Chapter 4

METHOD OF DEMAND FORECASTING AND PLANNING CAPACITY

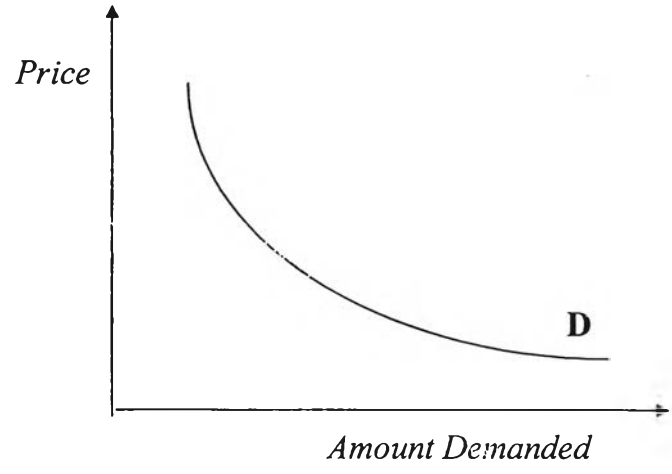
Introduction

Information has value in a world filled with uncertainty. Although it is said that history repeats itself, that truism is not entirely accurate because some unpredictable events occur that cannot be predicted or will not be repeated. Still historical information can be used to predict the likelihood of some future events. Businesspeople and government officials use historical data to quantify economic relationships that they can then use for predicting and forecasting.

The most frequently used method in quantifying the forecasted value is estimating from the historical data. Economic theory guides us in specifying the functional from to be estimated, and then helps to interpret into forecasting.

Demand for Automobiles

The demand for any product, its demand function, express the relationship between the price per unit and the amount of the product demanded. Generally, it is held that the amount demanded of any product will be inversely related to its price; that is to say, more of it will be demanded if the price is low and less will be demanded if the price is high. It can be shown in the form of a graphically that move in opposite directions as :



Accordingly demand forecasting for the sales volume of passenger car & one-ton pick up truck has to be thought of rationally and would be logical start from identifying the demand function.

Considering the factors that determine the demand (or, affect the amount of sales). To begin with price of motorvehicles, in Thailand the price has not been constantly varying except for a few significant change particularly due to implementation of government policies which would be described latterly. For this reason, it is decided to disregard the effect of price factor in the demand of this study. Thus, the position of the demand curve, or the height of the demand, depends upon the purchasing power in which closely related to :

1) the level of income, and
2) the price of all related products.

A change in any of these things will bring about a change in the demand.

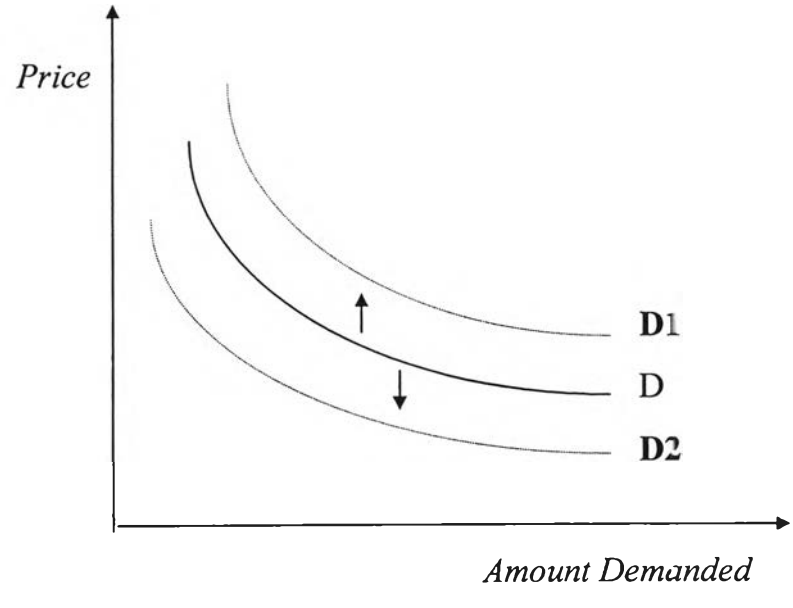
Influence of the level of income factor

It may be expected that the level of income will have considerable effect on the increase or decrease of the total number of motorvehicles because of their being the most expensive durable consumer goods. Secondly, once people

have acquired a motorvehicle, they must also be able to "run" it, which means that the income is used for covering the running costs.

At any price a change in sales volume would not occur because of a change in the product's price; instead it would be the result of a change in income level factor. Though, of course, it might be also be caused by a change the price itself as the law of demand. That means what would happen if there are an increase in the income of the buyers but no other change (or price held constant). Certainly with most products it would be reasonable to expect an increase in amount demand or sales volume at each price. Similarly when decreased the level of income and all other things being assumed constant, the buyers might not take as much of before. Therefore, a change in the income level of the buyer will lead to a change in the sales volume of motorvehicles.

In order to illustrate such a change, it follows that the original demand or demand function would no longer apply; a new D-curve would be required when such a change occurred.



D1 and D2 represent the new demand at increased and decreased demand respectively, while D is the original demand.

Influence of the price of all related products

Demand may, of course, change for several other reasons. When we look into the possible cause of the change, we can determine the factors that could influence the demand for passenger car & one-ton pick up truck, try to work out the effects upon the demand for any product as following :

(i) The decreased / increased in the price of a product which is complementary to or commonly used along with the motorvehicles.

- *Fuel price* can be expected to have effect on the demand for motorvehicles. Characteristically, the demand function is an inverse one in the sense that the amount of motorvehicle sales and the fuel price move in opposite directions.
- *Component part of motorvehicles price*, the Thai automotive industry is entirely dependent on imported component parts. Reliance on imported part leads to high cost of vehicles and degree of increased price depends upon the foreign exchange at the time of purchasing parts.

(ii) The decreased / increased in the price of a product which competes with. Apparently, *imported CBU (Completely Built-Up) motorvehicles*; if a reduction in import duty of these vehicles were implemented, the local automobile sellers would decrease their prices for competition, simultaneously the buyers or consumer would have more power against effect of consumer sovereignty with alternative in automobile market. As a result in a change of the sales volume occurred.

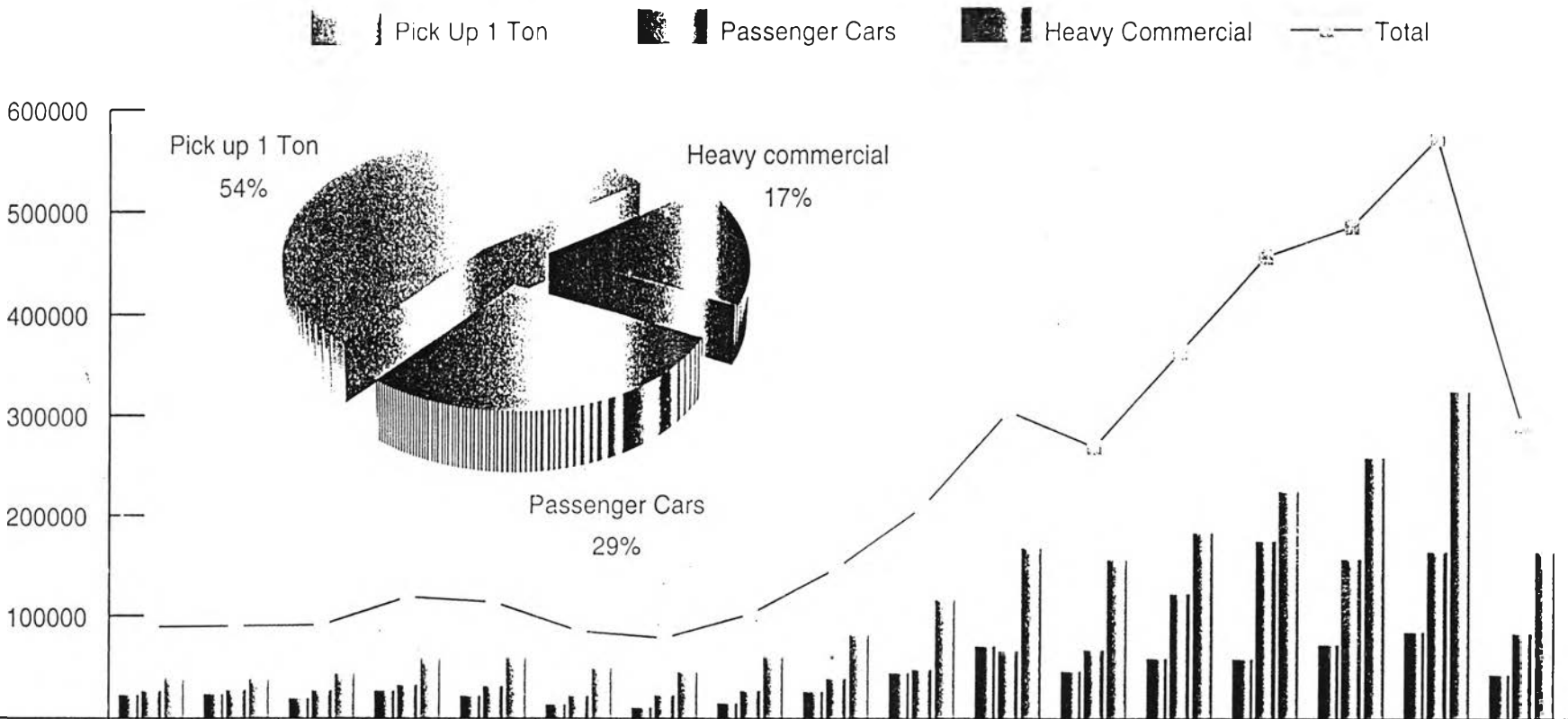
Data Collection

An accurate analysis of demand should take into consideration the actual sales data over the past several years. Due to lack of reliable sales data, it was not possible to project the demand of passenger cars and one-ton pick up trucks based on the time series of sales data. Therefore, the data on number of these vehicles registered is used to determined the demand values.

