 20 percent above average. Sales increased sharply to around 120 percent to 130 percent of annual monthly average again during January and February. Given this pattern it could be expected that the firms would have adequate cash during the first four months of the survey period.

Table 6.19 Monthly Sales of Ready-Made Garment Firms

Month	Type of Firm: Exporting Sale	Exporting % of Ave.[a]	D-C Sale	D-C % of Ave.	D-W/R Sale	D-W/R % of Ave.
March	162,776	140	18,973	85	32,970	95
April	163,733	141	28,345	127	32,790	94
May	159,439	137	23,388	104	40,226	115
June	172,510	149	17,570	78	33,359	95
July	74,758	64	21,961	98	30,584	88
August	73,633	63	20,181	90	29,654	85
September	52,051	45	14,735	65	40,818	117
October	139,227	120	12,495	56	32,979	95
November	44,585	38	11,364	51	32,214	92
December	58,688	51	31,110	139	27,611	79
January	141,003	122	39,040	174	45,410	130
February	152,927	132	29,200	130	39,209	113
Average	115,944	100	22,365	100	34,819	100

Source: Monthly Questionnaire

[a]% of Ave. = percent of annual monthly average.

6.8.1.2 The D-C Ready-Made Garment Firm

Over the year, gross sales of the D-C ready-made garment firms averaged 22,365 baht per month (Table 6.19). Above average gross sales occurred during April to May, and December to February, especially during December to February when gross sales were at least 30 percent above average. For the rest of the survey period, gross sales were from 51 percent to 91 percent of annual monthly average. Therefore it could be expected that the firms would have sufficient cash during the last quarter of the survey period.

6.8.1.3 The D-W/R Ready-Made Garment Firm

Over the year, gross sales of the D-W/R ready-made garment firm averaged 34,819 baht per month (Table 6.19). May, September, January and February were the four months when gross sales were at least 115 percent of the annual monthly average. For the rest of the survey period gross sales were from 79 percent to 95 percent of annual monthly average. Cash inflow for these firms seemd to distribute quite evenly over the year.

6.8.2 Sales Pattern of Individual Products

Sales seasonality of individual products will provide two important kinds of information needed for the construction of the LP model. First, it indicates expected demand for individual products in each period. Second, when sales and production of individual products are compared, it will provide information on size of inventory and inventory patterns of each product.

6.8.2.1 The Exporting Ready-Made Garment Firm

Quantity sold of each product is shown in Table 6.20. Figure 6.4 was developed by using information from Table 6.20 in order to facilitate the visualization of sales pattern of each product.

For the products which the firm did not produce and sell in large quantity such as pants, girls' skirts, and short dresses, the timing of production and sales were the same. That is, the sales of pants and girls' skirts occurred only in November and October respectively, and the sales of short dresses occurred in July, August and October. For the rest of the products which were produced and sold in large quantity, sales of the products, except men's shirts and denim shirts were at the highest level during March to May, were at a lower level during June to August and were at the lowest level during the rest of the survey period, September to February. For men's shirts, sales were high during March to May and October to January. Unlike the sales pattern of other products, sales of denim shirts were at a low level during the first 10 months and were at a very high level during the last two months of the survey period.

6.8.2.2 The D-C Ready-Made Garment Firm

Quantity sold of each product in each month is shown in Table 6.21. There seemed to be patterns of sales of the products which the firms produced and sold in large quantity, such as men's shirts, denim shirts, safari shirts, pants and short dresses. For men's shirts and short dresses, high levels of sales concentrated during the first half of the survey period. For safari shirts and pants, high levels of sales concentrated during the last four months of the survey period. Unlike other

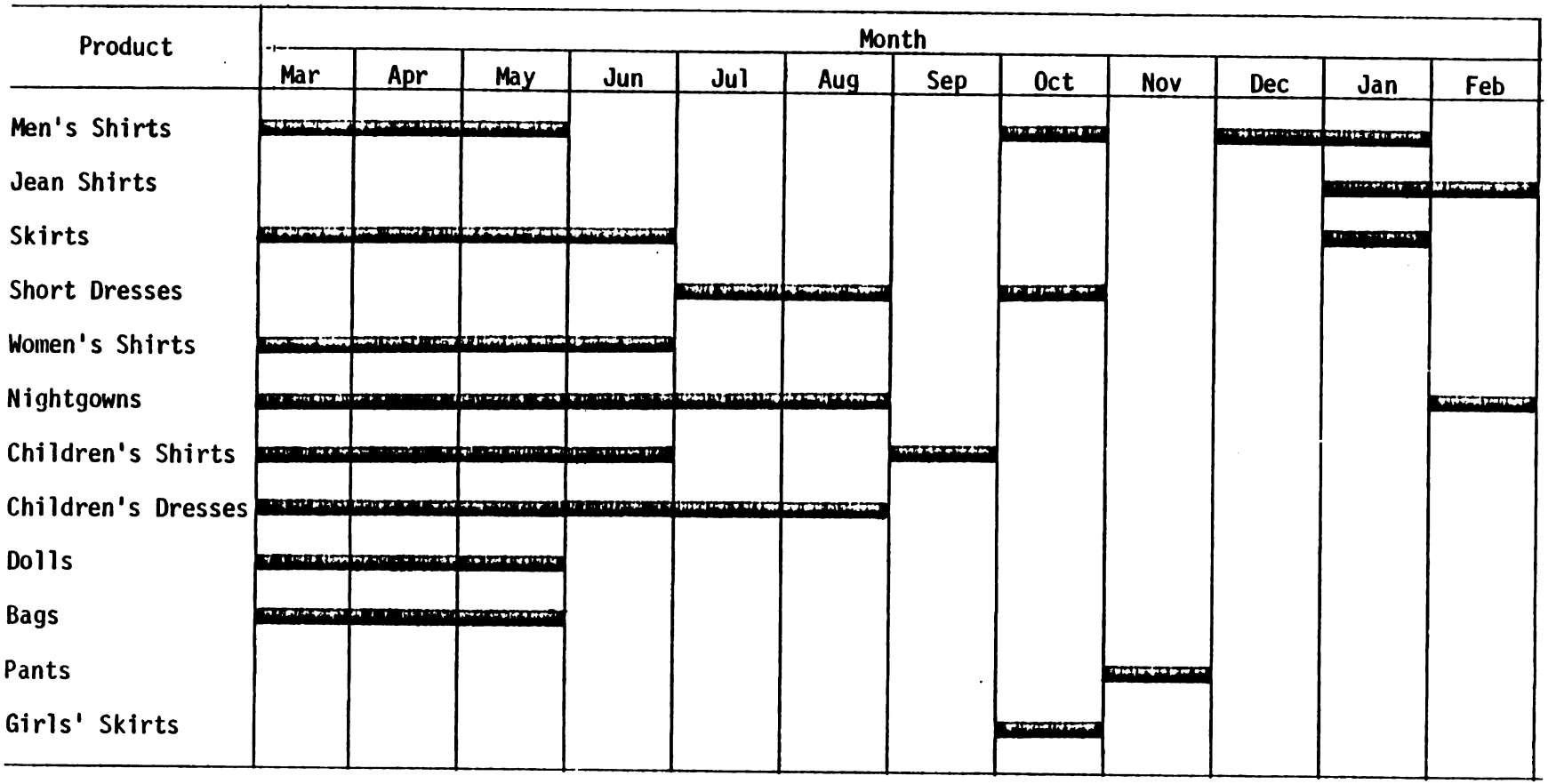
Table 6.20 Monthly Sales of the Exporting Ready-Made Garment Firms

Unit:Pieces

Product	Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave.
Men's Shirts	94	112	87	62	0	0	50	100	74	87	119	62	70.7
Index	133	159	124	88	0	0	71	141	104	123	167	88	100
Jean Shirts	50	75	87	62	0	0	37	100	0	0	375	437	102.1
Index	48	73	85	61	0	0	36	97	0	0	367	428	100
Skirts	500	500	500	500	135	135	11	27	0	62	375	0	228.8
Index	218	218	218	218	58	58	4	12	0	27	163	0	100
Short Dresses					75	75	0	125					22.9
Index					327	327	0	545					100
Women's Shirts	1,450	1,425	1,387	2,618	987	987	812	812	412	0	125	0	918.2
Index	157	155	151	285	107	107	88	88	44	0	13	0	100
Nightgowns	50	50	50	50	50	50	37	12	0	12	12	75	37.5
Index	133	133	133	133	133	133	100	33	0	33	33	200	100
Children's Shirts	384	384	384	375	125	0	250	10	125				169.8
Index	226	226	226	220	73	0	147	5	73				100
Children's Dresses	125	125	125	125	125	125	0	0	62	62	0	37	76.0
Index	164	164	164	164	164	164	0	0	82	82	0	49	100
Dolls	850	850	850	45	31	31	31	56	20	81	82	44	248.3
Index	342	342	342	18	12	12	12	22	7	32	33	17	100
Bags	687	812	625	19	19	19	37	37	37	125	75	94	215.6
Index	318	376	289	8	8	8	17	17	17	57	34	43	100
Pants									12				1.0
Index									1,200				100
Girls' Skirts								44					3.6
Index								1,200					100
Other	27	27	27	39	75	75	0	537	90	642	1,346	2,256	428.3
Index	6	6	6	9	17	17	0	125	21	149	314	526	100

Index for each product is $\frac{\text{monthly sales}}{\text{annual monthly average}} \times 100$

Source: Monthly Questionnaire



Months when Sales were at Least 10 Percent Above
Annual Monthly Average of the Exporting Ready-Made Garment Firms

Figure 6.4

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products, sales of denim shirts were high during the first two months and the last month of the survey period. Sales of other products which were not produced and sold in large quantity were irregular. For example, sales of long skirts were high during March to May. Sales of children's shirts and children's dresses were high during July and August. Sales of patterns of the rest of the products can be observed directly from Table 6.21 and Figure 6.5.

6.8.2.3 The D-W/R Ready-Made Garment Firm

Quantity sold of each product in each period is shown in Table 6.22. Farmer's shirts and men's shirts were the products which the firms produced and sold in large quantity. Sales patterns of these products moved in opposite directions. Sales of farmer's shirts were high during the first seven months and were low during the last five months of the survey period, while sales of men's shirts were low during the first six months and were high during the last six months of the survey period. Sales of women's shirts occurred only during the last quarter of the survey period. Sales of pants were high in June and February. Sales of student-related products such as school girls' skirts, school girls' shirts and students' uniforms concentrated during April to August. Sales patterns of the other products can be observed directly from Table 6.22 and Figure 6.6.

6.8.3 Inventory Pattern of Individual Products

Inventory is the difference between quantity produced and quantity sold. Cumulative inventory is the summation of monthly inventory. The maximum level of cumulative inventory of each product is used as a proxy

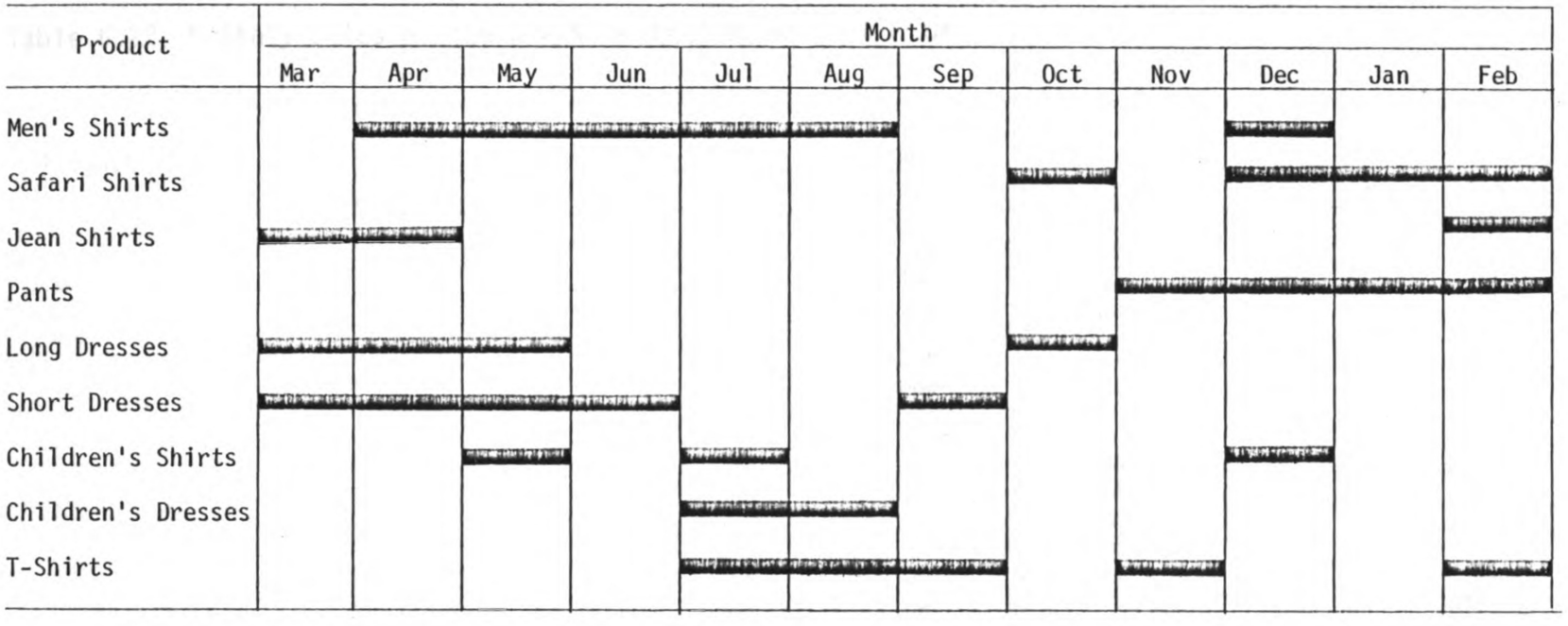
Table 6.21 Monthly Sales of the D-C Ready-Made Garment Firms

Unit:Pieces

Product	Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
Men's Shirts	38	130	112	94	102	98	30	33	29	84	56	72	73.1
Index	51	178	153	129	140	134	41	45	40	115	77	98	100
Safari Shirts				3	1	1	15	31	19	56	80	40	20.5
Index				15	5	5	73	151	93	273	390	195	100
Jean Shirts	60	50	38	36	40	30	38	26	8	20	38	64	36.7
Index	163	136	104	98	109	82	103	71	22	54	104	174	100
Pants	4	4	5	0	18	18	18	20	24	30	60	40	20.0
Index	20	20	25	0	88	88	88	100	120	150	300	200	100
Long Dresses	10	15	10					6					3.4
Index	292	439	292					175					100
Short Dresses	28	28	24	12	7	7	12						9.8
Index	285	285	244	122	71	71	122						100
Children's Shirts	2	0	2	0	4	0	0	1	1	2			1.0
Index	200	0	200	0	200	0	0	100	100	200			100
Children's Dresses					12	12							2.0
Index					600	600							100
T-Shirts					5	5	5	0	8	3	0	16	3.5
Index					143	143	143	0	229	86	0	457	100
Other									4	24	29	12	5.7
Index									70	417	504	209	100

Index for each product is $\frac{\text{monthly sales}}{\text{annual monthly average}} \times 100$

Source: Monthly Questionnaire



Months when Sales were at Least 10 Percent Above
Annual Monthly Average of the D-C Ready-Made Garment Firms

Figure 6.5

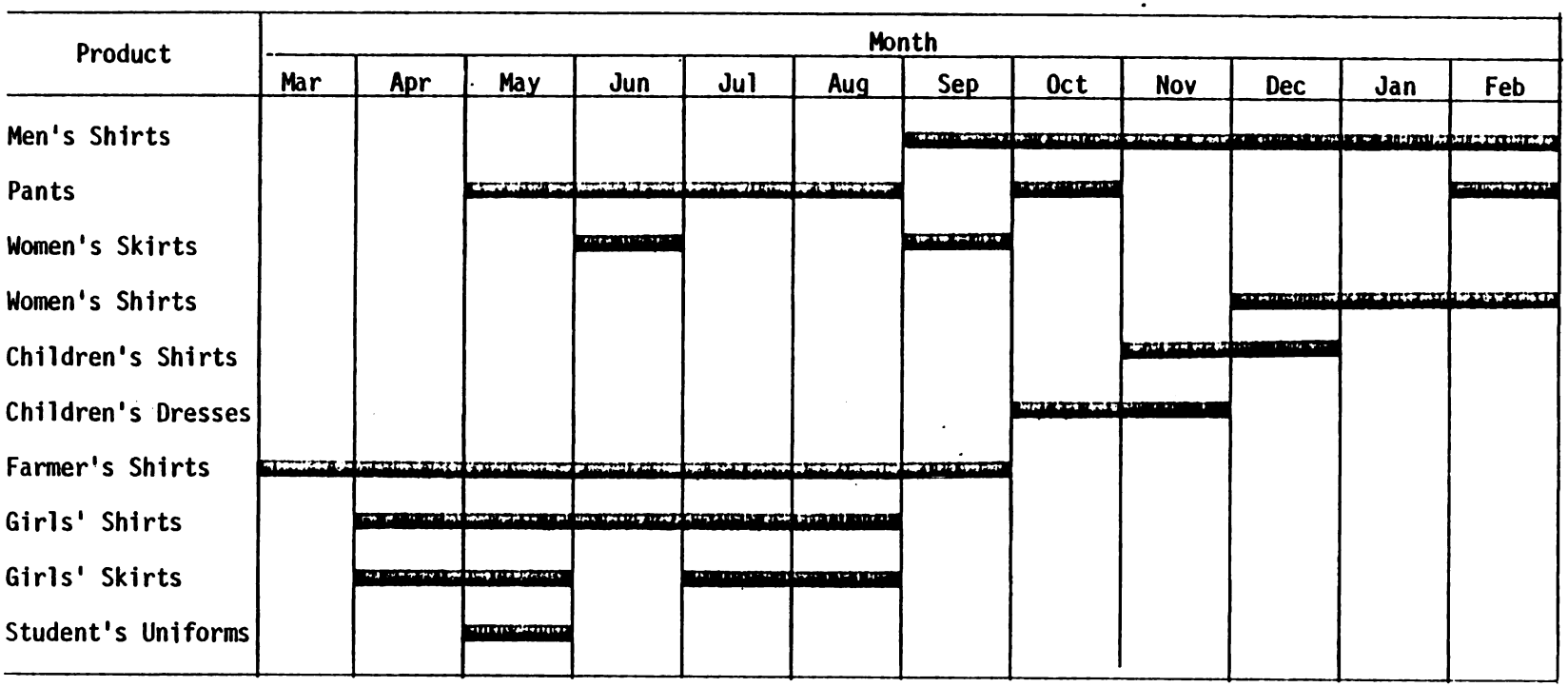
Table 6.22 Monthly Sales of the D-W/R Ready-Made Garment Firms

Unit:Dozens

Product	Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave.
Men's Shirts	0	1	8	0	1	1	42	30	28	28	61	51	21.0
Index	0	5	40	0	5	5	198	143	133	135	292	243	100
Pants			12	5	5	5	0	4				7	3.1
Index			375	160	160	160	0	128				215	100
Women's Skirts				12	0	0	5						.5
Index				240	0	0	1,000						100
Women's Shirts										17	25	30	6.0
Index										277	145	507	100
Children's Shirts									15	5			1.7
Index									904	301			100
Children's Dresses								46	35				6.8
Index								685	515				100
Farmer's Shirts	82	77	77	80	78	75	77	32	19	11	5	2	51.6
Index	160	150	150	156	152	147	150	62	38	22	10	5	100
Girls' Shirts	2	5	7	5	5	5	0	0	2				2.7
Index	92	184	277	184	184	184	0	0	92				100
Girls' Skirts		4	4	1	4	4	0	0	2				1.6
Index		234	234	95	234	234	0	0	158				100
Uniforms			5										.44
Index			1,193										100
Other									50	87	38	89	22.1
Index									226	396	174	403	100

Index for each month is $\frac{\text{monthly sales}}{\text{annual monthly average}} \times 100$

Source: Monthly Questionnaire



Months when Sales were at Least 10 Percent Above
Annual Monthly Average of the D-W/R Ready-Made Garment Firms

Figure 6.6

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for the maximum inventory space of the product. This maximum inventory space is used as one of the constraints in the linear programming model.