Thai Automotive Industry Club, The Federation of Thai Industry, and Toyota Motor Thailand Co., Ltd. are the main source of data collection of the automobile in Thailand under my study. Sale record of automobile in Thailand, number registered, is the primary source of data collection.

The data collection record started since in 1982. The latest data would be available to the year 1996. Scope of this research is focused on passenger car & one-ton pick up truck sales volume, most fabric usage of upholstery.

As a result, the sales record of passenger car & one-ton pick up truck in Thailand was collected to one valuable data. To make reliable analysis, at least 12 years of information is required. By this criteria the process of data collection was recorded from year 1982 through year 1996. These data are illustrated in *Figure 4.1*.



TYPE OF VEHICLE	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996*	TOTAL
HEAVY COMMERCIAL	22,818	23,841	19,716	27,058	22,401	13,688	10,674	15,110	26,198	44,574	70,590	46,415	58,541	57,911	71,917	84,396	43,273	659,121
PASSENGER CARS	26,840	27,672	27,356	32,779	31,500	22,097	22,481	27,116	38,768	47,705	65,864	66,779	121,488	174,162	155,670	163,371	83,002	1,134,650
PICK UP 1 TON	39,543	38,531	44,114	58,674	59,648	49,437	45,299	59,398	81,514	115,964	167,613	155,366	182,958	224,388	258,091	323,813	163,896	2,068,247
TOTAL	89,201	90,044	91,186	118,511	113,549	85,222	78,454	101,624	146,480	208,243	304,062	268,560	362,987	456,461	485,678	571,580	290,171	3,862,018

Figure 4.1 : Sales Record of Automobile in Thailand from 1980-1996*

(1996* = Jan - June)

Data Analysis

In case of the car fabric product in which demand depending on car assumption, coupling with the car is probably categorized as a high price and long life consumer product, demand volume in term of sale the new ones are inevitably determined in consideration of purchasing power, or the income level, under the economic situation at that time.

The volume of passenger car & one-ton pick up truck are presented in line-graph. The Y-axis is the quantity of sales and the X-axis shows time starting from 1982 to 1996, as can be seen from *Figure 4.2*. The graph showing how trend can be established the trend of the future demand by computer software program S.P.S. (Statistical Processing System) which profile fits the polynomial degree 3 equation, $y = ax^3 + bx^2 + cx + d$. The value of a, b, c, and d can be obtained to the equation as :

$$Y(x) = -229.22\,x^3 + 8325.3\,x^2 - 48192\,x + 138423$$

The basic method of forecasting is not enough useful in making qualitative, conditional predictions. We can forecast that the demand for a car fabric will increase with the increasing tendency of the passenger car & one-ton pick up truck sales volume if the situation of a market still steady-going.

Apparently all Southeast Asian economics have experienced economic turmoil relating to currency volatility. Thailand specifically faced declining economic growth, liquidity crunch and high interest rate environment. Subsequently, the decrease in overall consumption would lead to a decrease in automobile demand, and of course in car upholstery demand is no exception.

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Sale Volume	71470	91453	91148	71534	67780	86514	120282	163669	233477	222145	304446	398550	413761	487184	492466

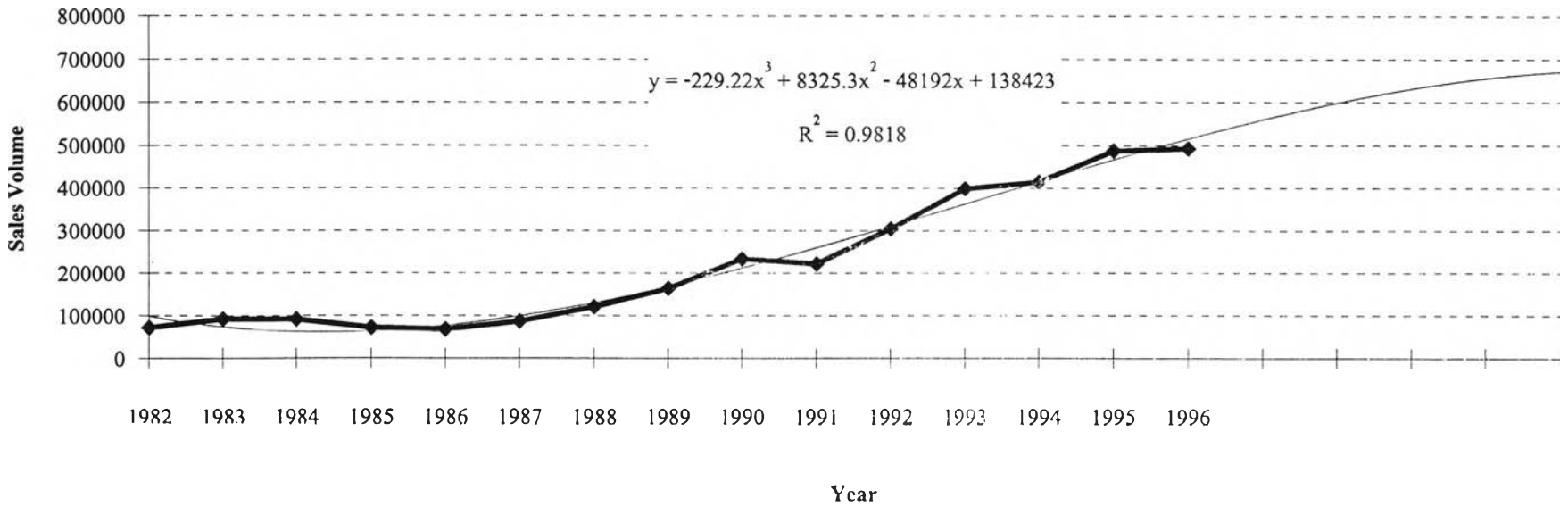


Figure 4.2 : Sales Volume of Passenger Car & Pick up 1 ton during 1982-1996

Forecasting Technique Analysis

Return to the factor determine demand for automobile sales, personal income or disposable income level can indicate changes in the sales volume of automobile. Basically disposable income is one of the important measure of economic activity, designed to show "money in people's pockets." Since the demand in term of historical data associated with economic performance, an attempt must be made to consider the structure of economic activity in the economy.

Projected Economic Activity

Generally, movements in the economic statistics can indicate changes in the economic environment. GDP (Gross Domestic Product) statistics may refer to demand levels for consumer goods. Inflation movement may indicate interest rates occurred in which may provide information on demand for large-scale capital equipment. Balance-of-payments movements signal changes in the export-import performance. As a result, analysts responsible for translating general economic projections into specific sales estimated for the company.

Figure 4.3 summarises the movement of GDF during 1989-1997 coupling with Figure 4.4 as outlined its growth rate, the onset of such data obviously display that Thailand encountered economics stability problem since 1995. Resulting from current account deficit and high inflation tendency (see in Figure 4.5 and 4.6 respectively), bank of Thailand proceeded to implement strict monetary policy and the money market was tight which causing in lending interest rate end year (see in Figure 4.7) raised up in order to restrain consumer spending at that period through 1997.

Additionally the above phenomenon of trade deficit became more severely critical in the current account as of the end year 1996. As a result the government attempt to build up local manufacturing while simultaneously

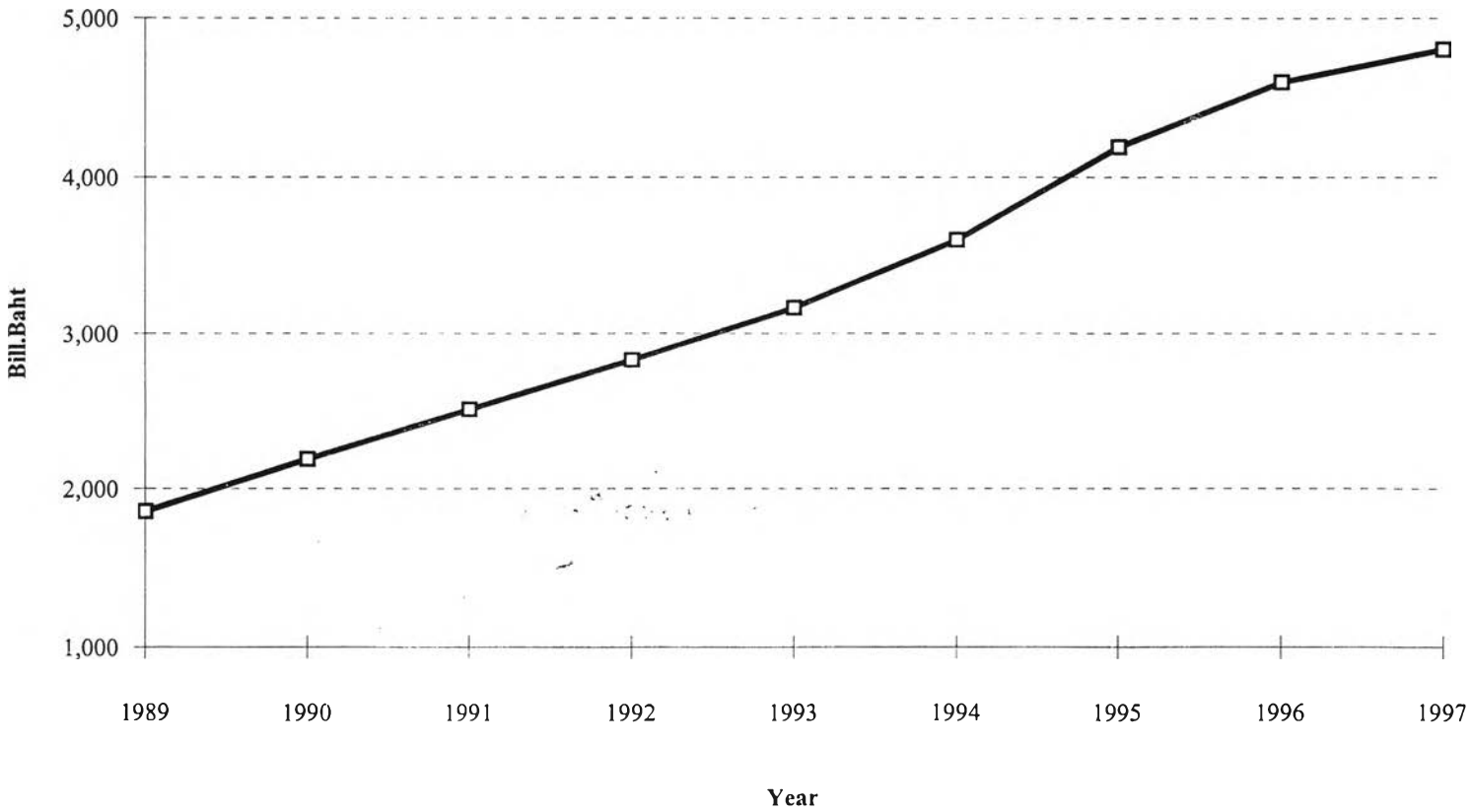
reducing capital outflow by discouraging usage of imported products (including vehicles).

All of these phenomenon represent in economics situation slowed down particularly in 1996 through 1997 which indicated by dramatically decreased in GDP growth rate, as illustrated in Figure 4.4.

Correspondingly, the extensive changes in the economy has influenced the buyer's purchasing power resulting in shifted of demand for automobile sales, or shifted D-curve.

Figure 4.3 : Gross Domestic Product (GDP) of Thailand during 1989-1997

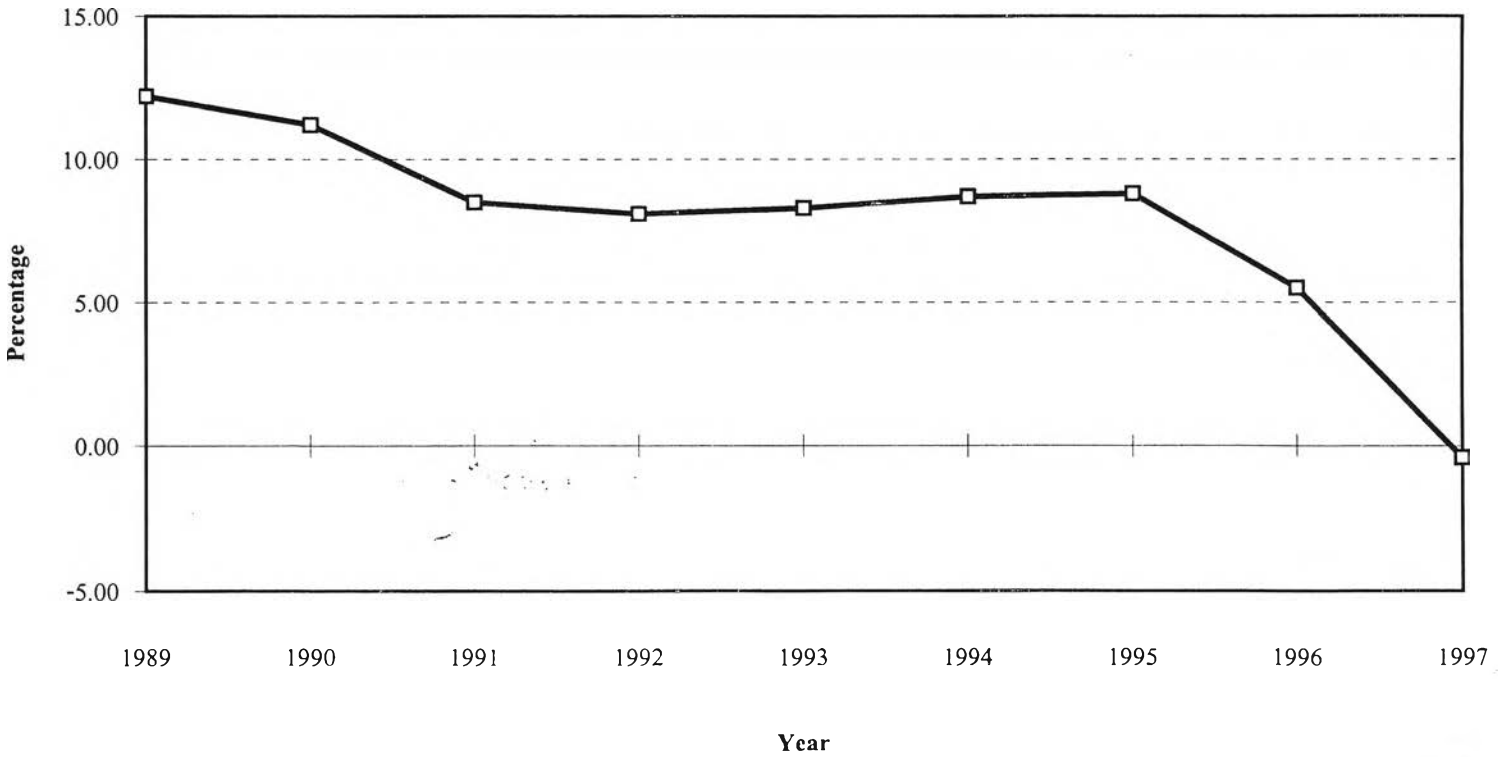
Year	GDP (Bill.Baht)
1989	1,857
1990	2,186
1991	2,507
1992	2,827
1993	3,164
1994	3,601
1995	4,189
1996	4,598
1997	4,804



Source : National Economic and Social Development Board ; Office of the Prime Minister -Bangkok , Thailand

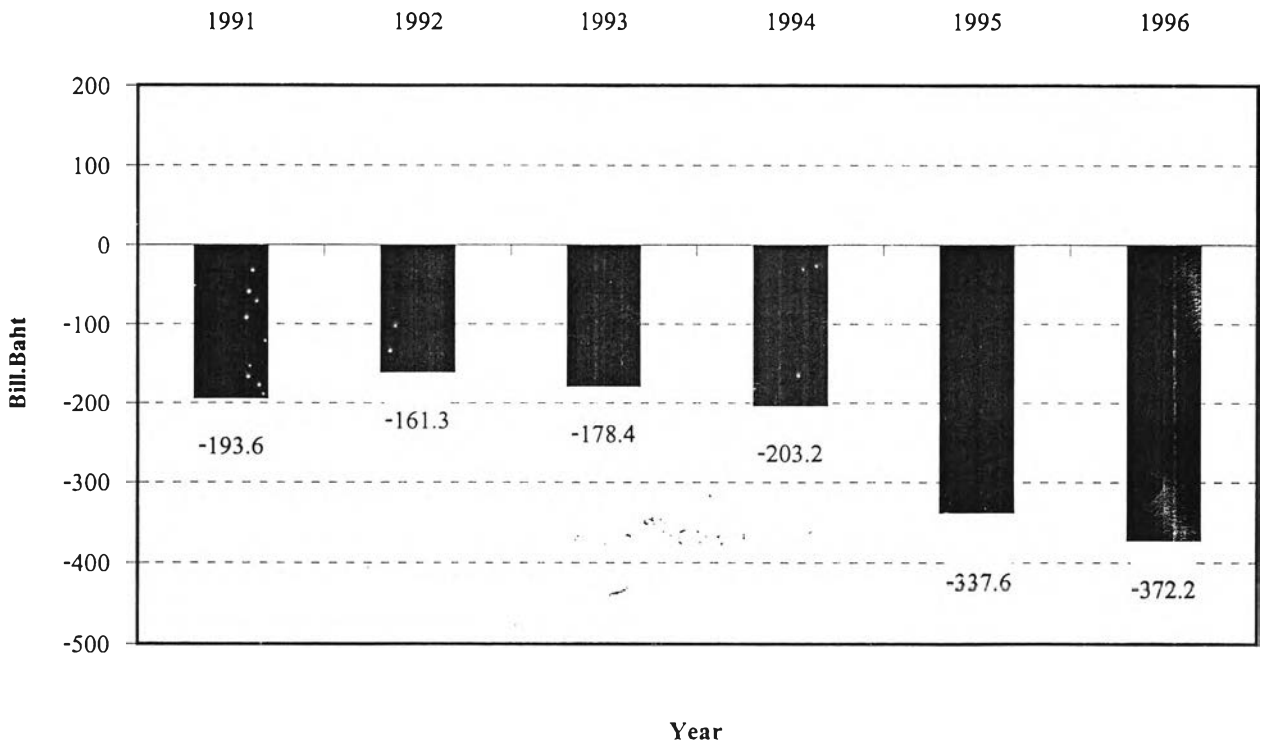
Figure 4.4 : GDP Growth Rate of Thailand during 1989-1997