6.8.3.1 The Exporting Ready-Made Garment Firm

There were five products out of 13 products for which the firm carried no inventory during the survey period. These products were short dresses, children's dresses, bags, pants, and girls' skirts (Table 6.23). For the rest of the products, except men's shirts, the accumulation of inventory was concentrated during the first seven months of the survey period. The accumulation of men's shirts was concentrated during the last five months of the survey period (see also Table 6.26 and Figure 6.7).

6.8.3.2 The D-C Ready-Made Garment Firm

These firms carried inventory of all the products produced. The firms accumulated pants in inventory nearly every month over the year. However, the firms liquidated many of the pants from inventory in November (Table 6.24). For the rest of the products, except safari shirts and T-shirts, the accumulation of the products in inventory concentrated during the first six months of the survey period. The firm liquidated some of the denim shirts and children shirts from inventory during September to December. For safari shirts and T-shirts, the accumulation of the products in inventory concentrated during the last six months of the survey period (see also Table 6.26 and Figure 6.7).

6.8.3.3 The D-W/R Ready-Made Garment Firm

Student's uniforms and pants were the two products for which the firm carried no inventory (Table 6.25). Women's skirts, children's

Table 6.23 Inventory of Individual Products of the Exporting Ready-Made Garment Firms

Unit:Pieces

	Month											
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Men's Shirts	0[a]	0	0	0			0	12.5	38.8	0	6.3	7.5
	0[b]	0	0	0			0	12.5	51.3	51.3	57.6	65.1
Jean Shirts	0	0	0	0			0	25.0			0	0
	0	0	0	0			0	25.0			25.0	25.0
Skirts	0	0	0	0	8.7	8.7	26.2	-2.5		0	0	
	0	0	0	0	8.7	17.4	43.6	41.1		41.1	41.1	
Short Dresses					0	0		0				
					0	0		0				
Women's Shirts	0	37.5	31.2	218.8	18.7	18.7	62.5	0	0		0	
	0	37.5	68.7	287.5	306.2	324.9	387.4	387.4	387.4		387.4	
Nightgowns	12.5	12.5	12.5	12.5	12.5	12.5	0	0		0	0	0
	12.5	25.0	37.5	50.0	62.5	75.0	75.0	75.0		75.0	75.0	75.0
Children's Shirts	3.1	3.1	3.1	0	0		0	2.5	0			
	3.1	6.2	9.3	9.3	9.3		9.3	11.8	11.8			
Children's Dresses	0	0	0	0	0			0	0		0	
	0	0	0	0	0			0	0		0	
Dolls	25.0	0	25.0	1.2	9.4	9.4	9.4	.6	.3	25.0	0	0
	25.0	25.0	50.0	51.2	60.6	70.0	79.4	80.0	80.3	105.3	105.3	105.3
Bags	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
Pants									0			
									0			
Girls' Skirts								0				
								0				
Other	47.5	47.5	47.5	48.8	0	0		-337.5	3.7	1.2	3.8	5.8
	47.5	95.0	142.5	191.3	191.3	191.3		-146.2	-142.5	-141.3	-137.5	-131.7

[a]The first line of each product is the difference between production and sales.

[b]The second line of each product is cumulative inventory.

Source: Monthly Questionnaire

Table 6.24 Inventory of Individual Products of the D-C Ready-Made Garment Firms

Unit:Pieces

Product	Month											
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Men's Shirts	104.4[a]	-28.0	1	27.0	4.0	42.0	0	9.4	17.0	5.0	4.0	28.0
	104.4[b]	76.4	77.4	104.4	108.4	150.4	150.4	159.8	176.8	181.8	185.8	213.8
Safari Shirts				0	1.0	1.0	5.0	5.0	2.0	2.0	8.0	10.0
				0	1.0	2.0	7.0	12.0	14.0	16.0	24.0	34.0
Jean Shirts	13.0	24.0	35.0	6.0	14.0	6.0	-5.8	10.0	-.8	0	8.0	-14.0
	13.0	37.0	72.0	78.0	92.0	98.0	92.2	102.2	101.4	101.4	109.4	95.4
Pants	5.0	2.0	4.0	0	2.4	2.4	2.4	2.0	-10.0	2.0	2.0	0
	5.0	7.0	11.0	11.0	13.4	15.8	18.2	20.2	10.2	12.2	14.2	14.2
Skirts	4.0	-4.0	4.0	0	0	0	0	0				
	4.0	0	4.0	4.0	4.0	4.0	4.0	4.0				
Short Dresses	0	-4.0	4.0	4.0	3.0	3.0	12.0					
	0	-4.0	0	4.0	7.0	10.0	22.0					
Children's Shirts	2.0	0	2.0	0	2.0	0	-.4	-1.0	-1.0	-2.0		
	2.0	2.0	4.0	4.0	6.0	6.0	5.6	4.6	3.6	1.6		
Children's Dresses					4.0	4.0						
					4.0	8.0						
T-Shirts					1.0	1.0	1.0	0	6.0	-3.0	0	4.0
					1.0	2.0	3.0	3.0	9.0	6.0	6.0	10.0
Other									-4.0	6.0	7.0	0
									-4.0	2.0	9.0	9.0

[a]The first line is the difference between production and sales.

[b]The second line is cumulative inventory.

Source: Monthly Questionnaire

Table 6.25 Inventory of Individual Products of the D-W/R Ready-Made Garment Firms

Unit:Dozens

Product	Month											
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Men's Shirts		1.2[a]	1.7	1.2	1.2	6.3	-2.5	0	13.5	5.5	15.0	
		1.2[b]	2.9	4.2	5.4	11.7	9.2	9.2	22.7	28.2	43.2	
Pants			0	0	0	0		0				0
			0	0	0	0		0				0
Women's Skirts				.5			-2.5					
				.5			-2.0					
Women's Shirts										2.5	2.7	3.0
										2.5	5.3	8.3
Children's Shirts									-15.0	0		
									-15.0	-15.0		
Children's Dresses								-22.5	5.0			
								-22.5	-17.5			
Farmer's Shirts	0	4.2	4.2	49.5	10.3	4.3	5.3	4.2	1.0	2.0	0	0
	0	4.2	8.4	57.9	68.2	72.5	77.8	82.0	83.0	85.0	85.0	85.0
Girls' Shirts	5.0	5.0	2.5	5.0	5.0			-2.5				
	5.0	10.0	12.5	17.5	22.5			20.0				
Girls' Skirts		1.3	0	-1.5	1.3	1.3		-2.5				
		1.3	1.3	-.2	1.1	2.4		-.1				
Student's Uniforms			0									
			0									
Other									25.0	12.5	31.7	25.0
									25.0	37.5	69.2	94.2

[a]The first line of each product is the difference between production and sales.

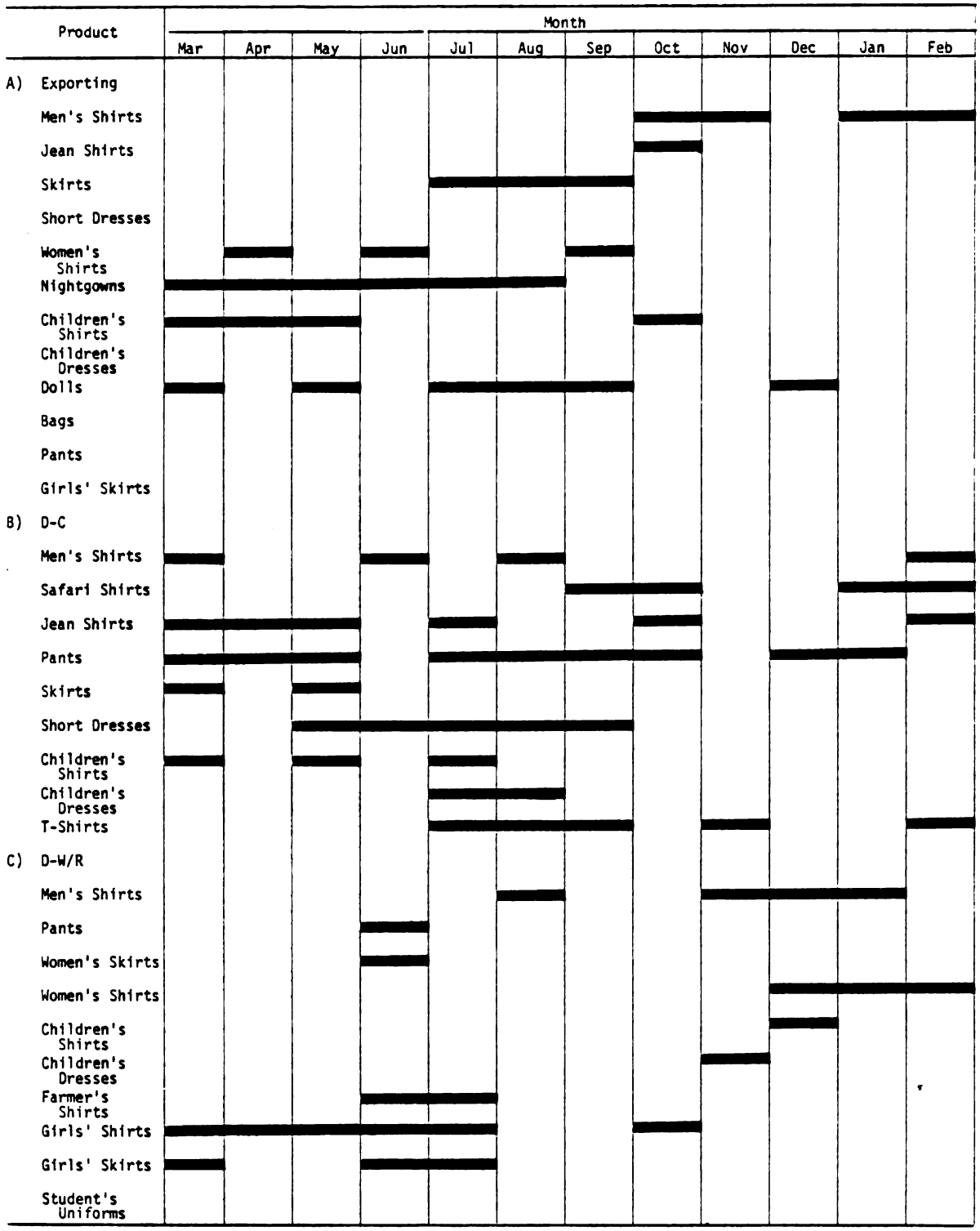
[b]The second line of each product is cumulative inventory.

Source: Monthly Questionnaire

Table 6.26 Ratio of Monthly Inventory/Annual Monthly Average of Ready-Made Garment Firms

Product	Month												
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ave
A) Exporting													
Men's Shirts								2.30	7.15		1.16	1.38	5.42
Jean Shirts								12					2.08
Skirts					2.54	2.54	7.65	-.73					3.43
Short Dresses													0
Women's Shirts		1.16	.97	6.77	.58	.58	1.93						32.28
Nightgowns	2	2	2	2	2	2							6.25
Children's Shirts	3.15	3.15	3.15					2.54					.98
Children's Dresses													0
Dolls	2.84		2.84	.14	1.07	1.07	1.07	.07	.03	2.84			8.77
Bags													0
Pants													0
Girls' Skirts													0
B) D-C													
Men's Shirts	5.86	1.57	.06	1.51	.22	2.35	0	.53	.95	.28	.22	1.57	17.82
Safari Shirts				0	.35	.35	1.76	1.76	.71	.71	2.83	3.53	2.83
Jean Shirts	1.63	3.01	4.40	.75	1.76	.75	-.73	1.26	-.10	0	1.00	1.76	7.95
Pants	4.22	1.69	3.38	0	2.03	2.03	2.03	1.69	-8.45	1.69	1.69	0	1.18
Skirts	4.00	-4.00	4.00										1.00
Short Dresses		-2.18	2.18	2.18	1.64	1.64	6.54						1.83
Children's Shirts	15.00	0	15.00	0	15.00	0	-3.00	-7.50	-7.50	-15.0			.13
Children's Dresses					6.00	6.00		.					.67
T-Shirts					1.20	1.20	1.20	0	7.20	-3.60	0	4.80	.83
C) D-W/R													
Men's Shirts		.33	.48	.35	.35	1.75	-.69	0	3.74	1.53	4.16		3.60
Pants													0
Women's Skirts				3.00			-15.0						-.17
Women's Shirts										3.61	3.97	4.34	.69
Children's Shirts									-12.0				-1.25
Children's Dresses								-15.43	3.43				-1.46
Farmer's Shirts	0	.59	.59	6.98	1.45	.61	.75	.60	.14	.28	0	0	7.09
Girls' Shirts	3.00	3.00	1.50	3.00	3.00			1.50					1.67
Girls' Skirts	156.0	0	-180.	156.0	156.0		-300.						-.008
Student's Uniforms			0										

Source: Calculate, Monthly Questionnaire



Source: Calculate from table 6.26.

Months When Inventory was at Least 10 Percent Above Annual Monthly Average

Figure 6.7

shirts, children's dresses, and school girls' skirts were the products which the liquidations were greater than the accumulation. In other words, the net accumulation of inventory of these products were negative. Some of the amount sold were withdrawn from inventory carried over from the previous year. The liquidation of the products concentrated during September to November. For the rest of the products, the accumulation of farmer's shirts and school girls' skirts in inventory concentrated during the first five months of the survey period and the accumulation of men's shirts and women's shirts in inventory concentrated during the last four months of the survey period (see also Table 6.26 and Figure 6.7).

6.8.4 Output Channels and Implications for Cash Inflow

This section tries to identify what the important channels of ready-made garment products are, as well as the content of cash sales, credit sales, and down payments of each channel. This information is not used in the construction of the linear programming model. Yet it provides some clues about cash inflow into the firm through each channel. As was the case for the discussion of the acquisition of raw materials, the presentation is in terms of number of firms, not in terms of monetary values.

Besides selling products in domestic markets directly to consumers, through wholesalers and retailers, some group of ready-made garment firms sold some of their products to foreign export markets (Table 6.27).

For each channel the sales transactions may be classified into 3 types: cash, combination of cash and credit, and down payment with cash on delivery. Cash means the buyers paid cash for the full value of the product purchased at time of purchase. Cash and credit means that the

Table 6.27 Output Channel and Pattern of Payment of Ready-Made Garment Firms

Product	No. of Firm Produced	No. of Firm Reported	Channel											
			Consumer			Wholesaler			Retailer			Export		
			Cash	Cash + Credit	Cash + Down	Cash	Cash + Credit	Cash + Down	Cash	Cash + Credit	Cash + Down	Cash	Cash + Credit	Cash + Down
A) Exporting: Total Number of Firm = 8														
Dresses	3	3	1				2						1	1
Women's Shirts	7	7	4			1	4			1			3	3
Men's Shirts	5	3	2				1	1		1				2
Children's Shirts	3	2	2					1		1				2
Bags	1	1	1				1						1	
Dolls	1	1	1				1							
B) D-C: Total Number of Firm = 5														
Men's Shirts	5	3	3						1					
Jean Shirts	3	2	2							1				
Safari Shirts	4	1	1											
Dresses	1	1	1						1					
Pants	2	2	2						1					
Children's Shirts	1	1	1											
C) D-W/R: Total Number of Firm = 4														
Men's Shirts	3	3				1			3					
Farmer's Shirts	4	2				1			2					
Women's Shirts	3	3	1			2			2					
Children's Shirts	1	1	1			2			2					
Student's Products	3	3	1			1			1	1				

Source: Marketing Questionnaire

firms provided some trade credit to buyers. The buyers paid for some of the full value of the merchandise in cash on the purchased date and paid for the rest later. The down payment with cash payment on delivery is self-explanatory.

6.8.4.1 Output Channel

In terms of number, consumer, wholesalers and export are the main channels of the exporting ready-made garment firms. Consumers were the most important channel of the D-C ready-made garment firms, and wholesalers and retailers were the most important channels of the D-W/R ready-made garment firms (Table 6.27).

6.8.4.2 Implication on Cash Inflow

6.8.4.2.1 The Exporting Ready-Made Garment Firm

All the sales directly to consumers were made in cash. Most of the firms which sold some of their products through wholesalers and retailers provided trade credit to both wholesalers and retailers. The firms usually asked for some down payments from buyers when they exported products to other foreign markets. Therefore, the more the sales were made directly to consumers and/or to the export outlets, the higher the level of cash inflow into the firms.

6.8.4.2.2 The D-C and D-W/R Ready-Made Garment Firms

Marketing channels for these firms had very little impact on the inflow of cash into the firm since all the sales that were made directly to consumers and through wholesalers were made in cash and very small number of firms provided trade credit to retailers (Table 6.27).

6.8.5 Credit Sales

The previous section indicated that the D-C and D-W/R ready-made garment firms rarely provided trade credit to their buyers, while the exporting ready-made garment firms provided some trade credit to the wholesaler and export customers. This section presents the share of total sales that were in the form of credit. This information will be used in the LP model specification for the combination of credit sales and cash sales which affected cash inflow into the firms as well as demand for credit in the construction of the model.

In this presentation, credit sales as a share of total is computed for all firms which amounted to an average weighted by the total sales of each firm. For exporting firms 22 percent of total sales were credit sales, and 13 percent and 9 percent of total sales of the D-C and D-W/R ready-made garment firms were credit sales respectively (Table 6.28). Therefore, the demand for credit of the exporting ready-made garment firms appears higher than for the other two groups of ready-made garment firms.

6.8.6 Prices of Product

This section describes the seasonal variation in the prices of a specific product over the survey period. This information will be used in the specification of prices for specific products in each period in the linear programming model.

Price of products produced by the exporting, D-C and D-W/R ready-made garment firms are reported in Table 6.29.

As was the case for the cement product firms, prices reported here are weighted average prices. Since the weights, i.e. size, design and

Table 6.28 Trade Credit Provided by Ready-Made Garment Firms

Type of Firm	Firm	Percentage of Credit Sales to Total Sales	Weights
A) Exporting	581216	5	.21
	571218	30	.35
	571221	20	.07
	581222	35	.22
	561223	10	.07
	561224	10	.02
	561225	20	.03
	571227	0	.04
	Weighted Average	22	
B) D-C	511103	0	.07
	521105	10	.21
	521106	20	.49
	521107	0	.07
	521208	10	.16
	Weighted Average	13	
C) D-W/R	562101	40	.17
	562102	5	.43
	562103	0	.32
	562104	0	.09
	Weighted Average	9	

Source: Finance Questionnaire and Monthly Questionnaire

Table 6.29 Prices of Products of Ready-Made Garment Firms

Unit:Baht/Piece

Product	Month											
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
A) Exporting												
Men's Shirts	42	42	42	25			22	57	50	33		25
Jean Shirts	19	19	19	19			20	20		60	45	
Skirts	77	77	77	77	57	57	60	110		60	60	
Short Dresses					70	70		70				
Women's Shirts	39	39	39	37	39	39	38	53	71		65	
Nightgowns	45	45	45	45	45	45	50	47		48	48	48
Children's Shirts	14	14	14	14	9		14	18	9			
Children's Dresses	25	25	25	25	25	25			50	30		20
Dolls	28	28	28	39	40	40	40	29	27	24	36	19
Bags	36	36	36	30	30	30	26	25	25	28	31	31
Pants									60			
Girls' Skirts								85				
B) D-C												
Men's Shirts	113	113	113	112	118	117	115	100	95	119	140	115
Safari Shirts				230	150	150	135	103	148	166	117	160
Jean Shirts	107	104	104	105	113	115	110	110	120	100	110	
Pants	150	150	150		177	177	177	115	165	180	180	100
Shirts	200	200	200					140				
Short Dresses	165	165	165	170	170	170	120					
Children's Shirts	50		50		50		55	55	60	50		
Children's Dresses					38	38						
T-Shirts					130	130	130		120	150		100
C) D-W/R[a]												
Men's Shirts		348	421		348	348	424	486	460	411	460	454
Pants			180	170	170	170		140				155
Women's Skirts					540		540					
Women's Shirts										363	396	352
Children's Shirts									96	240		
Children's Dresses								231	223			
Farmer's Shirts	387	387	377	379	361	358				163	180	180
Girls' Shirts	180	180	180	180	180	180			180			
Girls' Skirts		300	300	300	300	300			300			
Student's Uniforms		568										

Source: Monthly Questionnaire

[a]Price per dozen.

material used, changed over time, it was impossible to detect seasonal price variations of a specific product. However, there was evidence that the firms kept the price of the product of the same design, material and size constant for a period of time or for as long as the supply of a particular garment lasted.

6.9 Financial Characteristics

This section contains information on outstanding short-term and long-term debt at various sources, assets and rate of interest paid to lenders.

The information on long-term debt will be used later in the research to calculate the principal repayment of long-term debt as well as the interest on outstanding long-term debt. They represent financial commitments of the firm which also seem important; therefore, they are specified in the linear programming model.

The information on debt outstanding at the commercial bank for both short-term and long-term (loans) is used to specify the size of loan the firm is able to borrow from the commercial bank.

The information on current assets and current liabilities is used to provide guidance for specification of the constraint for borrowed money in each period.

The information on fixed assets and equity are presented to further describe the financial structure of the firm.

Information on the rate of interest is used directly in the construction of the model to calculate interest payment in each period.

6.9.1 Debt and Assets

Total investment or total assets of the D-W/R ready-made garment firms was around 3 times and 4 times the total assets of the D-C and the exporting ready-made garment firms respectively (Table 6.30). Whereas 80 percent of the total investment of the D-C and D-W/R garment firms were in the form of fixed assets, only 60 percent of the total investment of exporting ready-made garment firms was in the form of fixed assets.

The ratio of total debt/total assets indicates that 35 percent, 49 percent and 57 percent of total investment of the D-W/R, D-C, and exporting ready-made garment firms respectively were financed by borrowings.

The ratio of long-term debt/total debt indicates that while 80 percent of total debt outstanding of the D-W/R ready-made garment firms was long-term, around 70 percent and 40 percent of total outstanding debt of the exporting and the D-C ready-made garment firms were long-term.

Most of the long-term debt of the exporting and the D-W/R ready-made garment firms was outstanding to the commercial bank, while most of the long-term debt of the D-C ready-made garment firms was outstanding to friends and relatives. In other words, excluding equity capital, the commercial bank provided the most important source of long-term capital for the exporting and D-W/R ready-made garment firms, while friends and relatives were the most important source of long-term capital for the D-C ready-made garment firms.

The ratio of short-term debt/total debt indicates that 60 percent of total debt outstanding of the D-C ready-made garment firms was

Table 6.30 Debt-Assets Structure of Ready-Made Garment Firms

	Type of Firm					
	Exporting		D-C		D-W/R	
	%	Value	%	Value	%	Value
Current Assets (CA						
Accounts Receivable	13	17,562	25	16,000	34	71,250
Inventory: Product	69	94,375	51	32,200	28	57,725
Raw Material	18	25,354	24	14,642	38	79,385
Total	100	137,291	100	62,842	100	208,360
Fixed Assets (FA)						
Land	41	44,317[a]	44	96,340	14	112,750
Building	27	29,468[a]	48	105,623	55	434,785
Vehicle	8	8,854	3	6,827	21	169,523
Machinery	24	25,824	5	10,207	10	76,723
Total	100	108,463	100	218,997	100	793,781
Total Assets (TA)		245,754		281,839		1,002,141
Short-Term Debt (STD)						
Commercial Banks		-	69	60,000		-
Credit Associations	7	3,125		-	85	41,650
Friends and Relatives		-		-	15	7,500
Input Suppliers	93	42,687	31	27,500		-
Total	100	45,812	100	87,500	100	49,150
Long-Term Debt (LTD)						
Commercial Banks	93	88,750	22	11,500	84	250,000
Credit Associations	7	6,250	1	400	6	18,750
Friends and Relatives		-	77	40,000	10	30,000
Input Suppliers		-		-		-
Total	100	95,000	100	51,900	100	298,750
Total Debt (TD)	57	140,812	49	139,400	35	347,900
Equity (E)	43	104,942	51	142,439	65	654,241
Total Debt and Equity	100	245,754	100	281,839	100	1,002,141
CA/TA		.44		.22		.21
FA/TA		.56		.78		.79
STD/TD		.32		.63		.14
LTD/TD		.68		.37		.86
TD/TA		.57		.49		.35

Source: Finance Questionnaire

[a]Some of the firms did not report the value of land and building because the factories were a part of the family residence.

short-term, while only 30 percent and 14 percent of total outstanding debt of the exporting and the D-W/R ready-made garment firms were short-term. More than 40 percent of the short-term debt of the exporting ready-made garment firms was outstanding at input suppliers, whereas 70 percent and 85 percent of the short-term debt of the D-C and D-W/R ready-made garment firms were outstanding at the commercial bank and credit associations, respectively. In other words, input supplier, the commercial bank, and credit association were the most important sources of short-term capital of the exporting, the D-C, and the D-W/R ready-made garment firms, respectively.

6.9.2 Rate of Interest

The firms paid an 18 percent rate of interest on the funds borrowed from the commercial bank and paid an 18-24 percent rate of interest on the funds borrowed from friend and relative. However, some firms paid only a 15 percent rate of interest for the money borrowed from the commercial bank. This phenomenon occurred whenever the firms pledging their savings deposits as collateral and the amount borrowed was less than the amount of savings. Rate of interest and carrying charges paid to input suppliers was reported earlier in section 6.7.3.4. As was the case for cement product firms, the data collected were inadequate for computing the rate of interest paid to credit associations.

CHAPTER 7

THE BASIC MODELS OF THE READY-MADE GARMENT INDUSTRY

This chapter provides a description of the basic model for each group of ready-made garment firms, and a discussion of some expectations of the results, the actual results and a comparison between the expectations and the actual results of the basic models.

7.1 The Basic Models

Given the structure of the generalized model specified in Chapter 2, this section will specify the products to be included in the basic model, and a full specifications of constraints, coefficients in the objective function and coefficients of various (column) activities of each type of ready-made garment firms, i.e., the exporting, D-C and D-W/R ready-made garment firms.

7.1.1 Types of Products in the Basic Models

The products included in the basic model are those produced by nearly all by the sample firms. Most products are produced in large quantity.

The basic exporting ready-made garment firm is assumed to produce men's shirts, women's shirts, children's shirts, and long dresses. The basic D-C ready-made garment firm is assumed to produce men's shirts, denim shirts and safari shirts. Men's shirts, women's shirts, and farmer's shirts are the products produced by the basic D-W/R ready-made garment firm.

7.1.2 The Constraints

7.1.2.1 Inventory and Expected Demand Constraints

The right hand side values of inventory and expected demand constraints of each product in each period of the three types of ready-made garment firms are shown in Table 7.1. These right hand side values are drawn from sections 6.8.3 and 6.8.2 of the previous chapter. The maximum level of inventory is the maximum level of cumulative inventory the firm has had, and the expected demand is equal to the observed quantity sold of the products.

7.1.2.2 Machinery Constraint

As was mentioned in section 6.5.2, the machine to finish the edge of the fabrics is the only type of machine to be specified in the model. Every product makes use of this machine. The maximum production capacity of the machine in each period for each type of ready-made garment firm is drawn from section 6.5.3 and is shown in Table 7.1. The maximum capacity is expressed in terms of the total amount of time available to be used.

7.1.2.3 Fixed Financial Commitments

As was the case of cement product industry, fixed financial commitments that must be met in every period includes dividends, interest payment on long-term debt, and principal repayment of long-term debt. Dividends are a cash drain out on the business earnings, basically, for household consumption. The firm is assumed to pay 18 percent interest on the outstanding long-term debt every period and is assumed to pay 1/10 of the outstanding in period four. These fixed financial commitments for every type of ready-made garment firm in every period are shown in Table 7.2.

Table 7.1 Inventory, Expected Demand, and Machinery Constraints of the Basic Ready-Made Garment Firms

		Type of Firm								
		Exporting			D-C			D-W/R		
Product	Period	I	ED	M	I	ED	M	I	ED	M
Men's Shirts	1	65	300		215	270		500	115	
	2	65	60		215	294		500	25	
	3	65	225		215	93		500	1,200	
	4	65	270		215	213		500	1,692	
Long Dresses	1	45	1,500							
	2	45	770							
	3	45	40	108,000						
	4	45	440							
Women's Shirts	1	390	4,275					100	-	
	2	390	4,600					100	-	
	3	390	2,050					100	-	
	4	390	125					100	900	
Children's Shirts	1	12	1,150							
	2	12	500				36,000			72,000
	3	12	285							
	4	12	-							
Jean Shirts	1				110	150				
	2				110	105				
	3				110	72				
	4				110	123				
Safari Shirts	1				35	-				
	2				35	6				
	3				35	66				
	4				35	180				
Farmer's Shirts	1							1,000	2,900	
	2							1,000	2,900	
	3							1,000	1,550	
	4							1,000	225	

I = Inventory
ED = Expected Demand
M = Machinery

Table 7.2 Fixed Financial Commitments, Borrowing, and Credit Sales Constraints of the Basic Ready-Made Garment Firms

	Type of Firm		
	Exporting	D-C	D-W/R
Fixed Financial Commitments			
1. Interest on Long-Term Debt	4,300	2,350	13,500
2. Principal Repayment of Long-Term Debt	9,500	5,190	30,000
3. Dividends	6,000	6,000	6,000
Borrowing			
1. Commercial Bank	22,000	18,000	62,500
2. Total Outstanding	22,500	43,750	50,000
3. Input Suppliers	50%	55%	40%
Credit Sales			
1. Percentage of Credit Sales to Total Sales	20%	15%	10%

The debt-assets structure of the firms at the beginning of the first period are shown in Appendix A, Table A-2. These debt-assets structures are basically the same as those described in section 6.9.1, except that there are some modifications in the current assets section to make them conform to the assumptions specified in Chapter 2 (the generalized model).

7.1.2.4 Borrowing Constraints

7.1.2.4.1 The Commercial Bank

In any period, each of the basic ready-made garment firms is allowed to borrow not more than 25 percent of total outstanding short-term and long-term debt at the commercial bank. The amounts are shown in Table 7.2.

7.1.2.4.2 Total Debt Outstanding

In any period, for each of the basic ready-made garment firms, the total amount of debt outstanding at the commercial bank cannot exceed 50 percent of total current liabilities. However, for the D-W/R ready-made garment firm, the total amount outstanding is equal to 100 percent of total current liabilities, since the 50 percent figure is considered to be too low, compared to the ability to borrow up to 25 percent of the outstanding at commercial bank specified in the above section. The amounts of allowable total outstanding debt for each of the basic firms are shown in Table 7.2.

7.1.2.4.3 Input Suppliers

In any period, each of the basic ready-made garment firms is allowed to borrow from input suppliers up to a certain limit. This limit is specified as a percentage of total raw material cost and is also shown in

Table 7.2. The limit is equal to 1 minus the percentage of cash purchases mentioned in section 6.3.4.

7.1.2.5 Credit Sales Constraint

The percentage that credit sales are of total sales for each of the basic ready-made garment firms is also shown in Table 7.2. These coefficients were obtained from section 6.8.5.

7.1.3 The Objective Function

Each of the basic ready-made garment firms is assumed to maximize net return to fixed assets, family labor and equity capital. This net return is equal to gross sales minus expenses for raw material, labor, overhead and interest. The information on raw material cost per unit, cash price, and credit price of specific products in each period is shown in Table 7.3. The information on wage rate, overhead cost, and interest cost will be discussed in section 7.1.4.

Information on raw material cost per unit and cash price was obtained from the profitability questionnaire. Since it was noted in section 6.8.6 that the firm tended to keep the price of a specific product constant over a period of time or for as long as the supply lasts, then it is assumed in the model that price (both cash and credit) of a specific product is the same in every period. The specification of credit price at 10 percent above cash price follows the same reasoning as that discussed for constructing the cement product industry models (see section 4.3). The seasonal variation in raw material prices per units follows the pattern described in the previous chapter.

Table 7.3 Raw Material Cost per Unit, Cash Price, and Credit Price of the Basic Ready-Made Garment Firms

		Type of Firm								
		Exporting			D-C			D-W/R		
Product	Period	RMC	Cash Price	Credit Price	RMC	Cash Price	Credit Price	RMC	Cash Price	Credit Price
Men's Shirts	1	20.1	32.0	32.8	57.2	115.0	117.9	20.8	29.0	29.7
	2	21.3	32.0	32.8	56.6	115.0	117.9	21.3	29.0	29.7
	3	18.8	32.0	32.8	55.5	115.0	117.9	20.0	29.0	29.7
	4	18.8	32.0	32.8	57.7	115.0	117.9	20.2	29.0	29.7
Long Dresses	1	56.1	86.7	88.8						
	2	59.2	86.7	88.8						
	3	53.0	86.7	88.8						
	4	53.1	86.7	88.8						
Women's Shirts	1	25.5	45.0	46.1				8.6	12.5	12.8
	2	27.0	45.0	46.1				8.8	12.5	12.8
	3	24.0	45.0	46.1				8.2	12.5	12.8
	4	24.0	45.0	46.1				8.3	12.5	12.8
Children's Shirts	1	12.9	20.7	21.2						
	2	13.4	20.7	21.2						
	3	12.4	20.7	21.2						
	4	12.4	20.7	21.2						
Jean Shirts	1				43.2	105.0	107.6			
	2				42.8	105.0	107.6			
	3				42.2	105.0	107.6			
	4				43.5	105.0	107.6			
Safari Shirts	1				53.7	130.0	133.2			
	2				53.2	130.0	133.2			
	3				52.1	130.0	133.2			
	4				54.5	130.0	133.2			
Farmer's Shirts	1							21.1	32.7	33.5
	2							21.7	32.7	33.5
	3							20.3	32.7	33.5
	4							20.4	32.7	33.5

RMC = Raw Material Cost

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7.1.4 Other Coefficients

This section provides the a_{ij} values for coefficients which are not equal to $\pm$ 1 which are associated with the production, selling and other activities. The coefficients which are equal to $\pm$ 1 may be observed directly from linear programming tableau (Figure 2.1).

7.1.4.1 Production Activities

Labor requirement and overhead cost per unit of output are the coefficients of production activities which are not equal to $\pm$ 1. The coefficients for the labor requirement and overhead cost per unit of output of the basic exporting ready-made garment firms are shown in Table 7.4, and those for the basic D-C, and D-W/R ready-made garment firms are shown in Table 7.5. The information on labor requirement and overhead cost per unit are drawn from section 6.6.6 and 6.7.3, respectively.

7.1.4.2 Selling Activities

The firm is assumed to pay a 2 percent tax rate on gross sales of both cash and credit sales. The information on tax rate is drawn from Sangwanruang, et. al. (1978). The amount of tax that each basic ready-made garment firm must pay is shown in Table 7.4 and 7.5.

7.1.4.3 Cost of Hiring Workers Activities

The information on wage rate per man-day for each of the basic ready-made garment firms to be paid to both skilled and unskilled workers is shown in Table 7.6. The information is drawn from section 6.6.5. Wage rate in the first period is an interpolation of wage rates from the fourth to the second periods.

Table 7.4 Labor Requirements, Overhead Costs and Tax Expenses per Unit of Output of the Basic Exporting Ready-Made Garment Firm

Product	Period	Labor Requirement		Over-head Cost	Tax Expenses	
		Skilled	Un-skilled		Cash Sales	Credit Sales
Men's Shirts	1	.094	-	2.04	.64	.66
	2	.094	-	2.04	.64	.66
	3	.094	--	2.04	.64	.66
	4	.094	-	2.04	.64	.66
Long Dresses	1	.159	.008	5.53	1.73	1.78
	2	.159	.008	5.53	1.73	1.78
	3	.159	.008	5.53	1.73	1.78
	4	.159	.008	5.53	1.73	1.78
Women's Shirts	1	.094	-	2.87	.90	.92
	2	.094	-	2.87	.90	.92
	3	.094	-	2.87	.90	.92
	4	.094	-	2.87	.90	.92
Children's Shirts	1	.042	-	1.32	.41	.42
	2	.042	-	1.32	.41	.42
	3	.042	-	1.32	.41	.42
	4	.042	-	1.32	.41	.42

Table 7.5 Labor Requirements, Overhead Costs, and Tax Expenses per Unit of Output of the Basic D-C and D-W/R Ready-Made Garment Firms

	Product	Period	Labor Requirement		Over-head Cost	Tax Expenses	
			Skilled	Un-skilled		Cash Sales	Credit Sales
A)	D-C						
	Men's Shirts	1	.36	-	5.90	2.30	2.36
		2	.36	-	5.90	2.30	2.36
		3	.36	-	5.90	2.30	2.36
		4	.36	-	5.90	2.30	2.36
	Jean Shirts	1	.25	-	5.39	2.10	2.15
		2	.25	-	5.39	2.10	2.15
		3	.25	-	5.39	2.10	2.15
		4	.25	-	5.39	2.10	2.15
	Safari Shirts	1	.30	-	6.67	2.60	2.67
		2	.30	-	6.67	2.60	2.67
		3	.30	-	6.67	2.60	2.67
		4	.30	-	6.67	2.60	2.67
B)	D-W/R						
	Men's Shirts	1	.05	.03	1.85	.58	.59
		2	.05	.03	1.85	.58	.59
		3	.05	.03	1.85	.58	.59
		4	.05	.03	1.85	.58	.59
	Women's Shirts	1	.01	.01	.80	.25	.26
		2	.01	.01	.80	.25	.26
		3	.01	.01	.80	.25	.26
		4	.01	.01	.80	.25	.26
	Farmer's Shirts	1	.04	.05	2.09	.65	.67
		2	.04	.05	2.09	.65	.67
		3	.04	.05	2.09	.65	.67
		4	.04	.05	2.09	.65	.67

Table 7.6 Wage Rate and Interest Rate of the Basic Ready-Made Garment Firms

Table 7.6 Wage Rate and Interest Rate of the Basic Ready-Made Garment Firms

	Period			
	1	2	3	4
A) Exporting				
Wage Rate				
Skilled	37.10	35.33	32.13	38.87
Unskilled	15.83	16.67	15.00	15.00
Interest Rate				
Borrowing:				
Commercial Bank	.045	.045	.045	.045
Input Suppliers	.130	.130	.130	.130
Savings	.011	.011	.011	.011
B) D-C				
Wage Rate				
Skilled	59.60	58.52	40.00	60.69
Unskilled	-	-	-	-
Interest Rate				
Borrowing:				
Commercial Bank	.045	.045	.045	.045
Input Suppliers	.135	.135	.135	.135
Savings	.011	.011	.011	.011
C) D-W/R				
Wage Rate				
Skilled	24.78	23.13	23.94	26.43
Unskilled	17.16	16.00	16.50	18.33
Interest Rate				
Borrowing:				
Commercial Bank	.045	.045	.045	.045
Input Suppliers	.120	.120	.120	.120
Savings	.011	.011	.011	.011

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7.1.4.4 Interest Paid and Interest Received Activities

The rate of interest per period of each of the basic ready-made garment firms paid to the commercial bank and input suppliers, and the rate of interest per period the firm receives on its savings account are shown in Table 7.6. The information on rate of interest paid is derived from sections 6.4.5 and 6.9.2, and rate of interest received from savings comes from the discussion in section 4.2.3.