Year	GDP Growth Rate (Percentage)
1989	12.20
1990	11.20
1991	8.50
1992	8.10
1993	8.30
1994	8.70
1995	8.80
1996	5.50
1997	-0.40



Source : National Economic and Social Development Board

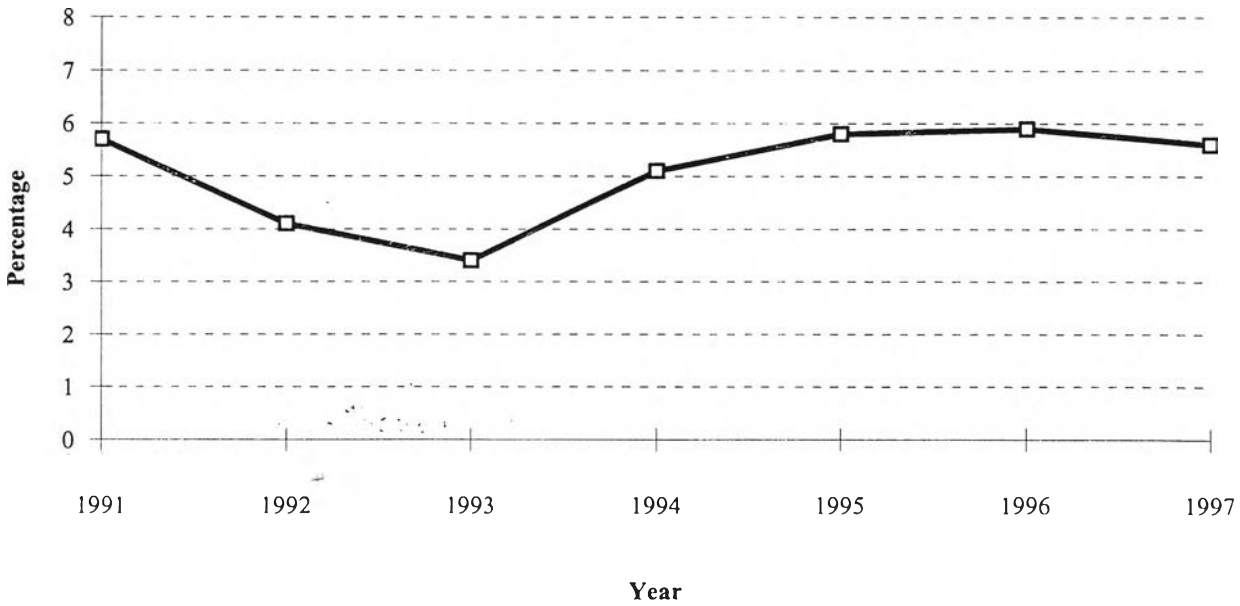
Figure 4.5 : Current Account of Thailand during 1991-1996



Source : National Economic and Social Development Board ; Office of the Prime Minister -Bangkok , Thailand

Figure 4.6 : Inflation of Thailand during 1991-1997

Year	Inflation (Percentage)
1991	5.7
1992	4.1
1993	3.4
1994	5.1
1995	5.8
1996	5.9
1997	5.6



Source : National Economic and Social Development Board ; Office of the Prime Minister -Bangkok , Thailand

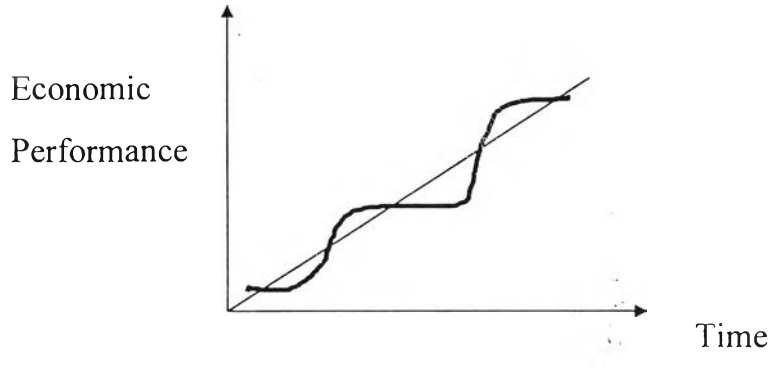
Figure 4.7 : Lending Interest Rate of Thailand during 1991-1997

Year	Interest (Percentage)
1991	13.75
1992	11.75
1993	10.50
1994	11.75
1995	14.00
1996	15.25
1997	15.69

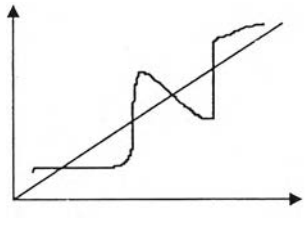
Source : National Economic and Social Development Board ; Office of the Prime Minister -Bangkok , Thailand

Forecasting with Economics Concerned

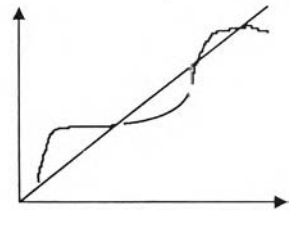
Regarding the previous described, nevertheless, the GDP remains increase between 1995-1997 which its rate probably slower than the preceding year. The influenced acted as an increased tendency, while the economic activity illustrate the periodic decline of the aggregate economy. That means a recession is actually occurring around a rising trend, as graphically shown below.



Up to this point, there are various pattern or path of recession phase such as L-shaped, U-shaped, V-shaped, and so on. For example :



V-shaped



U-shaped

Basically, the movement in the economic statistics can indicate characteristics of the economic activities as previously described.

Figure 4.8 summarises the movement of GDP-growth rate from 1980 to 1996 and Figure 4.9 outlines the movement of lending interest rate of Thailand for the same period, the onset of such data obviously display in similar tendency between during 1980-1984 and during 1992-1996.

In Figure 4.8, each of this two periodic interval starts with the stability for a certain period of time followed by declining trend for a couple years before recovering in latterly of GDP-growth rate in percentage. In other words, with regards to the monetary condition, liquidity in the financial market fluctuated during the year in the first interval (1980-1984) with occasional tightening. As a result the Bank of Thailand was intent on baht devaluation that had to intervene to rescue the situation at that time followed by keeping liquidity tight with higher interest rate to restrain consumer spending until the year 1984.

Similar to the second interval (1992-1996), liberalisation of capital flows since 1992, foreign funds poured into the market to profit from low interest rate especially in 1993, fuelling asset price inflation throughout 1994 and 1995 (see in Figure 4.6) that eventually puzzled the financial sector.

Coupling with the financial crisis in Mexico since the end of 1995 and the subsequent rumor of baht devaluation. These external factors contributed to increased volatility in domestic interest rate and substantially complicated the task of monetary management. Therefore, the Bank of Thailand intervened to stabilise the market condition with domestic interest rate stayed high throughout 1994 till 1996. As a result the property and equity markets affecting dramatically decreased in GDP-growth rate at the end of 1996 as shown in Figure 4.10.

Accordingly, it faces a difficult task, in early 1997 commercial pressures sound like to brought bank interest rate back down slightly. Similarly the figure of interest rate in the first interval was decreased throughout 1985 and 1986 then seeking a modest slowdown later, resulting in consumption pushed up

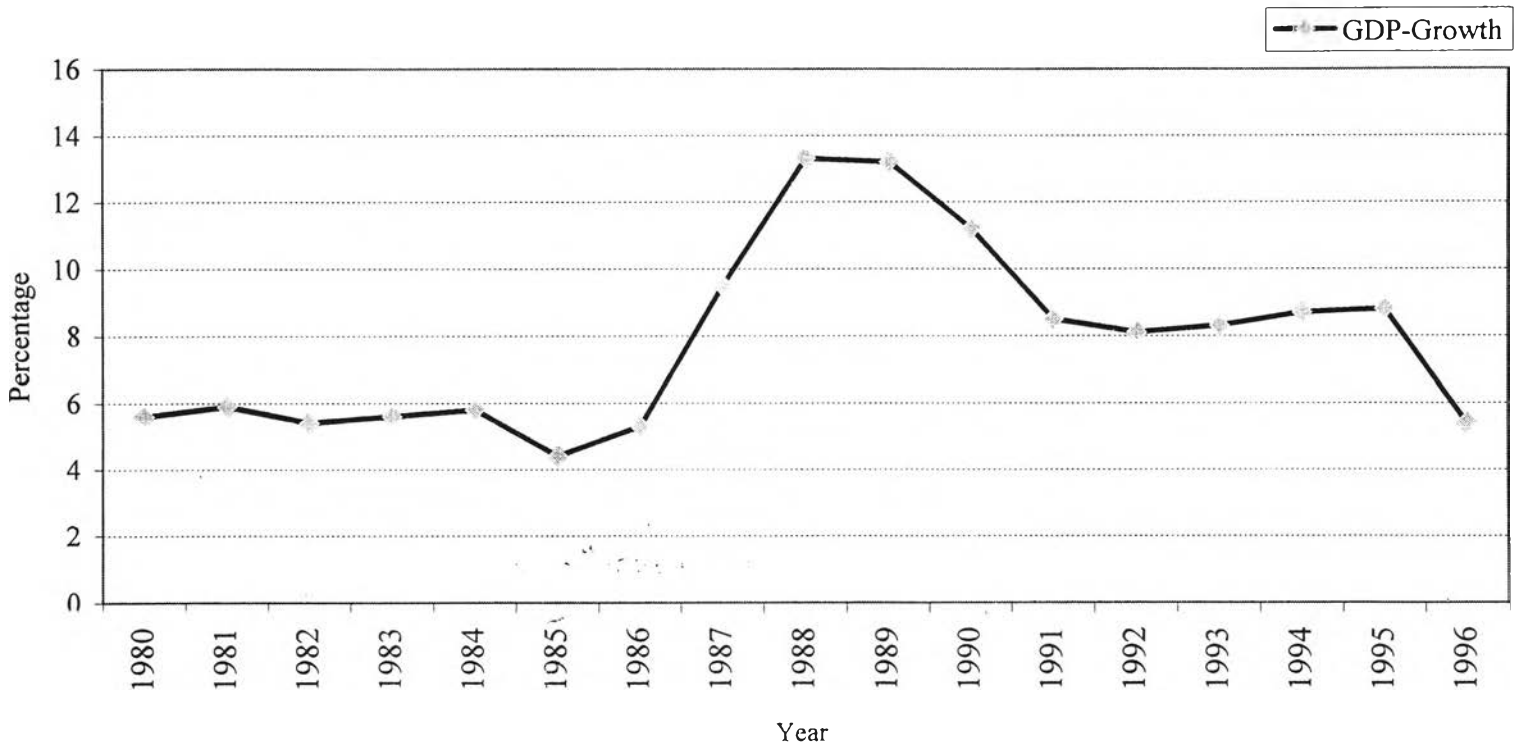
as increased in GDP-growth rate from 1985 to 1989 as shown in Figure 4.10 likewise.

For this reason, presumably as an alternative, the situation of economic activity in the forecasting interval from 1997 to 2001 likely to occur as the same pattern as from 1985 to 1989 which appears in U-shaped phenomenon based on the forecasting assumption that :

1. The two macroeconomic indicators -GDP-growth rate and lending interest rate summarizes the economics situation.
2. Without consideration of the external factors which be unpredictable such as political changed influence, episodes in the international financial markets, etc.

Year	GDP-Growth
1980	5.6
1981	5.9
1982	5.4
1983	5.6
1984	5.8
1985	4.4
1986	5.3
1987	9.5
1988	13.3
1989	13.2
1990	11.2
1991	8.5
1992	8.1
1993	8.3
1994	8.7
1995	8.8
1996	5.4

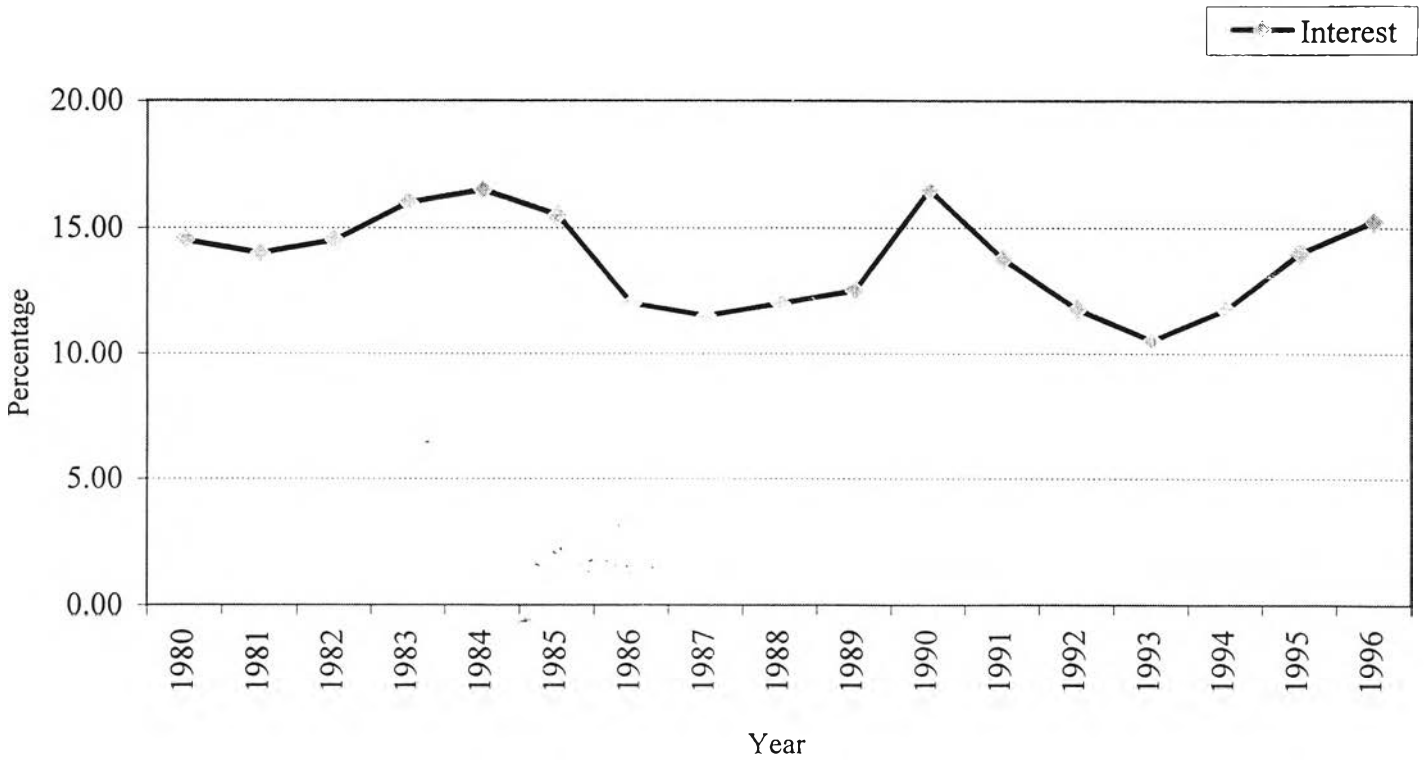
Figure 4.8 : GDP- Growth Rate of Thailand during 1980 - 1996



Source : National Economic and Social Development Board ; Office of the Prime Minister -Bangkok, Thailand

Year	Interest
1980	14.50
1981	14.00
1982	14.50
1983	16.00
1984	16.50
1985	15.50
1986	12.00
1987	11.50
1988	12.00
1989	12.50
1990	16.50
1991	13.75
1992	11.75
1993	10.50
1994	11.75
1995	14.00
1996	15.25

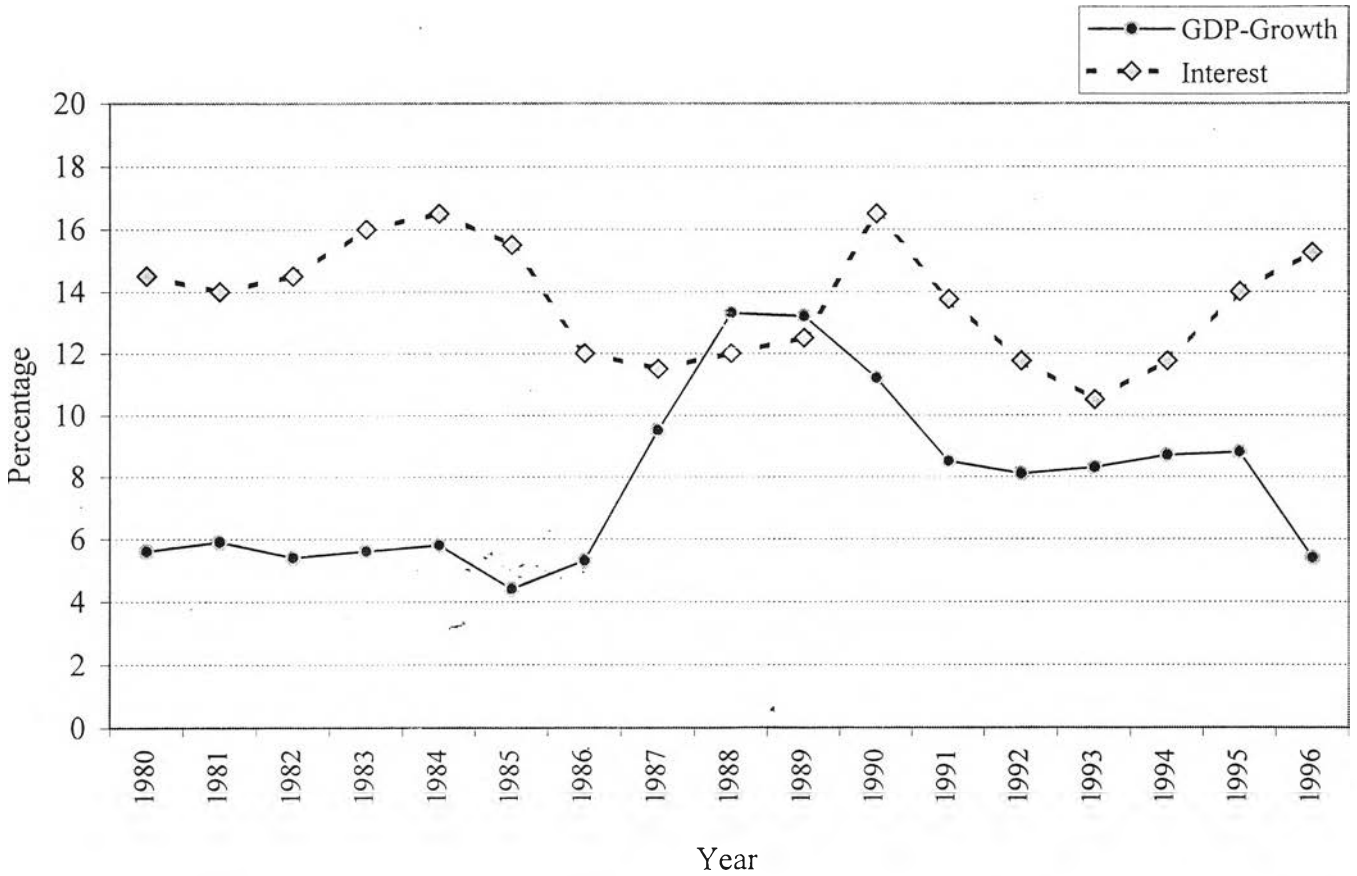
Figure 4.9 : Lending Interest Rate of Thailand during 1980 - 1996