7.1.4.5 Coefficients for Production, Cash Selling and Credit Selling Activities in Cash Flow Constraint

Cash flow behavior for the basic firm differs according to whether the so-called conservative or the liberal approach is followed because the pattern of cash payment for raw materials and cash inflow from cash selling and credit selling differ. The coefficients of cash inflow and cash outflow per unit of product produced and sold under the different approaches of the basic exporting ready-made garment firm are shown in Table 7.7 and those of the basic D-C and D-W/R ready-made garment firms are shown in Table 7.8.

7.2 Some Expectations

In this section, expected results for individual types and among firm types will be discussed.

7.2.1 Expectations Within a Type of Basic Ready-Made Garment Firm

1. It is expected that the firm which operates under the liberal approach will borrow more from a commercial bank than the firm operating under the conservative approach.

Table 7.7 Coefficients of Production, Cash Selling, and Credit Selling Activities of Cash Flow Constraint of the Basic Exporting Ready-Made Garment Firm

Table 7.7 Coefficients of Production, Cash Selling, and Credit Selling Activities of Cash Flow Constraint of the Basic Exporting Ready-Made Garment Firm

		Liberal			Conservative		
			Cash Inflow From		Raw Material		Cash
Product	Period	Raw Material	Cash Sales	Credit Sales	Cash Purchases	Credit Purchases	Inflow From Cash Sales
Men's Shirts	1	20.07	32.00		11.81		32.00
	2	21.32	32.00	32.80	12.54	13.35	32.00
	3	18.82	32.00	32.80	11.07	14.17	32.00
	4	18.82	32.00	32.80	11.07	12.51	32.00
Long Dresses	1	56.13	86.70		28.07		86.70
	2	59.17	86.70	88.80	29.59	31.72	86.70
	3	53.08	86.70	88.80	26.54	33.44	86.70
	4	53.08	86.70	88.80	26.54	30.00	86.70
Women's Shirts	1	25.53	45.00		12.77		45.00
	2	27.05	45.00	46.10	13.53	14.43	45.00
	3	24.00	45.00	46.10	12.00	15.29	45.00
	4	24.00	45.00	46.10	12.00	13.56	45.00
Children's Shirts	1	12.89	20.70		6.45		20.70
	2	13.40	20.70	21.20	6.70	7.29	20.70
	3	12.37	20.70	21.20	6.19	7.57	20.70
	4	12.37	20.70	21.20	6.19	6.99	20.70

Table 7.8 Coefficients of Production, Cash Selling, and Credit Selling Activities of Cash Flow Constraint of the Basic D-C and D-W/R Ready-Made Garment Firms

Table 7.8 Coefficients of Production, Cash Selling, and Credit Selling Activities of Cash Flow Constraint of the Basic D-C and D-W/R Ready-Made Garment Firms

			Liberal			Conservative		
				Cash Inflow From		Raw Material		Cash
	Product	Period	Raw Material	Cash Sales	Credit Sales	Cash Purchases	Credit Purchases	Inflow From Cash Sales
A)	D-C							
	Men's Shirts	1	57.16	115.00		25.72		115.00
		2	56.60	115.00	117.90	25.47	35.68	115.00
		3	55.50	115.00	117.90	24.98	35.33	115.00
		4	59.72	115.00	117.90	25.97	34.65	115.00
	Jean Shirts	1	43.16	105.00		19.42		105.00
		2	42.86	105.00	107.60	19.29	26.94	105.00
		3	42.25	105.00	107.60	19.01	26.76	105.00
		4	43.46	105.00	107.60	19.56	26.37	105.00
	Safari Shirts	1	53.72	130.00		24.17		130.00
		2	53.20	130.00	133.25	23.94	33.53	130.00
		3	52.17	130.00	133.25	23.48	33.21	130.00
		4	54.56	130.00	133.25	24.55	32.57	130.00
B)	D-W/R							
	Men's Shirts	1	20.76	29.00		12.45		29.00
		2	21.35	29.00	29.70	12.80	9.30	29.00
		3	20.02	29.00	29.70	12.01	9.57	29.00
		4	20.17	29.00	29.70	12.10	8.58	29.00
	Women's Shirts	1	8.56	12.50		5.13		12.50
		2	8.33	12.50	12.80	5.29	3.83	12.50
		3	8.23	12.50	12.80	4.94	3.96	12.50
		4	8.30	12.50	12.80	4.98	3.68	12.50
	Farmer's Shirts	1	21.11	32.67		12.66		32.67
		2	21.73	32.67	33.50	13.04	9.45	32.67
		3	30.33	32.67	33.50	12.19	9.74	32.67
		4	20.49	32.67	33.50	12.29	9.11	32.67

Comparing both approaches, if the firm does not borrow from a commercial bank, the amount saved by the firm under the conservative approach is greater than that by the firm under the liberal approach.

2. Under the conservative approach, it is expected that savings will be very high in the first period, decrease gradually in the second and third periods and increase to a higher level again in the fourth period.

3. Under the conservative approach, period 3 is when the firm may need the most credit since cash inflow is low due to a low level of sales and cash outflow is high as the firm takes the advantage of low wages and raw material costs to accumulate inventory for sale in period 4.

Under the liberal approach the firm may need the most credit in periods 1 and 3. In period 1, cash outflow is high as a result of a high level of production and cash inflow may not be as high as cash outflow since the firm under this approach provides some trade credit to customers. The intent to accumulate inventory is the main reason to explain why the firm is expected to need credit in period 3.

4. The firm under the conservative approach borrows some funds from input suppliers who charge very high interest rates, while the firm under the liberal approach does not borrow from input suppliers. It is expected that the net return of the firm which operates under the liberal approach will be higher than that of the firm which operates under the conservative approach.

7.2.2 Expectations Among Types of Basic Ready-Made Garment Firms

1. It is expected that net return of the basic exporting ready-made garment firm will be the highest and that of the D-W/R ready-made garment

firm will be the lowest since net margin (cash price-raw material cost) and the amount of products produced by the basic D-W/R ready-made garment firm are smaller than those of the basic exporting ready-made garment firms. Net return of the D-C ready-made garment firm is expected to be greater than that of the D-W/R ready-made garment firm, even though the amount produced and sold is smaller, because the net margin of the products produced by the D-C firms are much higher than those of the D-W/R ready-made garment firm.

2. The amount of funds borrowed from the commercial bank by the exporting ready-made garment firm is expected to be the highest since the amount produced and the percentage of credit sales are the largest.

The amount of funds borrowed from the commercial bank source of the D-W/R ready-made garment firm is expected to be more than that of the D-C ready-made garment firm since the amount of products produced and fixed financial commitments of the D-W/R ready-made garment firms are larger than those of the D-C ready-made garment firms.

3. Given expected demand, wage rate, raw material cost per unit and inventory constraint in each period of each of the basic ready-made garment firms, it is expected that period 1 and 3 will be the periods when the basic exporting ready-made garment firm needs credit the most. In period 3 the basic D-C ready-made garment firm will need credit the most and in periods 3 and 4 the D-W/R ready-made garment firm will need credit the most.

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7.3 The Results

7.3.1 The Exporting Ready-Made Garment Firm

1. Under the conservative approach: the firm needs no credit from the commercial bank. Savings drop from approximately 130,000 baht in the first period to slightly more than 120,000 baht in the second period; and drop sharply to roughly 64,000 baht and 35,000 baht in the third and fourth periods, respectively (Table 7.9). At the end of period 4, net return and accounts payable are around 44,000 baht and 14,600 baht, respectively.

2. Under the liberal approach: the firm borrows up to the maximum limit from the commercial bank in the first period. The outstanding in the second period is around 55,000 baht (Table 7.10). The firm is able to save around 30,000 baht in the third and 36,000 baht in the fourth period. At the end of period 4, net return and accounts receivable are approximately 68,000 baht and 10,500 baht, respectively. In the first period, shadow prices indicate that the firm can afford to pay at the margin more than a 200 percent rate of interest for additional borrowed capital.

7.3.2 The D-C Ready-Made Garment Firm

1. Under the conservative approach, the firm does not need to borrow from the commercial bank. Net return and accounts payable at the end of the period 4 is approximately 45,000 baht and 5,300 baht, respectively (Table 7.11). Savings in period 2 are higher than in period 1, decrease to the lowest level in period 3, and increase to around 23,000 baht at the end of period 4.

2. Under the liberal approach the firm borrows slightly less than 13,500 baht in period 3 (Table 7.12). Savings increase from around 1,200

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Table 7.9 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Basic Exporting Ready-Made Garment Firm, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	355,300	285,775	108,752	52,325
Credit Sales				
Interest Income		1,460	1,353	701
Beginning Cash	12,000			
Total	367,300	287,235	110,105	53,026
Cash Outflows				
RM[a]: Cash	113,519	82,123	32,294	12,952
Credit		128,277	92,799	36,492
Skilled Worker	28,372	18,603	8,230	3,201
Unskilled Worker	198	99	10	47
Subcontract Worker	50,875	35,180	15,942	5,560
Overhead Cost	24,201	16,736	7,680	2,602
Tax	7,106	5,715	2,175	1,046
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	4,300	4,300	4,300	4,300
Repayment of LTD				9,500
Interest on STD[c]				
Total	234,571	296,943	169,430	81,700
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	132,729			
Savings Withdrawal		9,708	59,325	28,674
Savings Outstanding	132,729	123,021	63,696	35,022
Shadow Price	0	0	0	0
Net Return				44,332
Accounts Payable				14,227

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 22,000 baht

Table

Table 7.10 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Basic Exporting Ready-Made Garment Firm, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	234,264	229,692	87,397	42,094
Credit Sales		58,566	57,423	21,849
Interest Income				321
Beginning Cash	12,000			
Total	246,264	288,258	144,820	64,264
Cash Outflows				
RM[a]: Cash	172,593	177,664	66,583	24,775
Credit				
Skilled Worker	21,790	20,351	8,230	3,201
Unskilled Worker	112	105	10	47
Subcontract Worker	38,999	38,330	15,942	5,560
Overhead Cost	18,614	18,242	7,680	2,602
Tax	5,856	5,742	2,185	1,052
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	4,300	4,300	4,300	4,300
Repayment of LTD				9,500
Interest on STD[c]		990	246	
Total	268,264	271,724	110,176	57,037
Balance				
Borrowing	22,000			
Repayment		16,534	5,466	
Outstanding[d]	22,000	5,466	0	
Savings Deposit			29,178	7,227
Savings Withdrawal				
Savings Outstanding			29,178	36,405
Shadow Price	.51	0	0	0
Net Return				68,433
Accounts Receivable				10,524

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 22,000 baht

Table

Table 7.11 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Basic D-C Ready-Made Garment Firm, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	46,800	45,615	26,835	60,810
Credit Sales				
Interest Income		220	254	39
Beginning Cash	2,700			
Total	49,500	45,835	27,089	60,849
Cash Outflows				
RM[a]: Cash	9,858	9,660	13,471	3,819
Credit		13,672	13,400	18,687
Skilled Worker	7,947	7,766	7,438	2,805
Unskilled Worker				
Subcontract Worker				
Overhead Cost	2,401	2,340	3,460	1,037
Tax	936	912	537	1,216
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	2,350	2,350	2,350	2,350
Repayment of LTD				5,190
Interest on STD[c]				
Total	29,492	42,700	46,656	41,104
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	20,008	3,135		23,321
Savings Withdrawal			19,567	3,576
Savings Outstanding	20,008	23,143	3,576	23,321
Shadow Price	0	0	0	0
Net Return				45,151
Accounts Payable				5,297

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 18,000 baht

Table 7.12 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Basic D-C Ready-Made Garment Firm, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	40,909	38,918	22,892	51,874
Credit Sales		7,219	6,868	4,040
Interest Income		13	72	
Beginning Cash	2,700			
Total	43,609	46,150	29,832	55,914
Cash Outflows				
RM[a]: Cash	22,480	21,463	29,942	8,472
Credit				
Skilled Worker	8,160	7,766	7,438	2,805
Unskilled Worker				
Subcontract Worker				
Overhead Cost	2,460	2,340	3,460	1,037
Tax	962	916	539	1,220
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	2,350	2,350	2,350	2,350
Repayment of LTD				5,190
Interest on STD[c]				602
Total	42,412	40,835	49,729	27,676
Balance				
Borrowing			13,385	
Repayment				13,385
Outstanding[d]			13,385	0
Savings Deposit	1,197	5,315		14,853
Savings Withdrawal			6,512	
Savings Outstanding	1,197	6,512	0	14,853
Shadow Price	0	0	0	0
Net Return				50,495
Accounts Receivable				9,154

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 18,000 baht

baht in period 1 to slightly more than 6,500 baht in period 2, drop down to 0 in period 3, and is roughly 15,000 baht in period 4. At the end of period 4, net return and accounts receivable are approximately 50,500 and 9,100 baht respectively.

7.3.3 The D-W/R Ready-Made Garment Firm

1. Under the conservative approach: the firm borrows nearly 30,500 baht from the commercial bank in period 4 (Table 7.13). Savings increase from around 13,400 baht in period 1 to nearly 17,400 baht in period 2, then drop gradually to 0 in period 4. Net return and accounts payable at the end of period 4 are approximately 6,600 baht and 13,300 baht, respectively.

2. Under the liberal approach: the firm is not able to save in any period. Debt outstanding at the commercial bank increases gradually from around 4,500 baht in period 1 to slightly more than 5,600 in period 3, then increases sharply to around 42,000 baht in period 4 (Table 7.14). At the end of period 4, net return and accounts receivable are approximately 15,000 baht and 6,800 baht, respectively.

It should be noted that borrowings from the commercial bank is the highest in the fourth period because the firm has to repay 1/10 of its outstanding long-term debts in that period.

7.4 Comparison Between Expectations and Actual Results

This comparison will follow the format used in the discussion of the expectations. The first part will be the comparison within a group of basic ready-made garment firms and the last part will be the comparison among each of the basic ready-made garment firms.

Table 7.13 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return : Basic D-W/R Ready-Made Garment Firm, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	97,585	94,975	85,175	67,630
Credit Sales				
Interest Income		148	191	83
Beginning Cash	4,000			
Total	101,585	95,123	85,366	67,713
Cash Outflows				
RM[a]: Cash	50,663	24,616	42,431	17,831
Credit		37,825	18,377	31,679
Skilled Worker	4,374	1,879	3,973	1,778
Unskilled Worker	3,254	1,459	2,270	845
Subcontract Worker				
Overhead Cost	8,410	3,971	6,935	2,845
Tax	1,952	1,899	1,703	1,353
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,500	13,500	13,500	13,500
Repayment of LTD				30,000
Interest on STD[c]				
Total	88,153	91,149	95,189	105,831
Balance				
Borrowing				30,535
Repayment				
Outstanding[d]				30,535
Savings Deposit	13,432	3,974	7,583	
Savings Withdrawal			17,406	7,583
Savings Outstanding	13,432	17,406	7,583	0
Shadow Price	0	0	0	0
Net Return				6,622
Accounts Payable				13,312

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 62,500 baht

Table 7.14 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Basic D-W/R Ready-Made Garment Firm, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	88,087	85,733	76,846	61,210
Credit Sales		9,787	9,526	8,538
Interest Income				
Beginning Cash	4,000			
Total	88,087	95,520	86,372	69,748
Cash Outflows				
RM[a]: Cash	59,203	63,111	55,257	45,695
Credit				
Skilled Worker	3,267	2,898	3,097	2,737
Unskilled Worker	2,425	2,239	1,822	1,939
Subcontract Worker				
Overhead Cost	6,274	6,107	5,459	4,335
Tax	1,957	1,905	1,708	1,360
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,500	13,500	13,500	13,500
Repayment of LTD				30,000
Interest on STD[c]		204	224	255
Total	92,626	95,964	87,067	105,821
Balance				
Borrowing	4,539	4,983	5,678	41,751
Repayment		4,539	4,983	5,678
Outstanding[d]	4,539	4,983	5,678	41,751
Savings Deposit				
Savings Withdrawal				
Savings Outstanding				
Shadow Price	0	0	0	0
Net Return				15,052
Accounts Receivable				6,801

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 62,500 baht

7.4.1 Comparison of Expectations and Actual Results Within a Type of Basic Ready-Made Garment Firm

It was expected that the firm operating under the liberal approach would have higher borrowings from the commercial bank and would have higher net returns than the firm operating under the conservative approach. These expectations (1 and 4) are accepted without modification. Expectation 2 regarding the savings behavior of firms is accepted for only the basic exporting and D-C ready-made garment firms. For the basic D-W/R ready-made garment firm, savings in period 4 go down to zero because the firm repays some of the principal of its outstanding long-term debt.

The expectation that period 3 would be a time of high credit needs (expectation 3) is accepted without any modification for the conservative approach. However, under the liberal approach, the expectation of timing of credit needs in period 1 is accepted for only the exporting ready-made garment firm. The other two groups of ready-made garment firms do not need to borrow from the commercial bank in the first period. These groups of firms provide less trade credit to customers than the exporting ready-made garment firm. The expectation of timing of credit needs in period 3 is accepted for the D-C ready-made garment firm. The exporting and the D-W/R ready-made garment firms do not need much credit in the third period because inventory is small relative to expected demand. In other words, not too many units can be produced and stored in inventory in the third period. Therefore, cash outflow to pay for production expenses and credit needs are not as high as expected.

7.4.2 Comparison of Expectations and Actual Results Among Types of Basic Ready-Made Garment Firms

Expectations 1, 2 and 3 are accepted. However, the net return of the exporting and the D-C ready-made garment firms under the conservative approach are nearly the same. High interest payments to input suppliers is the main factor which makes the net return of the exporting ready-made garment firm just a little below that of the D-C ready-made garment firm.