Source : National Economic and Social Development Board ; Office of the Prime Minister -Bangkok, Thailand

Figure 4.10 : Relationship between GDP-Growth Rate and Lending Interest Rate of Thailand during 1980-1996

Year	GDP-Growth	Interest
1980	5.6	14.50
1981	5.9	14.00
1982	5.4	14.50
1983	5.6	16.00
1984	5.8	16.50
1985	4.4	15.50
1986	5.3	12.00
1987	9.5	11.50
1988	13.3	12.00
1989	13.2	12.50
1990	11.2	16.50
1991	8.5	13.75
1992	8.1	11.75
1993	8.3	10.50
1994	8.7	11.75
1995	8.8	14.00
1996	5.4	15.25



Forecasting Process

Regarding the analytical information from previous described in the extensive change in economic situation, resulting in forecasting the demand of passenger cars and one-ton pick up trucks has to be thought of rationally and would be logical to start from understanding the relationship of the sales volume from 1984 to 1989 of each. Accordingly, I purposely introduced a comparative analysis for forecasted valued between 1997-2001. In other words, if you had forecasted the drop in total unit car sales during the recession period, you could also assumed equal percentage declines or increases for the forecasting period.

Starting with the value in 1984 as the beginner similar to the value in 1996, the forecasted value can then be determined by subtracting or additive the number of these groups registered in the previous duration (1984-1989) which occurred the similar trend with the same scale to the number for the year under the forecasting consideration.

Calculation

t	Year	Sale Volume
1	1984	91,453
2	1985	71,534
3	1986	67,780
4	1987	86,514
5	1988	120,282
6	1989	163,669

T	Year	Sale Volume
1	1996	492,466
2	1997	A
3	1998	B
4	1999	C
5	2000	D
6	2001	E

Equation for forecasted value of demand related to historical data is

$$SV_{T(n)} = SV_{T(n-1)} + \left\{ \frac{(SV_{t(n)} - SV_{t(n-1)})}{SV_{t(n-1)}} SV_{T(n-1)} \right\}$$

; SV = Sales Volume value

T = at the time between 1996-2001

t = at the time between 1984-1989

n = 0, 1, 2,.....

The first year of forecasting is the year of 1997, so T=1 is based on the actual value of the year 1996 in order that the forecasted value would be more accurate to the demand forecasting process.

Substitute variables in the equation,

The forecasted value of 1997 is A , so

$$A_{(1997)} = SV_{(1996)} + \left\{ \frac{(SV_{(1985)} - SV_{(1984)})}{SV_{(1984)}} SV_{(1996)} \right\}$$

$$= 492,466 + \left\{ \frac{(71,534 - 91,148)}{91,148} 492,466 \right\} = 386,493$$

Thus, demand value in 1997 is 386,493 units. After obtaining the forecasted values from this technique, we consider the demand forecasted value in 1997 compare with actual value in which occurred at the end of 1997 recently.

Year 1997	:	The forecasted value	386,493	units
		The actual value	328,571	units

It is different in quantity as 18 % from reality which resulting from shifted its demand function (from D-original to D2-decreased). Therefore, in order to be more accurately forecast in the demand forecasting process for the yearly demands in further until the year 2001, the forecasting for the year of 1998 (B). at T = 3 is based on the actual value of the year 1997 which equals to 328,571 units

Substitute variables in the equation
The forecasted value of 1998 is B, so

$$B_{(1998)} = SV_{(1997)} + \left\{ \frac{(SV_{(1986)} - SV_{(1985)})\ SV_{(1997)}}{SV_{(1985)}} \right\}$$

$$= 328{,}571 + \left\{ \frac{(67{,}780 - 71{,}534)\ 328{,}571}{71{,}534} \right\} = 311{,}328$$

Thus, demand value in 1998 is 311,328 units. To calculate for the yearly demands until the year 2001 which demand depending on this concept, apply the same manner in estimating the value of C, D, and E respectively.

In particular, each year the demand is forecasted and matched with the market based on economic situation of the same related period . See *Figure 4.11*, presenting the values quantity demanded for the passenger car & one-ton pick up truck over the next 5 year period and the forecasts is represented graphically on a line-graph to show its trend.

Year	Sales Volume (units)	
1996	492,466	Actual Value
1997	328,571	Actual Value
1998	311,328	
1999	397,377	
2000	552,480	
2001	751,765	

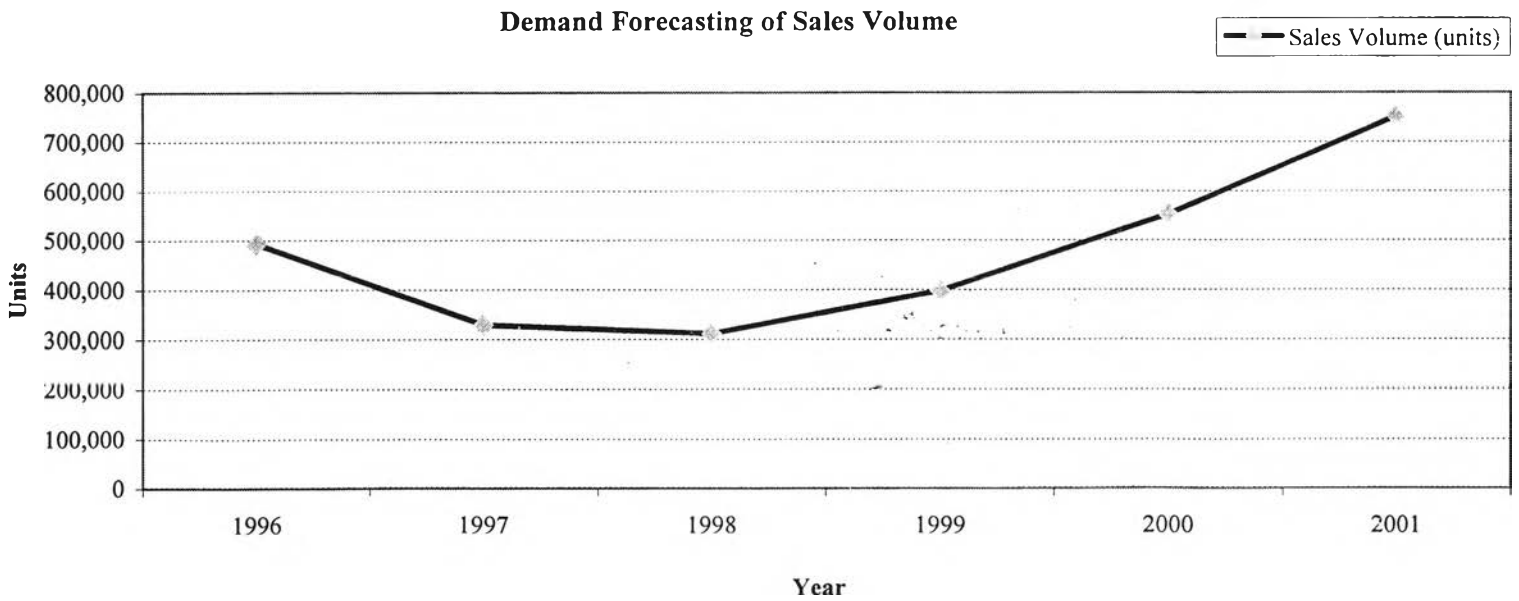


Figure 4.11 : Forecasted Demand of Sales Volume of Passenger Car & Pick up 1 Ton from 1997-2001

Marketing Projection for Fabric Production

Market Share Assessment

A useful way to assess is to be understood and characterized the nature of the competition in respect of major competitors. The market appraisement, taking into consideration of the share of assemblers or makers in the market of fabric upholstery product. Thus, starting with consideration the strength of the company within the framework of competitive market.

The threat of new entrants, in analysing markets, one of the factors to be appraised is the existence of "barriers to entry". In other words, how easy is it for new entrants to enter the market ? Due to the fabric upholstery product are mostly made by weaving machine in which this industry type is acquired by heavy start-up costs or the need for capital investment. That provides a high barrier by nature of production. Therefore, it is low degree of market competition or less major competitors such as D.R.S.Auto Seat, Srithai Auto Seat Industry, Summit Auto Seat Industry, and NHK Auto Seat.

Market standing/ Reputation, these competitors produce various type of automotive upholstery materials (e.g. leather, vinyl, and textiles by type). While our company only produce the fabric type under the primarily famous in textile or weaving product coupling with joint venture agreement with Kasumi Textile Co., Ltd., Japan's leading interior fabric manufacturers.

Production capabilities, according to the joint venture company, the firm obtained technical assistance and know-how from Japan leading industry while the other entirely Thai industries can not overcome cost barriers when technology changed.