CHAPTER 8

THE EXTENDED MODEL FOR THE READY-MADE GARMENT INDUSTRY

This chapter contains a description of the extension of the basic model, and needed modifications, some expectations in the results, and the results compared with the expectations.

8.1 The Extension of the Basic Model

As is the case for the cement product industry, the extended model of the ready-made garment industry examines what would happen to: (1) net return to fixed assets, family labor, and equity capital; (2) amount of credit needs; (3) timing of credit needs; and (4) shadow price of borrowed capital when the firm expands.

Since short-run expansion by the firm can be by: (1) increasing production of the existing products as demand for the products expand; (2) adding products to the existing product line; and (3) combining both; the analysis will consider these three options.

Three situations will be analyzed as reasonable extensions of the basic model. Each will differentiate between the conservative approach and liberal approach as defined earlier. Situation 1 is the basic model with a 10 percent increase in demand across the board. Situation 2 is an addition to the product line of the basic model with no change in demand. Situation 3 is the basic model with expanded demand plus the additional products proposed for Situation 2.

The additional products which are added to the existing product lines of the basic model of each type of ready-made garment firms are shown in the first column of Table 8.2

8.2 Modification of the Basic Model

8.2.1 Constraints

8.2.1.1 Demand Constraints

For Situation 1, the level of demand for all products in the basic model increases by 10 percent. The revised RHS values for these products of each type of the ready-made garment firms are shown in Table 8.1.

The initial expected demand for additional products added to the basic model of each type of ready-made garment firms is shown in Table 8.2. These are the constraints imposed on Situation 2. When these demand levels are increased by 10 percent, we have the applicable coefficients for Situation 3 for these products (Table 8.3).

8.2.1.2 Inventory Constraint

For the products added to the product line of the basic model, RHS values for the inventory constraint for each type of ready-made garment firms are presented in Table 8.2. These values are derived from information presented in section 6.8.3. These constraints apply to both Situation 2 and Situation 3.

8.2.1.3 Other Constraints

No further modifications on the RHS values of the basic model are required.

Table 8.1 Demand Increased 10 Percent for Basic Model Products[a]

	Period			
	1	2	3	4
A) Exporting				
Men's Shirts	330	66	247	297
Long Dresses	1,650	847	44	484
Women's Shirts	4,702	5,060	2,255	137
Children's Shirts	1,265	550	313	0
B) D-C				
Men's Shirts	308	323	102	234
Jean Shirts	165	115	80	135
Safari Shirts	0	7	73	198
C) D-W/R				
Men's Shirts	126	27	1,320	1,861
Women's Shirts	0	0	0	990
Farmer's Shirts	3,190	3,190	1,705	247

[a]These demand constraints apply to Situations 1 and 3 for these products.

Table 8.2 Inventory and Expected Demand of the Products Included in the Extended Ready-Made Garment Models[a]

	Inventory				Expected Demand			
	1	2	3	4	1	2	3	4
A) Exporting								
Nightgowns	75	75	75	75	150	150	50	100
Local Jean Shirts	10	10	10	10	220	60	140	800
Bags	0	0	0	0	2,125	60	115	300
B) D-C								
Long Dresses	22	22	22	22	36	0	6	0
Dresses	5	5	5	5	81	27	12	0
Pants	20	20	20	20	15	36	63	132
C) D-W/R								
Women's Skirts	0	0	0	0	0	16	60	0
Children's Shirts	300	300	300	300	180	180	30	0
School Girls' Skirts	30	30	30	30	90	110	30	0
Pants	0	0	0	0	190	180	50	81

[a]Expected demand represents the initial demand for these products and are the demand constraints for Situation 2. The inventory constraint applies to both Situations 2 and 3.

Table 8.

A) Expo

Ni

Lo

Ba

B) D-C

Lo

Dr

Pa

C) D-W

Wo

Cl

Sc

Pa

[a] 1(

Table 8.3 Related Demand Constraint for Products Added to the Basic Model (Situation 3)[a]

	Period			
	1	2	3	4
A) Exporting				
Nightgowns	165	165	55	110
Local Jean Shirts	242	66	154	880
Bags	2,337	66	126	330
B) D-C				
Long Dresses	40	0	7	0
Dresses	89	30	13	0
Pants	17	40	69	145
C) D-W/R				
Women's Skirts	0	18	66	0
Children's Shirts	198	198	33	0
School Girls' Skirts	99	121	33	0
Pants	154	198	55	89

[a]10 percent higher than the demand constraints shown in Table 8.2.

8.2.2 The Objective Function

Extension of the basic model to include additional products requires C_j values for raw material cost and selling price (both cash and credit sales) by period for each product respectively. These C_j values for each type of the ready-made garment firms apply to Situations 2 and 3 and are shown in Table 8.4.

8.2.3 Activities

8.2.3.1 Production Activities

Extension of the basic model to include additional products requires A_{ij} coefficients for labor requirements and overhead cost per unit of output by period for each product respectively. These A_{ij} coefficients for each type of ready-made garment firms apply to Situations 2 and 3 and are presented in Table 8.5.

8.2.3.2 Selling Activities

The payment of taxes by the firm is a function of the level of sales. The amount of tax paid per unit of product sold in each period for each of the products added to the basic model product line for each type of ready-made garment firms are shown in Table 8.6. These coefficients apply to Situations 2 and 3.

8.2.3.3 Cash Balance (row) Activity

The coefficients of cash outflow to pay for purchases of raw materials per unit of output and coefficients of cash inflow from cash sales and credit sales per unit of output of either the conservative or the liberal approach in each period for the products added to the basic model product

Table 8.4 Raw Material Cost per Unit, Cash Price and Credit Price of the Extended Ready-Made Garment Models[a]

	Raw Material Cost				Cash Price				Credit Price			
	1	2	3	4	1	2	3	4	1	2	3	4
A) Exporting												
Nightgowns	32.52	34.19	30.86	30.86	50.00	50.00	50.00	50.00	51.20	51.20	51.20	51.20
Local Jean Shirts	24.83	25.57	23.92	24.10	32.67	32.67	36.57	32.67	33.48	33.48	33.48	33.48
Bags	16.28	16.56	16.00	16.00	35	35	35	35	35.88	35.88	35.88	35.88
B) D-C												
Long Dresses	115.99	115.15	113.50	116.83	200	200	200	200	205	205	205	205
Dresses	92.54	92.16	91.40	92.93	190	190	190	190	195	195	195	195
Pants	69.33	68.40	67.25	69.56	160	160	160	160	164	164	164	164
C) D-W/R												
Women's Skirts	24.48	25.16	23.63	23.80	35	35	35	35	35.88	35.88	35.88	35.88
Children's Shirts	8.87	9.15	8.53	8.59	15	15	15	15	15.38	15.38	15.38	15.38
School Girls' Skirts	14.88	15.34	14.31	14.43	25	25	25	25	25.63	25.63	25.63	25.63
Pants	13.96	13.90	12.94	13.04	18.67	18.67	18.67	18.67	19.14	19.14	19.14	19.14

[a]Situations 2 and 3

Table 8.5 Labor Requirement and Overhead Cost per One Unit of Output of the Extended Ready-Made Garment Models[a]

	Labor Requirement								Overhead Cost			
	Skilled				Unskilled							
	1	2	3	4	1	2	3	4	1	2	3	4
A) Exporting												
Nightgowns	.104	.104	.104	.104	-	-	-	-	3.19	3.19	3.19	3.19
Local Jean Shirts	.091	.091	.091	.091	-	-	-	-	2.08	2.08	2.08	2.08
Bags	.062	.062	.062	.062	-	-	-	-	2.23	2.23	2.23	2.23
B) D-C												
Long Dresses	.330	.330	.330	.330	-	-	-	-	10.26	10.26	10.26	10.26
Dresses	.310	.310	.310	.310	-	-	-	-	9.74	9.74	9.74	9.74
Pants	.330	.330	.330	.330	-	-	-	-	8.21	8.21	8.21	8.21
C) D-W/R												
Women's Skirts	.044	.044	.044	.044	.035	.035	.035	.035	2.24	2.24	2.24	2.24
Children's Shirts	0	0	0	0	.062	.062	.062	.062	.96	.96	.96	.96
School Girls' Skirts	0	0	0	0	.073	.073	.073	.073	1.60	1.60	1.60	1.60
Pants	.010	.010	.010	.010	.052	.052	.052	.052	1.19	1.19	1.19	1.19

[a]Situations 2 and 3

Table 8.6 Tax Expenses per One Unit of Output of the Extended Ready-Made Garment Models[a]

	Tax Expenses							
	Cash Sales				Credit Sales			
	1	2	3	4	1	2	3	4
A) Exporting								
Nightgowns	1.00	1.00	1.00	1.00	1.03	1.03	1.03	1.03
Local Jean Shirts	.65	.65	.65	.65	.67	.67	.67	.67
Bags	.70	.70	.70	.70	.72	.72	.72	.72
B) D-C								
Long Dresses	4.00	4.00	4.00	4.00	4.10	4.10	4.10	4.10
Dresses	3.80	3.80	3.80	3.80	3.89	3.89	3.89	3.89
Pants	3.20	3.20	3.20	3.20	3.28	3.28	3.28	3.28
C) D-W/R								
Women's Skirts	.70	.70	.70	.70	.72	.72	.72	.72
Children's Shirts	.30	.30	.30	.30	.31	.31	.31	.31
School Girls' Skirts	.50	.50	.50	.50	.51	.51	.51	.51
Pants	.37	.37	.37	.37	.38	.38	.38	.38

[a]Situations 2 and 3

line for each type of ready-made garment firms are shown in Tables 8.7 and 8.8. These coefficients apply to Situations 2 and 3.

For a detailed discussion of this cash balance (row) activity, see section 5.2.3.3. However, the percentage of purchases of raw material on credit, and percentage of credit sales in the cement product industry and the ready-made garment industry are not the same. These percentages for each type of ready-made garment firms are specified in sections 7.1.2.4 and 7.1.2.5.

8.3 Some Expectations

The following are the expectations of the linear programming results of Situations 1, 2 and 3 when compared with the linear programming results of the basic model. They focus on net return, timing of credit needs, amount of credit needs, and amount of savings.

8.3.1 Expectations Concerning Net Return

Assuming that net return should increase with a short-run expansion of the firm, it is expected that the firm in Situation 3 of each type of ready-made garment firms will generate the greatest increase in net return compared with the basic model, since it contains expansion from an increased product line and from an increased demand. However, it is difficult to say in advance whether an increased demand with given product line (Situation 1) or an increase in product line with given demand (Situation 2) would yield the higher net return.

These generalizations apply for both the conservative and liberal approaches.

Table 8.7 Coefficients of Production, Cash Selling Activities in Cash Flow Activities of the Extended Ready-Made Garment Models[a]: Conservative Approach

	Raw Material								Cash Inflow From			
	Cash Purchases				Credit Purchases				Cash Sales			
	1	2	3	4	1	2	3	4	1	2	3	4
A) Exporting												
Nightgowns	16.26	17.09	15.43	15.43	-	18.38	19.31	17.43	50.00	50.00	50.00	50.00
Local Jean Shirts	12.41	12.78	11.96	12.05	-	14.03	14.45	13.51	32.67	32.67	32.67	32.67
Bags	8.14	8.28	8.00	8.00	-	9.20	9.36	9.04	35.00	35.00	35.00	35.00
B) D-C												
Long Dresses	52.20	51.82	51.08	52.57	-	72.41	71.88	70.85	200.0	200.0	200.0	200.0
Dresses	41.64	41.47	41.13	41.82	-	57.77	57.53	57.06	190.0	190.0	190.0	190.0
Pants	31.20	30.78	30.26	31.30	-	43.28	42.70	41.98	160.0	160.0	160.0	160.0
C) D-W/R												
Women's Shirts	14.65	15.09	14.17	14.28	-	10.96	11.27	10.58	35.00	35.00	35.00	35.00
Children's Shirts	5.32	5.49	5.12	5.16	-	3.97	4.09	3.82	15.00	15.00	15.00	15.00
School Girls' Shirts	8.93	9.20	8.58	8.66	-	6.66	6.87	6.42	25.00	25.00	25.00	25.00
Pants	8.07	8.34	7.76	7.82	-	6.03	6.22	5.80	18.67	18.67	18.67	18.67

[a]Situations 2 and 3

Table 8.8 Coefficients of Production, Cash Selling, and Credit Selling Activities in Cash Flow Activities of the Extended Ready-Made Garment Models[a]: Liberal Approach

	Raw Material				Cash Inflow From							
					Cash Sales				Credit Sales			
	1	2	3	4	1	2	3	4	1	2	3	4
A) Exporting												
Nightgowns	32.52	34.19	30.85	30.85	50.00	50.00	50.00	50.00	-	51.20	51.20	51.20
Local Jean Shirts	24.83	25.57	23.92	24.10	32.67	32.67	32.67	32.67	-	33.48	33.48	33.48
Bags	16.28	16.56	16.00	16.00	35.00	35.00	35.00	35.00	-	35.88	35.88	35.88
B) D-C												
Long Dresses	115.99	115.15	113.50	116.83	200.00	200.00	200.00	200.00	-	205.00	205.00	205.00
Dresses	92.54	92.16	91.40	92.93	190.00	190.00	190.00	190.00	-	195.00	195.00	195.00
Pants	69.33	68.40	67.25	69.56	160.00	160.00	160.00	160.00	-	164.00	164.00	164.00
C) D-W/R												
Women's Skirts	24.48	25.16	23.63	23.80	35.00	35.00	35.00	35.00	-	35.88	35.88	35.88
Children's Shirts	8.87	9.15	8.53	8.59	15.00	15.00	15.00	15.00	-	15.38	15.38	15.38
School Girls' Skirts	14.88	15.34	14.31	14.43	25.00	25.00	25.00	25.00	-	25.63	25.63	25.63
Pants	13.46	13.90	12.94	13.04	18.67	18.67	18.67	18.67	-	19.14	19.14	19.14

[a]Situations 2 and 3

8.3.2 Expectations About Timing of Credit Needs

A) The Exporting Ready-Made Garment Firm

It is expected that the firm which operates under the liberal approach in Situations 1, 2 and 3 will need some credit in the first period. This is because cash outflow is very high (due to a high production level) and cash inflow is curtailed by the provision of trade credit.

For the firm which operates under the conservative approach it is expected that the savings is the greatest in period 3 when sales are down and the firm has to repay principal and interest to the input supplier.

B) The D-C Ready-Made Garment Firm

In Situations 1, 2 and 3 it is expected that the firm, under the liberal approach, will need some credit in period 3 since the firm will try to accumulate inventory resulting in cash outflow being greater than cash inflow.

For the firm which operates under the conservative approach instead of needing credit the most in period 3, the withdrawal from savings is the greatest in period 3.

C) The D-W/R Ready-Made Garment Firm

In Situations 1, 2 and 3 it is expected that the firm, under the liberal approach will need credit in all periods. The firm which operates under the conservative approach, will withdraw a large amount of savings in period 3, and will need some credit in period 4.

8.3.3 Expectations About Amount of Credit Needed

A) The Exporting Ready-Made Garment Firm

A.1) Comparison of Situation 1 with the Basic Model

It is expected that the firm in Situation 1 needs more credit than the firm in the basic model, since cash expenses increase as production level increases.

A.2) Comparison Between the Basic Model and Situation 2

Since some of the products added, such as bags and local denim shirts, do not need embroidery work, the production and sales of these products provides additional cash inflow into the firm. Therefore it is expected that the amount of credit needed by the firm in Situation 2 will be less than that in the basic model.

A.3) Comparison Between the Basic Model and Situation 3

Given the expectation of the pattern of demand for credit in sections A.1 and A.2 above it is difficult to say in advance whether the amount of credit needed by the firm in Situation 3 is greater or smaller than that of the basic firm. However, it is expected that the amount of credid needed by the firm in Situation 3 will be less than that of the firm in Situation 1, but greater than that of the firm in Situation 2.

B) The D-C Ready-Made Garment Firm

Since, in period 3, cash inflow of the firm in Situations 1, 2 and 3 is greater than cash inflows of the basic firm, when cash outflow needed to accumulate inventory remains unchanged from the basic firm, it is expected that the amount of credit needed by the firm in Situations 1, 2 or 3 will be less than that of the basic firm.

C) The D-W/R Ready-Made Garment Firm

In Situations 1, 2 and 3 it is expected that cash inflow increases as the firm expands its size and therefore the amount of credit needed will be less than that of the basic firm.

8.3.4 Expectation About Savings

It is expected that savings pattern of the firm in all situations will be the same as that of the basic firm, and it is expected also that the amount of savings of the firm in all situations will be greater than that of the basic firm. It is difficult to state in advance whether the amount saved by the firm in Situation 1 will be greater or less than that of the firm in Situation 2, yet it is expected that the amount saved by the firm in Situation 3 will be the greater.

8.4 The Linear Programming Results of the Extended Model

8.4.1 The Exporting Ready-Made Garment Firm

A) Situation 1

Under the conservative approach: the firm does not borrow from the commercial bank and therefore the shadow price equals zero (Table 8.9). In other words, there is slack in the borrowing constraint. Saving is highest in the first period (147,068 baht) and drops every period to about 42,500 baht in the fourth period. At the end of period 4, net return is 50,472 baht and the firm owes 16,158 baht to input suppliers.

Under the liberal approach: in the first period the firm borrows from the commercial bank up to the maximum limit and the shadow price is around 200 percent annual rate per period (Table 8.10). The firm is unable to save in the first two periods, but does save 33,462 baht in the

Table 8.9 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Exporting Ready-Made Garment Firm, Situation 1, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	390,807	314,352	119,601	57,535
Credit Dales				
Interest Income		1,618	1,506	795
Beginning Cash	12,000			
Total	402,807	315,970	121,107	58,330
Cash Outflows				
RM[a]: Cash	124,223	90,916	35,441	14,299
Credit		140,372	102,735	40,048
Skilled Worker	31,040	20,621	9,007	3,573
Unskilled Worker	217	109	11	53
Subcontract Worker	55,664	38,993	17,450	6,196
Overhead Cost	26,479	18,550	8,407	2,901
Tax	7,816	6,287	2,392	1,151
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	4,300	4,300	4,300	4,300
Repayment of LTD				9,500
Interest on STD[c]				
Total	255,739	326,148	185,743	88,021
Balance				
Borrowing				
Repayment				
Outstanding				
Savings Deposit	147,068			
Savings Withdrawal		10,178	64,636	29,691
Savings Outstanding	147,068	136,890	72,254	42,563
Shadow Price	0	0	0	0
Net Return				50,472
Accounts Payable				16,158

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 22,000 baht

Table 8.10 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Exporting Ready-Made Garment Firm, Situation 1, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	243,596	252,661	96,116	46,286
Credit Sales		60,899	63,165	24,029
Interest Income				368
Beginning Cash	12,000			
Total	255,596	313,560	159,281	70,683
Cash Outflows				
RM[a]: Cash	178,507	195,432	71,753	27,612
Credit				
Skilled Worker	22,778	22,386	9,007	3,573
Unskilled Worker	97	115	11	53
Subcontract Worker	40,469	42,163	17,450	6,196
Overhead Cost	19,355	20,067	8,407	2,901
Tax	6,090	6,316	2,403	1,157
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	4,300	4,300	4,300	4,300
Repayment of LTD				9,500
Interest on STD[c]		990	279	
Total	277,596	297,769	119,610	61,292
Balance				
Borrowing	22,000			
Repayment		15,791	6,209	
Outstanding[d]	22,000	6,209	0	
Savings Deposit			33,462	9,391
Savings Withdrawal				
Savings Outstanding			33,462	42,853
Shadow Price	.51	0	0	0
Net Return				75,929
Accounts Receivable				11,571

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 22,000 baht

third and 42,853 baht in the fourth period. At the end of the year, extended trade credit is 11,571 baht, and net return is 75,929 baht.