Additionally, in order to formulate efficient and effective plan under uncertainty of car market according to the forecasting analysis. TFU has made every effort to earn the highest level of reputation from both domestic and foreign customers. To

fill this drop down of local market. Marketing will target new project and export business as follows :

Report from TFU Marketing Team,

- Commission Weaving exported to Kasumi Textile
- Expand export business to Asian country
- Bus Business
- Furniture Business
- Theater Business

Therefore, the market share estimation of the company would be determined in judgment of auditing market as noted above, which result in 35 % market share. As the past sales recorded in 1995 and 1996 has shown in 34.65 and 34.80 percentage of market share respectively.

Sales Record during 1995-1996

Year	Sales Revenue (Bht.) (fabric upholstery)	**Total Amount of Fabric Sales (m.)**
1995	189,350,700	450,835
1996	192,902,640	459,292

Automobile Sales Projection during 1995-1996

Year	Sales Projection ⟶ (from historical data in Fig.4.2)	P.car (units)	Pick up (units)	**Fabric Usage (m.)** P.car = 4 m./ unit Pick up = 2 m./ unit
1995	487,184	163,371	323,813	1,301,110
1996	492,466	167,439	325,027	1,319,810

Interpreting into Production Volume

The car fabric upholstery production volume is determined in consideration of its type of vehicles demand related to company market share, and assuming that demand will be fully met by local demand forecasting volume. Coupling with the amount of fabric consumption can be easily calculated in term of usage of fabric per unit and quantity of consumption.

The processes to find the volume of fabric production are :

1) Market segmentation of passenger car & one-ton pick up truck, and then ration on the sale projection volume (forecasted values). Passenger car : Pick up 1 Ton, 34 : 66
2) Define the usage of fabric for Passenger car = 4 m./ unit and Pick up = 2 m./ unit.
3) Calculate the total fabric usage
4) Calculate related to the company market share, in which represent the total volume of fabric production yearly. These data are illustrated in *Table 4.1*.

Table 4.1 : Marketing Projection for Car Fabric Production

Year	Sales Projection (units)	Automobile		Fabric Usage (m.)		Total Fabric Usage (m.)	Market Share for TFU		
		P.car	Pick up	P.car	Pick up		%	Metre	Amount Bht.
1997	328,571	111,714	216,857	446,857	433,714	880,570	35	**308,200**	129,444,000
1998	311,328	105,852	205,476	423,406	410,953	834,359	35	**292,026**	122,650,920
1999	397,377	135,108	262,269	540,433	524,538	1,064,970	35	**372,740**	156,550,800
2000	552,480	187,843	364,637	751,373	729,274	1,480,646	35	**518,226**	217,654,920
2001	751,765	255,600	496,165	1,022,400	992,330	2,014,730	35	**705,156**	296,165,520

Percentage of Passenger Car : Pick up 1 Ton , 34 : 66

Usage of fabric for Pcar 4m./unit and Pick up 2m./unit

The amount in 1997 is actual sale

The price on average 420 baht/m. in 1997-2001

Define the Optimum Production Capacity

The capacity of production are determined in consideration of cost of production under quantity of forecasted consumption, and it should be planned in order to minimise overhead cost at the optimum capacity.

Assigning Production Capacity Option

Table 4.2 presents data of forecasted consumption, in other words the actual projected fabric production volume of each, which related to marketing process.

Year	Projected Fabric Production Volume (m.)
1997	308,200
1998	292,026
1999	372,740
2000	518,226
2001	705,156

Table 4.2 : Projected fabric production volume

So. the option for capacity determination is set up as :

250,000 / 550,000 / and 750,000 metre per year

Assigning Cost to Product

The production cost represents the manufacturing accounts which show the cost of goods manufactured during the period of 5 years at each production capacity option, and the following standard cost items must be considered in the study.

- Direct Material Cost
- Direct Labor Cost
- Factory Overhead Cost

Direct material and direct labor, they have naturally allocated costs to products proportional to volume produced.

✦ **Direct Materials** are materials traceable to individual units produced. The costs are almost always variable, and the estimates of both each finished unit materials requirements and its usage must be identified. Accordingly, in general, the cost per unit of the direct materials of each comes from studies of past cost behavior and projected prices of suppliers.

Hence, the budgeted or standard direct materials cost per finished fabric unit is illustrated in *Table 4.3*.

✦ **Direct Labor** represents work traceable directly to particular units of product. Engineering time and motion studies and studies of past labor time usage behavior indicate that a unit requires about 0.65 hours of labor time. This estimate allows for normal, idle time 20%. The standard wage rate for production workers is 160 Baht per day of 8 hours working time.

Direct labor cost could be fixed, as in high-tech companies having only a few workers particularly in this study case. See *Table 4.4*

✦ **Manufacturing Overhead**

Variable manufacturing costs vary with units produced. Fixed manufacturing overhead costs give a firm the capacity to produce. In addition, when overhead is applied based on the volume of output, high-volume products are allocated relatively more overhead than low-volume products.

Table 4.5 shows the manufacturing overhead of fabric production in term of fixed and variable cost. These data are estimated calculation result from past experience and projected changes in cost at each capacity of production, and the following *Table 4.6 - 4.12* illustrate the total costs, for each elements of the factory overhead, at each specific capacity.

Table 4.3 : Direct Material Cost for Car Fabric Production

Raw Material	Usage (kg for fabric 1	Cost (bht / kg.)	Cost at each Production capacity (bht.)		
			250,000 m./year	550,000 m./year	750,000 m./year
Ground Yarn					
* T1.5 DBR 20/2	0.175	145.50	6,365,625	14,004,375	19,096,875
* T80 RDT 30/2	0.097	149.91	3,635,318	7,997,699	10,905,953
Pile Yarn					
* ST TQ (SD) 30/30	0.458	227.07	25,999,515	57,198,933	77,998,545
Others					
* Latex SS-2	0.274	49.00	3,356,500	7,384,300	10,069,500
Total Direct Material Cost	*	*	**39,356,958**	**86,585,307**	**118,070,873**
Direct Material Cost per metre	*	*	**157.43**	**157.43**	**157.43**

Table 4.4 : Direct & Indirect Labor Cost for Car Fabric Production

Direct Labor Cost for Car Fabric Production

Production Capacity (sq.m/ year)	Production Time Use (hours / sq.m)	Total Labour Hours (hours)	Labour Rate (idle time 20%) (@ 160 baht/day ; work 8 hours/da	**Direct Labour Cost** (baht./year)
250,000	0.65	162,500	25	**4,062,500**
550,000	0.65	357,500	25	**8,937,500**
750,000	0.65	487,500	25	**12,187,500**

Indirect Labor Cost for Car Fabric Production

Description	Cost at each Production Capacity (bht.)								
	250,000 m./y			550,000 m./y			750,000 m./y		
	No.of person	Salary per each	Total wages per year	No.of person	Salary per each	Total wages per year	No.of person	Salary per each	Total wages per year
Management									
Managing Director	1	200,000	2,400,000	1	200,000	2,400,000	1	200,000	2,400,000
Department Manager	5	50,000	3,000,000	5	50,000	3,000,000	5	50,000	3,000,000
Division Head	8	15,000	1,440,000	8	15,000	1,440,000	8	15,000	1,440,000
Staff	16	8,000	1,536,000	16	8,000	1,536,000	16	8,000	1,536,000
Driver & Maid	6	6,000	432,000	7	6,000	504,000	8	6,000	576,000
Total	**36**	279,000	**8,808,000**	**37**	279,000	**8,880,000**	**38**	279,000	**8,952,000**

Table 4.5 : Manufacturing Overhead of Car Fabric Production

Manufacturing Overhead items	Production Capacity		
	250,000 m/ year	550,000 m/year	750,000 m/ year
Land ; see Table 4.6	12,500,000	17,500,000	25,000,000
Building ; see Table 4.7	83,000,000	87,500,000	93,000,000
Elec. & Water Supply System ; see Table 4.8	8,300,000	8,750,000	9,300,000
Machinery & Equipment ; see Table 4.9	119,527,116	124,909,252	129,035,666
Vehicle ; see Table 4.10	700,000	1,400,000	1,750,000
Total Capital Investment	**224,027,116**	**240,059,252**	**258,085,666**
Expenditure			
Insurance (0.5% of Bld.+Veh+EWs)	460,000	488,250	520,250
Preventive Maintenance (5% of m/c)	5,976,356	6,245,463	6,451,783
Depreciation			
Machinery & Equipment (10y)	11,952,712	12,490,925	12,903,567
Building (20y)	4,150,000	4,375,000	4,650,000
Vehicles (5y)	140,000	280,000	350,000
Elec &Water System (10y)	830,000	875,000	930,000
Indirect Labor ; see Table 4.4	8,808,000	8,880,000	8,952,000
Transportation ; see Table 4.10	312,500	687,500	937,500
Others (0.5% of total cost above)	1,283,283	1,371,907	1,468,904
Total Fixed Cost	**33,912,851**	**35,694,045**	**37,164,004**
Accomodation ; see Table 4.11	752,000	1,654,400	2,256,000
Miscelleneous (15% of accom. cost)	112,800	248,160	338,400
Total Variable Cost	**864,800**	**1,902,560**	**2,594,400**
Total FOH (FC+VC)	**34,777,651**	**37,596,605**	**39,758,404**
FOH per metre	**139**	**68**	**53**
Remark : Bld + Veh + Elec&W.syst	*92,000,000*	*97,650,000*	*104,050,000*

Table 4.6 : Land Cost for Car Fabric Production

Production Capacity (metre)	Land (rai)	Cost of land (bht) * including improvment
250,000	5	12,500,000
550,000	7	17,500,000
750,000	10	25,000,000

Remark : land cost 2,500,000 bht. / rai

Table 4.7 : Construction Cost for Car Fabric Production

Description	Cost of Construction at each Production Capacity (bht)		
	250,000 m./ year	550,000 m./year	750,000 m./year
Factory	73,040,000	77,000,000	81,840,000
Office	7,470,000	7,875,000	8,370,000
Others	2,490,000	2,625,000	2,790,000
Total	83,000,000	87,500,000	93,000,000

Table 4.8 : Elec.& Water Supply System Cost for Car Fabric Production
(10% of cost of construction)

Description	Cost of Construction at each Production Capacity (bht)		
	250,000 m./ year	550,000 m./year	750,000 m./year
Water & elec. supply system	8,300,000	8,750,000	9,300,000

Table 4.9 : Machinery & Equipment Cost for Car Fabric Production

This is cost appraisal of machine & equipment including taxes, insurance, transportation cost which assessing from asked the company we bought these technology.