B) Situation 2

Under the conservative approach: the firm borrows only from the input supplier. Saving is the highest in the first period, 182,398 baht, and is the lowest in the fourth period, 84,250 baht (Table 8.11). At the end of period 4, outstanding debt at input suppliers is 28,252 baht and net return is 81,222 baht.

Under the liberal approach: the firm borrows 18,773 baht from the commercial bank (Table 8.12). This is less than the maximum limit, consequently, the shadow price is zero. The firm starts saving in the second period (27,556 baht). In the fourth period savings, trade credit provided, and net return are 73,346 baht, 18,873 baht, and 113,740 baht respectively.

C) Situation 3

Under the conservative approach: savings amount to 201,931 baht in the first period, and diminish to 96,838 baht in the fourth period (Table 8.13). In period 4, outstanding short-term debt to input suppliers and net return are 31,447 baht and 91,056 baht respectively.

Under the liberal approach: the firm borrows 20,822 baht from the commercial bank in period 1 and none in other periods resulting in zero shadow prices in all periods (Table 8.14). Savings begin in period 1 (31,154 baht) and increase to the maximum level in period 4 (84,554 baht). At the end of period 4 net return and accounts receivable (trade credit provided) are 126,833 baht and 20,755 baht respectively.

Table 8.11 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Exporting Ready-Made Garment Firm, Situation 2, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	444,325	297,325	119,827	93,825
Credit Sales				
Interest Income		2,006	1,691	1,050
Beginning Cash	12,000			
Total	456,325	299,331	121,518	94,875
Cash Outflows				
RM[a]: Cash	137,292	84,489	37,006	25,001
Credit		155,140	95,473	41,817
Skilled Worker	34,887	19,165	9,311	6,831
Unskilled Worker	198	99	10	47
Subcontract Worker	52,225	35,630	16,692	5,710
Overhead Cost	30,138	17,214	8,649	5,002
Tax	8,886	5,946	2,396	1,876
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	4,300	4,300	4,300	4,300
Repayment of LTD				9,500
Interest on STD[c]				
Total	273,927	327,983	179,803	106,086
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	182,398			84,250
Savings Withdrawal		28,652	58,285	95,461
Savings Outstanding	182,398	153,746	95,461	84,250
Shadow Price	0	0	0	0
Net Return				81,222
Accounts Payable				28,252

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 20,000 baht

Table 8.12 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Exporting Ready-Made Garment Firm, Situation 2, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	357,259	238,986	96,309	75,490
Credit Sales		89,315	59,747	24,077
Interest Income			303	678
Beginning Cash	12,000			
Total	369,259	328,301	156,359	100,245
Cash Outflows				
RM[a]: Cash	258,897	185,318	74,860	49,307
Credit				
Skilled Worker	32,716	21,219	9,311	6,831
Unskilled Worker	192	105	10	47
Subcontract Worker	48,625	39,230	16,692	5,710
Overhead Cost	28,371	18,980	8,649	5,002
Tax	8,931	5,975	2,408	1,887
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	4,300	4,300	4,300	4,300
Repayment of LTD				9,500
Interest on STD[c]		845		
Total	388,032	281,972	122,230	88,584
Balance				
Borrowing	18,773			
Repayment		18,773		
Outstanding[d]	18,773	0		
Savings Deposit		27,556	61,685	11,661
Savings Withdrawal			27,556	
Savings Outstanding		27,556	61,685	73,346
Shadow Price	0	0	0	0
Net Return				113,740
Accounts Receivable				18,873

[a]RM = purchases of raw materials

[b]STD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 22,000 baht

Table 8.1

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Table 8.13 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: Exporting Ready-Made Garment Firm, Situation 3, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	488,717	327,057	131,784	103,185
Credit Sales				
Interest Income		2,221	1,879	1,181
Beginning Cash	12,000			
Total	500,717	329,278	133,663	104,366
Cash Outflows				
RM[a]: Cash	150,235	93,759	40,347	27,856
Credit		169,765	105,947	45,592
Skilled Worker	38,173	21,271	10,168	7,600
Unskilled Worker	217	109	11	53
Subcontract Worker	57,104	39,533	18,230	6,406
Overhead Cost	32,983	19,101	9,446	5,567
Tax	9,774	6,541	2,636	2,064
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	4,300	4,300	4,300	4,300
Repayment of LTD				9,500
Interest on STD[c]				
Total	308,786	360,378	197,085	114,936
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	201,931			
Savings Withdrawal		31,100	63,422	10,570
Savings Outstanding	201,931	170,831	107,408	96,838
Shadow Price	0	0	0	0
Net Return				91,056
Accounts Payable				31,477

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 22,000 baht

Table 8.14 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: Exporting Ready-Made Garment Firm, Situation 3, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	392,953	262,885	105,918	83,022
Credit Sales		98,238	65,721	26,480
Interest Income			343	777
Beginning Cash	12,000			
Total	404,953	361,123	171,982	110,279
Cash Outflows				
RM[a]: Cash	284,765	203,851	81,702	54,855
Credit				
Skilled Worker	35,985	23,341	10,168	7,600
Unskilled Worker	211	115	11	53
Subcontract Worker	53,484	43,153	18,230	6,406
Overhead Cost	31,206	20,878	9,446	5,567
Tax	9,824	6,572	2,648	2,075
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	4,300	4,300	4,300	4,300
Repayment of LTD				9,500
Interest on STD[c]		937		
Total	425,775	309,147	132,505	96,356
Balance				
Borrowing	20,822			
Repayment		20,822		
Outstanding[d]	20,882	0		
Savings Deposit		31,154	70,631	13,923
Savings Withdrawal			31,154	
Savings Outstanding		31,154	70,631	84,554
Shadow Price	0	0	0	0
Net Return				126,833
Accounts Receivable				20,755

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 22,000 baht

8.4.2 The D-C Ready-Made Garment Firm

A) Situation 1

Under the conservative approach: the firm does not borrow from the commercial bank and the shadow prices are all zero (Table 8.15). Savings are highest in periods 2 and 4 (27,136 and 30,449 baht, respectively) and lowest in periods 1 and 3 (23,232 and 7,955 baht, respectively). In the fourth period net return and outstanding debt at the input suppliers are 50,840 baht and 6,925 baht, respectively.

Under the liberal approach, the firm saves 1,882 baht and 8,570 baht in the first and second periods, respectively (Table 8.16). But, in period 3, savings drop to zero when it is necessary for the firm to borrow around 10,000 baht from the commercial bank. In period 4, savings, accounts receivable, and net return are 19,931 baht, 10,065 baht and 56,484 baht, respectively.

B) Situation 2

Under the conservative approach: no borrowings from the commercial bank results in zero shadow prices in all periods (Table 8.17). Savings increase from 35,022 baht in the first period to more than 37,000 baht in the second period, dropped sharply to a little above 22,000 baht in the third period, and more than doubled in the fourth period to 51,800 baht. At the end of period 4 net return and outstanding debt at input suppliers (accounts payable) are 69,348 baht and 10,156 baht, respectively.

Under the liberal approach: the firm is able to save in each period. Savings start at 5,549 baht in the first period and increase to about 17,000 baht in the second period, drop to less than 700 baht in the third

Table 8.15 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: D-C Ready-Made Garment Firm, Situation 1, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	52,745	50,176	29,654	66,859
Credit Sales				
Interest Income		255	298	87
Beginning Cash	2,700			
Total	55,445	50,431	29,952	66,946
Cash Outflows				
RM[a]: Cash	11,126	10,624	14,072	4,992
Credit		15,434	14,737	19,521
Skilled Worker	8,976	8,542	7,765	3,726
Unskilled Worker				
Subcontract Worker				
Overhead Cost	2,706	2,574	3,616	1,336
Tax	1,055	1,003	593	1,337
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	2,350	2,350	2,350	2,350
Repayment of LTD				5,190
Interest on STD[c]				
Total	32,213	46,527	49,133	44,452
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	23,232	3,904		22,494
Savings Withdrawal			19,181	
Savings Outstanding	23,232	27,136	7,955	30,449
Shadow Price	0	0	0	0
Net Return				50,840
Accounts Payable				6,925

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 18,000 baht

Table 8.16 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: D-C Ready-Made Garment Firm, Situation 1, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	45,000	42,809	25,297	57,034
Credit Sales		7,941	7,555	4,464
Interest Income		21	94	
Beginning Cash	2,700			
Total	47,700	50,771	32,946	61,498
Cash Outflows				
RM[a]: Cash	24,727	23,609	31,273	11,086
Credit				
Skilled Worker	8,976	8,542	7,765	3,726
Unskilled Worker				
Subcontract Worker				
Overhead Cost	2,706	2,575	3,616	1,336
Tax	1,059	1,007	595	1,342
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	2,350	2,350	2,350	2,350
Repayment of LTD				5,190
Interest on STD[c]				454
Total	45,818	44,083	51,599	31,484
Balance				
Borrowing			10,083	
Repayment				10,083
Outstanding[d]			10,083	0
Savings Deposit	1,882	6,688		19,931
Savings Withdrawal			8,570	
Savings Outstanding	1,882	8,570	0	19,931
Shadow Price	0	0	0	0
Net Return				56,484
Accounts Receivable				10,065

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 18,000 baht

Table 8.17 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: D-C Ready-Made Garment Firm, Situation 2, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	71,790	56,505	40,395	81,930
Credit Sales				
Interest Income		385	408	246
Beginning Cash	2,700			
Total	74,490	56,890	40,803	82,176
Cash Outflows				
RM[a]: Cash	15,577	11,886	16,785	7,321
Credit		21,609	16,488	23,284
Skilled Worker	10,422	8,940	8,762	5,023
Unskilled Worker				
Subcontract Worker				
Overhead Cost	3,683	2,899	4,320	1,957
Tax	1,436	1,130	808	1,639
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	2,350	2,350	2,350	2,350
Repayment of LTD				5,190
Interest on STD[c]				
Total	39,468	54,814	55,513	52,764
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	35,022	2,076	22,388	51,800
Savings Withdrawal			37,098	22,388
Savings Outstanding	35,022	37,098	22,388	51,800
Shadow Price	0	0	0	0
Net Return				69,348
Accounts Payable				10,156

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 18,000 baht

period and increase sharply to over 38,000 baht in the fourth period (Table 8.18). In period 4, accounts receivable and net return are 12,334 baht and 77,050 baht, respectively.

C) Situation 3

Under the conservative approach: the amount for savings is 28,748 baht, the lowest level, in period 3 and is 61,847 baht, the highest level in period 4 (Table 8.19). Net return and accounts payable at the end of period 4 are 77,457 baht and 12,354 baht, respectively.

Under the liberal approach: as in the case of the firm which operates under the conservative approach, savings are at the lowest and highest levels in the third and fourth period, respectively. At the end of period 4, savings, accounts receivable and net return are 45,487 baht, 13,560 baht, and 85,532 baht, respectively (Table 8.20).

8.4.3 The D-W/R Ready-Made Garment Firm

A) Situation 1

Under the conservative approach: savings increase from 17,984 baht in the first period to 23,601 baht in the second period, and drop to 14,671 baht in the third period (Table 8.21). In period 4 instead of having some savings, the firm borrows 22,641 baht from the commercial bank. Net return and accounts payable at the end of period 4 are around 12,817 baht and 15,145 baht, respectively.

Under the liberal approach: cash inflow from sales and collection of accounts receivable above cash outflow for production expenses is not enough to pay for financial commitments. The firm has to borrow in each period and the amount borrowed is the greatest in period 4 since the firm has to repay some part of the outstanding long-term debt in that period.

Table 8.18 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: D-C Ready-Made Garment Firm, Situation 2, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	62,226	48,207	34,460	69,892
Credit Sales		10,981	8,507	6,081
Interest Income		61	188	7
Beginning Cash	2,700			
Total	64,926	59,249	43,155	75,980
Cash Outflows				
RM[a]: Cash	35,187	26,413	37,301	16,260
Credit				
Skilled Worker	10,634	8,940	8,762	5,023
Unskilled Worker				
Subcontract Worker				
Overhead Cost	3,742	2,899	4,320	1,957
Tax	1,464	1,134	811	1,644
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	2,350	2,350	2,350	2,350
Repayment of LTD				5,190
Interest on STD[c]				
Total	59,377	47,736	59,544	38,424
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	5,549	11,513	673	38,229
Savings Withdrawal			17,062	673
Savings Outstanding	5,549	17,062	673	38,229
Shadow Price	0	0	0	0
Net Return				77,050
Accounts Receivable				12,334

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 18,000 baht

Table 8.19 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: D-C Ready-Made Garment Firm, Situation 3, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	80,295	62,276	44,484	90,059
Credit Sales				
Interest Income		438	468	316
Beginning Cash	2,700			
Total	82,995	62,714	44,952	90,375
Cash Outflows				
RM[a]: Cash	17,436	13,401	17,636	8,906
Credit		24,185	18,171	24,466
Skilled Worker	11,703	9,847	9,188	6,201
Unskilled Worker				
Subcontract Worker				
Overhead Cost	4,119	3,195	4,541	2,362
Tax	1,606	1,245	890	1,801
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	2,350	2,350	2,350	2,350
Repayment of LTD				5,190
Interest on STD[c]				
Total	43,214	59,923	58,776	57,276
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	39,781	2,791	28,748	61,847
Savings Withdrawal			42,572	28,748
Savings Outstanding	39,781	42,572	28,748	61,847
Shadow Price	0	0	0	0
Net Return				77,457
Accounts Payable				12,354

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 18,000 baht

Table 8.20 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: D-C Ready-Made Garment Firm, Situation 3, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	68,500	53,125	37,952	76,840
Credit Sales		12,088	9,375	6,697
Interest Income		73	222	61
Beginning Cash	2,700			
Total	71,200	65,286	47,549	83,598
Cash Outflows				
RM[a]: Cash	38,743	29,103	39,196	19,795
Credit				
Skilled Worker	11,703	9,847	9,188	6,201
Unskilled Worker				
Subcontract Worker				
Overhead Cost	4,119	3,195	4,541	2,362
Tax	1,612	1,250	893	1,808
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	2,350	2,350	2,350	2,350
Repayment of LTD				5,190
Interest on STD[c]				
Total	64,527	51,745	62,168	43,706
Balance				
Borrowing				
Repayment				
Outstanding[d]				
Savings Deposit	6,673	13,541		45,487
Savings Withdrawal			14,619	5,595
Savings Outstanding		20,214	5,595	45,487
Shadow Price	0	0	0	0
Net Return				85,532
Accounts Receivable				13,560

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 18,000 baht

Table 8.21 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: D-W/R Ready-Made Garment Firm, Situation 1, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	107,329	104,472	93,692	74,371
Credit Sales				
Interest Income		198	260	161
Beginning Cash	4,000			
Total	111,329	104,670	93,952	74,532
Cash Outflows				
RM[a]: Cash	54,457	28,382	46,017	20,286
Credit		40,657	21,189	34,357
Skilled Worker	4,704	2,166	4,305	2,025
Unskilled Worker	3,497	1,682	2,470	959
Subcontract Worker				
Overhead Cost	9,041	4,577	7,527	3,230
Tax	2,146	2,089	1,874	1,487
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,500	13,500	13,500	13,500
Repayment of LTD				30,000
Interest on STD[c]				
Total	93,345	99,053	102,882	111,844
Balance				
Borrowing				22,641
Repayment				
Outstanding[d]				22,641
Savings Deposit	17,984	5,617	14,671	
Savings Withdrawal			23,601	14,671
Savings Outstanding	17,984	23,601	14,671	0
Shadow Price	0	0	0	0
Net Return				12,817
Accounts Payable				15,145

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 62,500 baht

At the end of period 4, outstanding debt at the commercial bank, accounts receivable and net return are around 35,060 baht, 7,453 baht and 22,397 baht, respectively (Table 8.22).

B) Situation 2

Under the conservative approach: savings increase from 15,336 baht in period 1 to around 21,910 baht in period 2, drop to 12,430 baht and 0 baht in periods 3 and 4, respectively (Table 8.23). In period 4, borrowings from the commercial bank, borrowings from input suppliers and net return are 26,018 baht, 13,388 baht and 10,666 baht, respectively.

Under the liberal approach: in period 4, borrowings from the commercial bank, accounts receivable and net return are 36,889, 6,951 baht and 20,066 baht, respectively (Table 8.24)

C) Situation 3

Under the conservative approach: savings pattern of the firm in Situation 3 is the same as that for other situations. However, in period 2, the amount saved is 28,617 baht which is the greatest amount among the situations (Table 8.25). In period 4, the firm borrows 17,668 baht and 15,656 baht from the commercial bank and input suppliers, respectively. Net return at the end of period 4 is 17,327 baht.

Under the liberal approach: the firm borrows 2,443 baht in the first period, is able to save 963 baht in the second period, neither borrow nor save in the third period, and borrows 29,870 baht in the fourth period (Table 8.26). At the end of period 4, accounts receivable and net return are 7,619 baht and 27,753 baht, respectively.

8.5 Comparisons Among the Basic Models and the Extended Models

This section describes what would happen to net return, demand for credit (amount of credit needed), timing of credit needs and shadow price

Table 8.22 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: D-W/R Ready-Made Garment Firm, Situation 1, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	96,882	94,307	84,531	67,081
Credit Sales		10,765	10,478	9,392
Interest Income				
Beginning Cash	4,000			
Total	100,882	105,072	95,009	76,473
Cash Outflows				
RM[a]: Cash	69,512	69,422	60,784	50,732
Credit				
Skilled Worker	3,593	3,188	3,407	2,998
Unskilled Worker	2,667	2,463	2,004	1,468
Subcontract Worker				
Overhead Cost	6,900	6,718	6,005	4,751
Tax	2,153	2,096	1,878	1,491
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,500	13,500	13,500	13,500
Repayment of LTD				30,000
Interest on STD[c]		155	86	25
Total	104,325	103,542	93,664	110,965
Balance				
Borrowing	3,443	1,913	568	35,060
Repayment		3,443	1,913	568
Outstanding[d]		1.913	568	35,060
Savings Deposit				
Savings Withdrawal				
Savings Outstanding				
Shadow Price	0	0	0	0
Net Return				22,397
Accounts Receivable				7,453

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 62,500 baht

Table 8.23 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: D-W/R Ready-Made Garment Firm, Situation 2, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	105,125	104,315	87,400	69,129
Credit Sales				
Interest Income		169	241	137
Beginning Cash	4,000			
Total	109,125	104,484	89,641	69,266
Cash Outflows				
RM[a]: Cash	54,758	27,362	44,521	17,932
Credit		40,882	20,428	33,239
Skilled Worker	4,409	1,937	4,048	1,799
Unskilled Worker	3,906	1,746	2,379	921
Subcontract Worker				
Overhead Cost	9,114	4,397	7,157	2,941
Tax	2,102	2,086	1,788	1,382
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,500	13,500	13,500	13,500
Repayment of LTD				30,000
Interest on STD[c]				
Total	93,789	97,910	99,121	107,714
Balance				
Borrowing				26,018
Repayment				
Outstanding[d]				26,018
Savings Deposit	15,336	6,574	12,430	
Savings Withdrawal			21,910	12,430
Savings Outstanding	15,336	21,910	12,430	0
Shadow Price	0	0	0	0
Net Return				10,666
Accounts Payable				13,388

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 62,500 baht

Table 8.24 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: D-W/R Ready-Made Garment Firm, Situation 2, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	94,891	94,162	80,659	62,563
Credit Sales		10,543	10,462	8,962
Interest Income				
Beginning Cash	4,000			
Total	98,891	104,705	91,121	71,525
Cash Outflows				
RM[a]: Cash	68,002	69,323	57,999	47,339
Credit				
Skilled Worker	3,302	2,955	3,172	2,758
Unskilled Worker	2,850	2,705	1,966	1,415
Subcontract Worker				
Overhead Cost	6,757	6,706	5,730	4,432
Tax	2,109	2,092	1,792	1,390
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,500	13,500	13,500	13,500
Repayment of LTD				30,000
Interest on STD[c]		163	106	68
Total	102,520	103,444	90,265	106,902
Balance				
Borrowing	3,629	2,368	1,512	36,889
Repayment		3,629	2,368	1,512
Outstanding[d]		2,368	1,512	36,889
Savings Deposit				
Savings Withdrawal				
Savings Outstanding				
Shadow Price	0	0	0	0
Net Return				20,066
Accounts Receivable				6,951

[a]RM = purchases of raw materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 62,500 baht

Table 8.25 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Payable and Net Return: D-W/R Ready-Made Garment Firm, Situation 3, Conservative Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	115,623	114,760	98,340	76,018
Credit Sales				
Interest Income		221	315	220
Beginning Cash	4,000			
Total	119,623	114,981	98,655	76,238
Cash Outflows				
RM[a]: Cash	58,934	31,408	47,572	20,969
Credit		43,999	23,449	35,518
Skilled Worker	4,742	2,230	4,388	2,048
Unskilled Worker	4,211	1,998	2,593	1,042
Subcontract Worker				
Overhead Cost	9,811	5,047	7,776	3,336
Tax	2,312	2,295	1,967	1,520
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,500	13,500	13,500	13,500
Repayment of LTD				30,000
Interest on STD[c]				
Total	99,510	106,477	107,245	113,933
Balance				
Borrowing				17,668
Repayment				
Outstanding[d]				17,668
Savings Deposit	20,113	8,504	20,027	
Savings Withdrawal			28,617	20,027
Savings Outstanding	20,113	28,617	20,027	0
Shadow Price	0	0	0	0
Net Return				17,327
Accounts Payable				15,656

[a] RM = purchases of raw materials

[b] LTD = long-term debts

[c] STD = short-term debts

[d] Maximum borrowing limit = 62,500 baht

Table 8.26 Quarterly Cash Flow Statement, Shadow Price of Borrowed Capital, Accounts Receivable and Net Return: D-W/R Ready-Made Garment Firm, Situation 3, Liberal Approach

Unit:Baht

	Period			
	1	2	3	4
Cash Inflows				
Cash Sales	104,367	103,590	88,725	68,567
Credit Sales		11,596	11,510	9,858
Interest Income			10	
Beginning Cash	4,000			
Total	108,367	115,186	100,245	78,425
Cash Outflows				
RM[a]: Cash	74,793	76,264	67,137	48,512
Credit				
Skilled Worker	3,631	3,251	3,659	2,837
Unskilled Worker	3,135	2,976	2,293	1,409
Subcontract Worker				
Overhead Cost	7,432	7,377	6,647	4,513
Tax	2,319	2,302	1,972	1,524
Dividends	6,000	6,000	6,000	6,000
Interest on LTD[b]	13,500	13,500	13,500	13,500
Repayment of LTD				30,000
Interest on STD[c]		110		
Total	110,810	111,780	101,208	108,295
Balance				
Borrowing	2,443		0	29,870
Repayment		2,443		
Outstanding[d]	2,443	0	0	29,870
Savings Deposit		963		
Savings Withdrawal			963	
Savings Outstanding		963	0	
Shadow Price	0	0	0	0
Net Return				27,753
Accounts Receivable				7,619

[a]RM = purchases of rwa materials

[b]LTD = long-term debts

[c]STD = short-term debts

[d]Maximum borrowing limit = 62,500 baht

of borrowed capital when the firm expands as expected demand increases, when the firm adds some new products to the existing ones, or when both demand and product line increase. Comparisons are made between the linear programming results of the basic model to those of the extended model under different situations. The comparison between the basic model and Situation 1 of the extended model, tells what would happen if the firm increases its production as expected demand increases. The comparison between the basic model and Situation 2 of the extended model tells what would happen if the firm expands its size by adding new products to the existing ones, and the comparison between the basic model and Situation 3 of the extended model tells what would happen if the firm expands by both adding new product lines as well as increasing level of production of both existing and new products in response to an increased demand.

8.5.1 The Exporting Ready-Made Garment Firm

8.5.1.1 Comparison Between the Basic Model and Situation 1 of the Extended Model

When the firm can produce and sell more as demand increases, net return as well as savings increases (Table 8.27). This conclusion is true for both the conservative and the liberal approach. However, under the liberal approach, in period 1, the basic firm and the firm in Situation 1 both borrow from the commercial bank up to maximum limit, and the period shadow price of borrow capital is the same, .51. Even though shadow prices are the same, when the borrowing limit was removed, the firm in Situation 1 would borrow 34,000 baht while the basic firm would borrow 31,000 baht. Therefore it can be concluded that for this type of ready-made garment firm, when production level increases as demand increases, the firm needs more credit in the first period.

Table 8.27 Borrowing, Savings, Lending and Net Return of the Exporting Ready-Made Garment Firms

	Period	Basic Model		Situation 1		Situation 2		Situation 3	
		Con	Lib	Con	Lib	Con	Lib	Con	Lib
Borrowing Commercial Bank[a]	1	-	22,000[b]	-	22,000[c]	-	18,773	-	20,822
	2	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-
Shadow Price	1	0	.51	0	.51	0	0	0	0
	2	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0
Input Suppliers	1	113,519	-	124,223	-	137,292	-	150,234	-
	2	82,123	-	90,915	-	84,489	-	93,758	-
	3	32,294	-	35,441	-	37,006	-	40,346	-
	4	12,950	-	14,229	-	25,001	-	27,885	-
Savings	1	132,729	0	147,068	0	182,398	0	201,931	0
	2	123,021	0	136,889	0	153,746	27,556	170,830	31,153
	3	63,695	29,178	72,254	33,462	95,461	61,684	107,408	70,631
	4	35,021	36,405	42,563	42,852	84,249	73,346	96,838	84,554
Accounts Receivable	4	-	10,523	-	11,571	-	18,872	-	20,755
Net Return	4	44,332	68,433	50,472	75,928	81,222	113,740	91,056	126,833

Con = Conservative; Lib = Liberal

[a]Maximum borrowing limit is 22,000 baht.

[b]Maximum amount of credit needed is 30,876 baht.

[c]Maximum amount of credit needed is 34,132 baht.

8.5.1.2 Comparison Between the Basic Model and Situation 2 of the Extended Model

When the firm adds to its product line, savings as well as net return, under both conservative and liberal approaches, increase, and the amount increased is greater than those in Situation 1 (Table 8.27). Furthermore, the firm in Situation 2 starts savings in period 2, but not in period 3 as is the case for the basic firm and the firm in Situation 1. In period 1, unlike the firm in Situation 1 where demand for credit is higher than that of the basic firm, demand for credit of the firm in Situation 2 is lower than that of the basic firm. In other words, comparing the basic firm with the firm in Situations 1 and 2 indicates that in period 1, demand for credit increases for the former and decreases for the latter situation.

8.5.1.3 Comparison Between the Basic Model and Situation 3 of the Extended Model

Table 8.27 also shows that when expected demand and production of both existing and additional products increase by 10 percent, net return and savings increase. As would be expected for this short-run adjustment, net return and savings of the firm in Situation 3 are the greatest among the other Situations, including the basic one. It was observed from the comparison between the firm in Situation 1 and the basic firm that when expected demand and production of the same set of products increase, demand for credit, in period 1, increased. Therefore, it is not surprising that the demand for credit of the firm in Situation 3 is greater than that of the firm in Situation 2. However, the amount of credit needed by the firm in Situation 3 is much lower than that of the firms in Situation 1 and the basic firm.

The borrowings from input suppliers were not discussed in the comparisons above since the amount borrowed from input suppliers is fixed at a certain percentage of total raw material costs. Therefore, the amount borrowed increases as the firm increases production level of existing products or adds more product line or both.

8.5.2 The D-C Ready-Made Garment Firm

8.5.2.1 Comparison Between the Basic Model and Situation 1 of the Extended Model

When expected demand as well as production of the same set of products increase, net return as well as savings increase. Since the firm in Situation 1 is able to save more than the basic firm, then the amount borrowed by the firm in Situation 1 is less than that of the basic firm. It can be seen in Table 8.28 that, in period 3, the amount borrowed from the commercial bank by the firm in Situation 1 is less than that of the basic firm. Since the firms in both situations do not borrow up to the maximum limit, shadow prices of borrowed capital are all zero.

8.5.2.2 Comparison Between the Basic Model and Situation 2 of the Extended Model

Given the same level of demand for the existing products, when the firm produces and sells additional products, net return as well as savings increase. It can be observed from Table 8.28 that, under the liberal approach, in period 3, instead of borrowing some capital from commercial banks, the firm in Situation 2 is able to deposit some money in the savings account. The amount saved and net return of the firm in Situation 2 are greater than those of the firm in Situation 1, and the basic firm. Shadow prices of the firms under both situations are the same and equal zero.

Table 8.28 Borrowing, Savings, Lending and Net Return of the D-C Ready-Made Garment Firms

		Basic Model		Situation 1		Situation 2		Situation 3	
	Period	Con	Lib	Con	Lib	Con	Lib	Con	Lib
Borrowing									
Commercial Bank[a]	1	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-
	3	-	13,384	-	10,083	-	-	-	-
	4	-	-	-	-	-	-	-	-
Shadow Price	1	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0
Input Supplier	1	12,045	-	13,599	-	19,042	-	21,310	-
	2	11,807	-	12,985	-	14,528	-	16,011	-
	3	16,465	-	17,201	-	20,516	-	21,557	-
	4	4,666	-	6,100	-	8,946	-	10,883	-
Savings	1	20,007	1,197	23,231	1,882	35,022	5,548	39,781	6,673
	2	23,142	6,512	27,135	8,569	37,097	17,061	42,572	20,214
	3	3,575	0	7,954	0	22,387	673	28,747	5,594
	4	23,320	14,853	30,448	19,930	51,800	38,228	61,846	45,487
Accounts Receivable	4	-	9,154	-	10,064	-	12,333	-	13,557
Net Return	4	45,151	50,495	50,840	56,483	69,348	77,050	77,457	85,532

Con = Conservative; Lib = Liberal

[a]Maximum borrowing limit is 43,750 baht.

8.5.2.3 Comparison Between the Basic Model and Situation 3 of the Extended Model

Given the comparisons above, it is not surprising to conclude that net return and savings of the firm in Situation 3 are much greater than those of the basic firm. Actually net return and savings of the firm in Situation 3 is the greatest among the situations (Table 8.28). As for the case of the firm in Situation 2, the firm in Situation 3 never borrows from the commercial banks.

As in the case for the exporting ready-made garment firm, borrowings from input suppliers are fixed at a certain percentage of total raw material costs, therefore the borrowings increase as the firm expands.

8.5.3 The D-W/R Ready-Made Garment Firm

8.5.3.1 Comparison Between the Basic Model and Situation 1 of the Extended Model

As is true for the other types of ready-made garment firms, when expected demand for and production of the products increase, net return and savings increase. The increment in savings is reflected in the increment of amount saved by the firm under the conservative approach and the reduction in the amount borrowed of the firm under the liberal approach (Table 8.29). Therefore, for this type of ready-made garment firm, demand for credit decreases as expected demand for and production of products increase. Since the amounts borrowed never reached the maximum limit, shadow prices of borrowed capital in both situations are all zero.

8.5.3.2 Comparison Between the Basic Model and Situation 2 of the Extended Model

As indicated in Table 8.29, given the same level of demand for existing products, when the firm produced and sells additional products,

Table 8.29 Borrowing, Savings, Lending and Net Return of the D-W/R Ready-Made Garment Firms

	Period	Basic Model		Situation 1		Situation 2		Situation 3	
		Con	Lib	Con	Lib	Con	Lib	Con	Lib
Borrowing									
Commercial Bank[a]	1	-	4,538	-	3,443	-	3,629	-	2,443
	2	-	4,982	-	1,913	-	2,368	-	-
	3	-	5,678	-	567	-	1,512	-	-
	4	30,534	41,751	22,640	35,059	26,017	36,888	17,668	29,870
Shadow Price	1	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0
Input Supplier	1	33,777	-	36,305	-	36,506	-	39,290	-
	2	16,410	-	18,921	-	18,241	-	20,939	-
	3	28,288	-	30,680	-	29,682	-	31,716	-
	4	11,893	-	13,530	-	11,959	-	13,985	-
Savings	1	13,432	0	17,984	0	15,335	0	20,113	0
	2	17,405	0	23,601	0	21,910	0	28,618	963
	3	7,582	0	14,670	0	12,429	0	20,026	0
	4	0	0	0	0	0	0	0	0
Accounts Receivable	4	0	6,801	0	7,453	-	6,951	-	7,618
Net Return	4	6,622	15,052	12,816	22,396	10,666	20,006	17,327	27,752

Con = Conservative; Lib = Liberal

[a]Maximum borrowing limit is 62,500 baht.

net return and savings increase. As for the case of the firm in Situation 1, the increment in savings reflects in the increment in the amount saved of the firm under the conservative approach and the reduction in the amount borrowed of the firm under the liberal approach. However, the comparison between the firm in Situation 2 and the firm in Situation 1 shows that net return and savings of the firm in Situation 2 are less than those of the firm in Situation 1. These findings are contrary to the results in the other two types of ready-made garment firms in which net return and savings of the firm in Situation 2 are greater than those of the firm in Situation 1. Therefore it is not necessarily true that net return and savings of the firm which expands its production line are greater than those of the firm which increase the production level of the existing product line.

8.5.3.3 Comparison Between the Basic Model and Situation 3 of the Extended Model

Given the comparisons above, it can be concluded that net return and savings of the firm in Situation 3 must be higher and demand for credit must be lower than those of the basic firm. Actually, the firm in Situation 3 has the highest net return and savings and the lowest demand for credit among the firms in other situations (Table 8.29).

8.6 Comparison Between Expectations and Actual Results

This section presents the comparison between the expectations of the results discussed in section 8.3 and the actual results discussed in sections 8.4 and 8.5.

Since the expectations were stated in relative rather than absolute levels, nearly all outcomes were as expected. However, the expectation

that the D-C ready-made garment firms in Situations 1, 2 and 3 would need some credit in period 3 was only partially realized. It was found that the firm in Situation 1 needs some credit while the firms in Situations 2 and 3 need no credit.

8.7 Constraints Facing the Ready-Made Garment Firms

8.7.1 The Exporting Ready-Made Garment Firm

Under the conservative approach, in all situations, for each product expected demand is a constraint in each period. Inventory is a constraint in period 1 and/or period 3.

Under the liberal approach, in all situations, inventory is a constraint in period 3. In Situations 2 and 3, expected demand for each product is a constraint in every period. In Situation 1, expected demand for each product is a constraint in every period, except expected demand for men's shirts and long dresses in period 1. In this Situation 1, credit is a constraint in period 1.

8.7.2 The D-C Ready-Made Garment Firm

Under both approaches, in all situations, for each product demand is a constraint in every period. Inventory is a constraint in period 3, and credit is never a constraint.

8.7.3 The D-W/R Ready-Made Garment Firm

Under both approaches, in all situations, for each product, demand is a constraint in every period. Under the conservative approach, inventory is a constraint in period 1 or 3, yet under the liberal approach, inventory is not a constraint in any period.

8.8 Summary of the Findings

This section will summarize only the findings with regard to the amount of credit needs, timing of credit needs, and rate of interest paid or can afford to pay.

8.8.1 Credit Needs from Commercial Bank Source

For the exporting ready-made garment firms: under the conservative approach when the firms borrow as much as they can from input suppliers, they need no credit from commercial banks. Under the liberal approach, it has been shown that the firm should obtain around 35,000 baht or an increase of around 15 percent of total outstanding debts at the commercial bank.

For the D-C ready-made garment firms: under the conservative approach when the firms borrow as much as they can from input suppliers, they need no credit from commercial banks. Under the liberal approach, the amount of credit the firm should obtain from commercial banks is around 14,000 baht which is less than the limit specified in the model.

For the D-W/R ready-made garment firms: the amount of credit the firm should obtain from commercial banks under the conservative and liberal approaches are around 31,000 baht and 42,000 baht, respectively. These amounts are also less than the limit specified in the model.

8.8.2 Timing of Credit Needs

Results of the above analysis indicate that timing of credit needs varies according to the type of ready-made garment firm. The exporting ready-made garment firms need credit in the first period. The D-C ready-made garment firms need credit in the third period, and the D-W/R ready-made garment firms need credit in every period.

8.8.3 Rate of Interest

There are two aspects of rate of interest. The first one is the rate of interest the firm actually pays. The second one is the rate of interest the firm can afford to pay to other lenders when the borrowings level from commercial banks is constrainted. The rate of interest the firm can afford to pay is indicated by the shadow price of borrowed capital.

In the above analyses the exporting, D-C and D-W/R ready-made garment firms pay 52 percent, 54 percent and 48 percent rate of interest to input suppliers respectively, and pay 18 percent rate of interest to commercial banks.

The shadow price of borrowed capital of the exporting ready-made garment firm, in period 1 only, indicates that the firm could pay up to around 200 percent annual rate of interest for additional borrowings. Of course, as borrowings increase the shadow price is made smaller.

CHAPTER 9

SUMMARY AND CONCLUSIONS

9.1 Research Methodology

9.1.1 General Features of the Model

Previous studies regarding small scale industries in developing countries did not provide quantitative measurement of the amount and timing of short-term credit needs from commercial banks. This study has attempted to fill this void.

In response to this need, a generalized linear programming model was constructed that can be applied to any small scale industry providing certain essential data are available. For this study, the model was adapted for analyzing the need for short-term credit by firms in the cement product and the ready-made garment industries in Thailand.

The generalized linear programming model has the following characteristics: (1) multiperiod to analyze one 12 month production cycle; (2) separate production and marketing activities with input prices and wages varying by season; (3) a differentiation between cash and credit transactions for input purchases and product sales; (4) a finished product inventory by product in physical terms by season adjusted by production, sales, and carryover phenomenon; (5) a seasonal cash flow and financial accounting (row activity) reflecting sales, borrowing, accounts receivable, purchases, other cash outflows and accounts payable of the

firms; and (6) an objective function fo maximize net return to fixed assets, family labor, and equity capital subject to demand, inventory, machinery, borrowed capital and other financial constraints.

The following variables are determined from the model: (1) production flow by product and by period; (2) accumulation and liquidation of inventory of product by product and by period; (3) amount sold in cash and on credit by product and by period; (4) the use of machinery by product and by period; (5) the use of labor and labor cost of skilled and unskilled labor by period; (6) tax, dividends, overhead cost, interest payment and interest income by period; (7) borrowing, repayment, and outstanding by source and by period; (8) savings deposit, withdrawal, and balance by period; and (9) net return to fixed assets, family labor, and equity capital.

Technically, the savings activity in the model is merely a term to balance the cash flow equation by forcing cash inflows to equal cash outflows in periods when there is a computed cash surplus. In reality, this surplus for investment and family consumption would take on a different pattern if the cash flow management behavior of the firm departs from the assumptions imposed on this model. Nevertheless, the inforamtion on savings provides some measure of the ability of the firm to repay outstanding short-term debt and to make long-term investment.

9.1.2 Limitations of the Model

Despite these many features of the model, there are many things not provided that might be of interest. For example, the model does not answer the following questions: (1) To what extent is the availability of labor a constraint in small scale industries? The model could be

modified to answer this question but it was assumed that all needed labor could be obtained from the local labor market. (2) What is the optimum inventory of finished product to be maintained throughout the year and especially as the firm enters a new production cycle? (3) What is the optimum inventory of raw materials to be maintained throughout the year and especially as the firm enters a new production cycle? Data were lacking to model this feature adequately and if they were available, it would have added much more complexity to an already very complex model. (4) What is the optimum technology for use by firms of differing size and market conditions for inputs and products? This is an important question and has an important bearing on firm credit use. However, there are so many facets to this question that it can be regarded as a major study by itself. (5) What is the optimum size of small scale firm? This question would be considering long-term investments which were considered beyond the scope of this study. (6) What is the nature of the expansion path to be followed by a firm as it adjusts to an expanded market or increases its product line? (7) What are the ramifications of making decisions as to the number and timing of products to produce? This question is approached in the LP methodology but matters having to do with unique situations for input availability and market accessibility have not been considered. (8) What is the potential for market development for individual products and what would be the effect on credit utilization resulting from a change in the ratio of prices in the product line?

These apparent shortcomings in the model will be addressed later as matters for potential future research. The brief summary of the results to follow is cognizant of the fact that the findings in any linear

programming analysis are contingent upon the specification of the model, its explicit assumptions and the adequacy of the data base needed for the analysis.

9.1.3 Application of the Model

The generalized model was modified as needed to analyze total amount of credit needs, seasonal credit needs, timing of credit use, and marginal productivity of borrowed capital for each type of cement product and ready-made garment firm.

A basic model firm was defined from data obtained from the selected sample firms of both cement product and ready-made garment industries. The firms were classified according to marketing characteristics, yielding one type of cement product firm (which sells the majority of its products directly to consumers in domestic markets) and three types of ready-made garment firms; namely, the exporting, the domestic-consumers (D-C), and the domestic-wholesalers/retailers (D-W/R) ready-made garment firms. These basic firms for each type of cement product and ready-made garment manufacturer were synthesized from the average of all the sample firms in each group. Since the basic firm was constructed from the average firm, it did not necessarily characterize any particular firm since it contains some aspect of every sample firm. The products specified in the basic model are not those being produced by all sample firms. They represent those products produced by most of the sample firms for which sufficient data were available to carry out the LP analysis.

Instead of estimating credit needs for the basic firm under average conditions, an approach was used to examine commercial bank credit use

behavior at extreme ends of the spectrum. A conservative approach wherein trade credit available from input suppliers combined with all product sales in the form of cash would suggest minimum borrowings from the bank. A liberal approach wherein no credit was obtained from input suppliers in combination with a reasonable proportion of product sales in the form of credit would suggest maximum borrowing from the bank.

These alternative strategies were examined for all basic firms and all basic firms assumed to extend short-term credit requirements through an increase in product demand and/or an increase in the number of products produced.

9.1.4 Data Sources

Data used in the study were obtained from surveys conducted as part of the Thailand Rural Off-Farm Employment Assessment Project during the period May 1980 through April 1981.

The surveys took place in San Patong, San Kamphang, and Muang districts in Chiang Mai Province, Ban Phai and Muang districts in Khon Kaen Province, and Muang district in Roi Et Province. Chiang Mai is in the Northern Region and Khon Kaen and Roi Et are in the Northeastern Region. ("Muang" refers to the district within which the provincial capital is located.)

Sample firms were selected by using procedures to provide randomness within groups. However, there were purposive elements in the sampling procedure employed by the industry research supervisors in order to insure diversity of firm size, product type, production technology and location along with the willingness of entreprenuers to cooperate in the study. All firms did not supply all requested information. Since this

study required complete data from all sources, the actual number of sample firms used in the analysis was about 60 percent of the total number of sample firms.

9.2 Short-Term Credit Needs of Cement Product and Ready-Made Garment Firms

9.2.1 Credit Needs from the Commercial Bank of Cement Product Firm

These are some of the general conclusions drawn from the linear programming analysis of cement product firms.

In the first period, the firm may not need any credit from the commercial bank if the firm obtains trade credit from input suppliers. However, if the firm does not obtain trade credit from input suppliers and also provides some trade credit to customers, the firm needs some credit from the commercial bank. In the second period, the reduction in sales, the accumulation of inventory and the payment to input suppliers require the firm to borrow from the commercial bank. In the third period, even though sales pick up, yet as a result of continued inventory accumulation, the firm still needs some credit from the commercial bank. In the fourth period, on the one hand, if the firm can accumulate a lot of inventory in the second and third periods and liquidate them in the fourth period, the firm needs no credit from the commercial bank. On the other hand, if borrowed capital is a constraint in the second and third periods which does not permit the firm to accumulate a lot of inventory in the second and third periods, the firm may have to produce more in the fourth period when raw material prices and wages are higher than in the earlier two periods. In this case, the firm will need some credit from the commercial bank.

The analysis reveals that the amount of credit needed is the highest in the second period. Credit needs in the third period is only a little lower than that of the second period. Credit needs in the first period is about 1/2 of the amount needed in the third period. The amount of credit needed in the fourth period, if needed, is very small.

9.2.2 Credit Needs from the Commercial Bank of Ready-Made Garment Firms

As a result of high level of production, and the accumulation of inventory, the exporting ready-made garment firm that does not obtain credit from input suppliers and provide trade credit to customers has to borrow some money from the commercial banks in the first period. Given the assumptions of this analysis, this is the only occasion when the exporting ready-made garment firm requires commercial bank credits.

The accumulation of inventory and the reduction in sales requires the D-C ready-made garment firm to borrow from the bank in the third period if it does not obtain credit from input suppliers and provides some trade credit to customers. This is the only occasion when the D-C ready-made garment firm needs some credit from the commercial bank.

The repayment of some portion of outstanding long-term debt requires the D-W/R ready-made garment firm that obtains some credit from input suppliers to borrow some money from the commercial bank in the fourth period. Interest payment on a high level of outstanding long-term debt is one of the main factors which requires the D-W/R ready-made garment firm that does not obtain credit from input suppliers and provide some trade credit to customers to borrow from the commercial bank in every period. For this situation, the amount of credit needed is the greatest

in the fourth period when some part of the outstanding long-term debt must be repaid.

9.2.3 Credit Needs as Demand Increase for a Given Product Line

The following conclusions apply to both the cement product and ready-made garment industries.

In the first period, the provision of trade credit and the increase in cash expenses require the firms which do not obtain credit from input suppliers to borrow more from the commercial bank than before a demand increase.

In the second and third periods, cash expenses for the accumulation of inventory are the same regardless of the demand assumptions. But, because there are more sales in these periods with an increase in product demand, the requirements for credit from the commercial bank decrease, if needed at all.

In the fourth period, additional cash inflow from the added increment in sales reduces the amount of credit needs (if needed) from the commercial bank.

9.2.4 Credit Needs as Product Lines Increase, Given Demand

Again these conclusions apply to both industries under study.

Attention is drawn to the first period for those firms that do not obtain trade credit from input suppliers. If net cash margin of the additional product lines after taking into account the provision of trade credit to consumers is positive, the addition of some products to the product line decreases the demand for credit from the commercial bank. On the other hand, if net cash margin of additional product lines after

taking into account the provision of trade credit is negative, the production of additional products increases the demand for credit from the commercial bank (if needed).

In the second and third periods, the production of additional products can increase or decrease the amount of credit needed. On the one hand, if the firm accumulates a large inventory of the additional products, demand for credit from the commercial bank may increase. On the other hand, if the firm does not accumulate inventory of additional products, demand for credit from the commercial bank may decrease.

In the fourth period, liquidation of inventory make cash inflow greater than cash outflow and therefore reduces the demand for credit from the commercial bank (if needed) in this period.

9.3 Shadow Prices When Credit is a Constraint

Given the assumptions specified in the model, credit from the commercial bank is never a constraint for the D-C and D-W/R ready-made garment firms. Therefore, the shadow price for borrowed money is zero. However, credit from the commercial bank is a constraint for the cement product and exporting ready-made garment firms which do not obtain credit from input suppliers and provide some trade credit to customers.

Whenever credit from the commercial bank is a constraint, shadow price of borrowed capital is well above commercial bank rate of interest. The shadow prices range from 32 to 200 percent on an annual basis when this situation occurred.

The shadow price was greater than zero more frequently for situations analyzed in the cement product industry than for similar situations

analyzed in the ready-made garment industry. This is true, even though the maximum borrowing limit was at a higher level for the former industry than for the latter.

9.4 Overall Conclusions

1. It appears that the credit needs and the timing of those needs of small scale industry firms can vary substantially among firms even for those of comparable size and product line.

2. The shadow prices indicated that the marginal return to capital varies widely by season according to the production, inventory, input acquisition and sales strategies of the firm as they relate to the lending policies of commercial banks.

3. The amount of credit needed from commercial bank sources varies directly with the level of total production, the percentage of production costs paid in the form of cash, the amount of trade credit provided to buyers and the level of inventory maintained for finished products.

4. Periods with critical credit requirements associated with rigid lending institution policy result in shadow prices for borrowed money well above commercial interest rates.

5. When the firm expands (other things equal):

   (a) the amount of credit needed in any period will increase or decrease depending on the type of expansion, raw material acquisition strategy, and the credit sale policy which the firm chooses to follow.

   (b) the timing of credit needs may change. Net income growth for the firm may replace the need for short term credit.

   (c) an increase in net return and savings may be expected.

6. The above conclusions with respect to the maximum amount of credit needs, seasonal credit needs, timing of credit needs, and shadow price of borrow capital for the basic firms as well as the extended firms should be of vital interest to financial institutions. The need for financial institutions to have a good understanding of the management problems in the industries they serve, is apparent, if the needs of those industries are to be adequately served. The results of the study suggest that commercial banks or other financial institutions should not fix the maximum borrowing limit of the firm to a certain percentage of value of collateral pledged. (In this study, it is implicitly assumed that for a certain percentage of value of collateral, the banks do not allow the firms to make additional borrowings more than 25 percent of the existing outstanding-debt at the banks at the beginning of the first period.) The determination of the maximum borrowing limit should be based on pro-forma cash flow, income statement and balance sheet of the firm. If the limit is set at a level higher than the needs of the firm, it will hurt the portfolio as well as the net return of the bank. If the limit is lower than the needs of the firm, credit will become a constraint and it will reduce net return of both the firm and the bank.

9.5 Suggestions for Further Research

1. In this study, the analysis of cement product industry covered only a part of the different types of cement product firms found in rural areas in Thailand. Little if anything could be said about branch firms, more advanced firms, and specialized cement block making firms. Branch firms were excluded from the study because the decision making process is not done at the regional site and they are too big to be classified

as small-scale firms. The more advanced and specialized cement block making firms were excluded because complete production cost and financial data were not obtainable from them.

The study of credit needs of the more advanced firms is recommended because the products produced by this type of firm, such as lamp posts, concrete slabs, etc., are expected to have great demand in the future. An expansion of this group of firms will require a large capital investment and the employment of many workers. This suggestion is not intended to downplay the role of the group of cement product firms included in this study in the generation of income and employment of rural households. This is because the more advanced firms exist only in large provincial towns while the type of firm included in this study exists in both large and small provincial towns as well as in large and small district towns.

As in the case of the cement product industry, there is a need to study the credit needs of those ready-made garment firms that produce fashion garments and athletic garments since demand for the products are expanding very fast.

Given this good intention, the most important hurdle facing researchers is the cooperation and the willingness of the firm to provide important data. Perhaps research on an improved methodology for the collection of data is needed.

2. It would be desirable for research on the analysis of the short-term credit needs of the firms of different sizes in the same industry and among the firms in different regions be undertaken. To accomplish this objective, more production cost data from each individual sample firms as well as the addition of more sample firms are needed.

3. Since data were not available on the added cost (reduced return) and/or added return (reduced cost), resulting from the adaption of new technology in small scale industries, this suggests a fertile area for future research. Also, analysis of the credit implications for firms making long-term investments should be pursued.

4. As mentioned earlier, further refinements in the generalized linear programming model developed for this study could improve its ability to solve important problems. For example, the inclusion of inventory of raw materials could be undertaken. However, personal experience with the industries of the researcher indicates that the firms do not carry very many raw materials in inventory, especially in the ready-made garment industry in which style, design of the fabric and consumer tastes change frequently. More study is needed to validate or modify this observation, however. If inventory of raw materials is to be included as one of the activities in the model, the following data are needed: monthly prices of individual raw materials, space or inventory, and cost of holding inventory.

5. The optimum number of time periods to be specified in the model is a researchable question. There is a tradeoff between the added cost and the added understanding that may be incurred with the specification of more periods in the model. Given a number of products produced an increase in the number of periods specified would add greatly to the complexity of the model. Furthermore the greater the number of periods, would markedly increase the cost of data collection, specifiation of the model and computer costs.

6. The model, in this analysis, is assumed to behave under conditions of certainty. The model would more nearly resemble reality if uncertainty was taken into account. To do so could require information on the probability distributions of some variables such as demand, supply of labor, etc.

7. The small scale industry of Thailand is complex and involves many products under a wide range of production and marketing conditions.

Employing the methodology used in this study to other industries for which data were collected in the ROFEA Project could yield important results. Such omitted industries include: fruit and vegetable processing, furniture, noodles, bean curds, silk fabrication and woodcrafts.

In summary, the agenda for research on small scale industries in Thailand is very long. This study is a modest contribution to all that is needed.

APPENDICES

APPENDIX A

Table A-1 Debt and Assets Structure of the Basic Cement Product Firm

Assets			Liabilities and Equity	
Current			Short-Term Debt	
Cash		10,000	Commercial Banks	909
Accounts Receivable		--	Credit Associations	288,182
Inventory:	Finished Goods	--	Friends & Relatives	15,454
	Raw Materials	--	Input Suppliers	16,182
Total		10,000	Total	320,727
Fixed			Long-Term Debt	
Land		545,371	Commercial Banks	223,676
Buildings		225,421	Credit Associations	--
Vehicles		335,577	Friends & Relatives	70,634
Machinery:	CB* Machine	163,402	Input Suppliers	--
	Mixing Machine	15,089	Total	294,310
	Molds	116,616		
Total		1,401,476	Total Debt	615,237
TOTAL		1,411,476	Equity	796,239
			TOTAL	1,411,476

*CB = Cement Block

Table A-2 Debt-Assets Structure of Basic Ready-Made Garment Firms

	Types of Firm		
	Exporting	D/C	D-W/R
Current Assets			
Cash	12,000	2,700	4,000
Total	12,000	2,700	4,000
Fixed Assets			
Land	44,317	96,340	112,750
Building	29,468	105,623	434,785
Vehicle	8,855	6,827	169,523
Machinery	25,824	10,207	76,723
Total	108,463	218,997	793,781
Total Assets	120,463	221,697	797,781
Short-Term Debt			
Commercial Banks	-	60,000	-
Credit Associations	3,125	-	41,650
Friends and Relatives	-	-	7,500
Input Suppliers	42,687	27,500	-
Total	45,812	87,500	41,950
Long-Term Debt			
Commercial Banks	88,750	11,500	250,000
Credit Associations	6,250	400	18,750
Friends and Relatives	-	40,000	30,000
Input Suppliers	-	-	-
Total	95,000	51,900	298,750
Total Debt	140,812	139,400	347,990

APPENDIX B

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Table B-1 Types of Product Produced by Each Cement Product Firm

Product	Firm										
	10	11	16	21	22	19	12	08	18	15	14
Bricks									X		
Cement Blocks	X	X	X			X	X	X	X	X	X
Concrete Slabs											X
Wind Blocks	X	X	X		X	X	X	X	X		X
House Plots	X	X	X	X	X	X	X	X	X	X	X
Drainage Pipes	X	X	X	X	X	X	X	X	X	X	X
Roof Tiles		X									
Floor Tiles										X	
Toilet Heads	X		X	X			X	X			
Well Pipes	X	X	X	X	X	X	X	X	X	X	X
Table Sets				X	X	X		X	X	X	
Spirit Houses				X	X	X				X	
Stoves					X	X				X	
Well Pipe Covers			X				X			X	X
Connection Pipes										X	
Shallow Pipes									X	X	

Table B-2 Sales, Value of Production and Inventory by Period, Debt and Assets, Percentage of Credit Purchases and Percentage of Credit Sales of Each of Cement Product Firm

	Firm											
	10	11	16	21	22	19	12	08	18	15	14	Avg.
Sales (1000฿)	83	199	237	383	676	744	1067	1248	1526	1672	3307	1013
% by Period 1	37	44	14	17	47	39	28	37	44	7	19	27
2	41	17	15	27	28	10	17	39	14	34	8	20
3	0	20	18	19	12	19	27	12	9	34	43	26
4	22	19	53	36	13	32	28	12	33	25	30	27
Production (1000฿)	102	240	354	661	794	862	1004	1407	2034	1857	4113	1220
% by Period 1	52	40	16	22	41	37	23	38	41	9	15	25
2	28	22	15	29	32	10	20	36	16	35	15	22
3	0	17	24	24	16	25	27	11	20	31	45	29
4	20	21	45	25	11	28	30	15	23	25	25	24
Inventory (1000฿)												
1	22	9	25	76	4	22	-61	74	168	46	0	35
2	-6	17	15	90	69	14	19	19	100	86	348	70
3	0	2	41	86	45	72	-21	5	269	4	412	83
4	2	13	35	25	0	9	0	61	-29	48	46	19
STD (1000฿)	10	0	40	100	230	0	88	0	0	2060	1000	321
LTD (1000฿)	0	96	600	40	40	0	70	150	550	1300	1000	349
TD (1000฿)	10	96	640	140	270	0	158	150	550	3360	2000	670
% to Bank	100	100	16	29	15	0	44	100	73	30	50	39
TA (1000฿)	33	512	1000	414	722	471	510	2580	2908	8930	4911	1982
TD/TA %	30	19	64	34	37	0	31	6	19	38	41	34
% Credit Purchases	100	100	70	20	60	80	80	85	100	50	100	82
% Credit Sales	0	10	5	30	5	0	5	50	80	30	60	41

STD = Short Term Debt; LTD = Long Term Debt; TD = Total Debt; TA = Total Assets

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