At	Production Capacity 250,000 m./y Cost of machinery & equipment =	119,527,116 bht.
At	Production Capacity 550,000 m./y Cost of machinery & equipment =	124,909,252 bht.
At	Production Capacity 750,000 m./y Cost of machinery & equipment =	129,035,666 bht.

Table 4.9a Machinery & Equipment for Car Fabric Production

	Description	Cost at each Production Capacity (bht)					
		250,000 m./y		550,000 m./y		750,000 m./y	
		m/c	Cost	m/c	Cost	m/c	Cost
I	Preparation Department						
	* One sectional warper,						
	type H.S.B		7,525,500		7,525,500		7,525,500
II	Weaving Department						
	* 4 VMm22-175 with 3 pile deliveries						
	and 3 pile beamstand						
	cost @ 9,882,900	4	39,531,600	4	39,531,600	4	39,531,600
	* 4 VMm22-175 with 2 pile deliveries						
	and 2 pile beamstand						
	cost @ 9,321,300	4	37,285,200	4	37,285,200	4	37,285,200
	* 1 Jacquard m/c with electronic						
	control cx 860, size **1344** Hooks for						
	loom picanol GTX with 1 Harnesses						
	with springs, heat-shrink tubes,						
	9200 cords and Metallic understructure						
	for a weaving machine.						
	cost @ 2,063,208	2	4,126,416	2	4,126,416	4	8,252,830
	* 1 Jacquard m/c with electronic						
	control cx 860, size **2688** Hooks for						
	loom picanol GTX with 1 Harnesses						
	with springs, heat-shrink tubes,						
	9200 cords and Metallic understructure						
	for a weaving machine.						
	cost @ 2,691,068	*	*	2	5,382,136	2	5,382,136
III	Finishing Department						
	* One velvet finishing line		17,264,000		17,264,000		17,264,000
	* One velvet backcoating m/c 1800 mm.		13,243,400		13,243,400		13,243,400
	* One inspection table		551,000		551,000		551,000
	Total	**10**	**119,527,116**	**12**	**124,909,252**	**14**	**129,035,666**

Source : Textile Machinery for Carpets and Velvets; Michel Van De Wiele N.V. (Belgium) and Staubli-Verdol SA F-69680 Chassieu / Lyon(France)

Table 4.10 : Transportation & Vehicle Cost for Car Fabric Production

* Petrol cost 200 baht / pick-up / round, so 1 m. cost 1.25 baht

Production Capacity (metre / year)	Cost of Transportation (baht / metre)	Transportation Cost (baht / year)
250,000	1.25	312,500
550,000	1.25	687,500
750,000	1.25	937,500

* 1 pick up can carry the Car-Fabric 160 m./round
* Approximately working day 315 days / year

Production Capacity (metre / year)	Number of Round- trip per year (round / year)	Number of Round trip per day (round / year)
250,000	1,563	5
550,000	3,438	11
750,000	4,688	15

* Due to the Car-Fabric would be transported to car industry which mostly located in up-country of Bangkok. Therefore the transportation for one pick up might be set up 2-3 round-trip per day. (Basically pick up truck cost @ 350,000 baht /unit.)

Production Cacity (metre / year)	No.of Pick up (unit)	Purchasing Budget (baht)	Depreciation (10y) (baht)
250,000	2	700,000	70,000
550,000	4	1,400,000	140,000
750,000	5	1,750,000	175,000

Table 4.11 : Accommodation Consumption at Car Fabric Production

Accommodation Consumption	Production Capacity (sq.m/ year)		
	250,000 sq.m/ year	550,000 sq.m/ year	750,000 sq.m/ year
At Factory			
Electricity	360,000	792,000	1,080,000
Water	80,000	176,000	240,000
Telephone	120,000	264,000	360,000
	560,000	1,232,000	1,680,000
At Office			
Electricity+Water+Telephone	192,000	422,400	576,000
Total Cost of Accom.Consumption	**752,000**	**1,654,400**	**2,256,000**

Summary of Production Cost

Workers and machines perform activities on each product as it is produced. Cost of fabric production are allocated to product by multiplying each production standard cost elements per metre by the amount of total production metres, and then summation is the result as illustrated in *Table 4.13*.

Determining the Optimum Capacity

Basically return generated from the employment of assets is shown in a company's manufacturing, trading, and profit/loss accounts. The returns in which coming from the employment of assets would be maximum when produced at the minimum cost of product per unit. For analyzing these returns, one of evaluating performance is the estimation in term of profit margin over the 5 years period. The yearly profit margin value is calculated by total sales income of each year subtracts with total production cost of the goods sold at the same year.

Regarding the consequence of production cost studied in *Table 4.13*, the fabric cost per metre result is shown the lowest value from the maximum capacity of production at 750,000 m. per year. That means, there would be invested for the production capacity of 750,000 m. per year.

Whereas the production volume vary between lower 550,000 and higher 700,000 through this studied period, therefore, the right time of capacity investment is important to assess. Accordingly the recommended determining the optimum capacity is done under the consideration that either :

I) the investment could be placed one time at the year begin for the production capacity 750,000 m. per year, or

II) two times starting with capacity as enough as volume produced at 550,000 m. per year for the time between 1997 and 2000 and

then increased capital for capacity up to 750,000 m. per year at the year of high volume produced in 2001.

To select the better alternative than the other one would be to calculate a value of the average profit margin over the 5 years period, determine this value for each, and choose the alternative that give the higher profit margin value.

Calculation Equation :

Total Production Cost	=	Production volume * Production cost per unit
Total Sales Income	=	Production volume; sold them all * Sales Price
Total Profit Margin	=	Total Sales Income - Total Production Cost

The following *Table 4.14 - 4.15* illustrate the values of profit margin over the 5 years period, for alternative I and II of the capacity investment respectively.

Apparently, the final solution for planning capacity of car fabric product is alternative I, investment for 750,000 m. per year at the year beginning of the production period.

Table 4.12 : Production Cost of Car Fabric

Fabric Cost Description	Cost per metre at each Production Capacity (bht.)		
	250000 sq.m./year	550000 sq.m./year	750000 sq.m./year
Direct Material	39,356,958	86,585,307	118,070,873
Direct Labour	4,062,500	8,937,500	12,187,500
Factory Overhead	34,777,651	37,596,605	39,758,404
Total Production Cost	**78,197,108**	**133,119,411**	**170,016,776**
Total Fabric Cost per metre	**313**	**242**	**227**

Table 4.13 : Alternative I of Capacity Investment

At Production Capacity 750,000 m./year from 1997 to 2001

Year	Production Volume (m./year)	Total Prod. Cost (bht.) cost @ 227	Total Sales (bht.) sale price @ 420	Total Profit Margin (bht./year)
1997	308,200	69,961,400	129,444,000	59,482,600
1998	292,026	66,289,902	122,650,920	56,361,018
1999	372,740	84,611,980	156,550,800	71,938,820
2000	518,226	117,637,302	217,654,920	100,017,618
2001	705,156	160,070,412	296,165,520	136,095,108
Total	2,196,348	**498,570,996**	922,466,160	**423,895,164**
Average for period 5 years		**227**	420.00	**193.00**

Table 4.14 : Alternative II of Capacity Investment

At Production Capacity 550,000 m./year between 1997-2000 and 750,000 m./year in 2001

Year	Production Volume (sq.m./year)	Total Prod. Cost (bht.) cost @ 242	Total Sales (bht.) sale price @ 400	Total Profit Margin (bht./year)
1997	308,200	74,584,400	129,444,000	54,859,600
1998	292,026	70,670,292	122,650,920	51,980,628
1999	372,740	90,203,080	156,550,800	66,347,720
2000	518,226	125,410,692	217,654,920	92,244,228

In 2001 : Additional capital investment = 21,911,219 bht. (29.21 bht./metre), see * **Table 4.15a** *
So, the fabric cost per metre = 227 plus 29.21 = @ **256.21**

2001	705,156	180,668,019	296,165,520	115,497,501
Total	2,196,348	**541,536,483**	922,466,160	**380,929,677**
Average for period 5 years		**246.56**	420.00	**173.44**

*** Table 4.14a ***

Capital investment in 2001 for increasing production capacity from 550,000 to 750,000 m./year

Factory Overhead	Production Capacity (m./year)		**Increment**
	550,000	750,000	
Land	17,500,000	25,000,000	7,500,000
Machinery & equipment	124,909,252	129,035,666	4,126,414
Building	87,500,000	93,000,000	5,500,000
Vehicle	1,400,000	1,750,000	350,000
Electrical & Water Supply Syst	8,750,000	9,300,000	550,000
Total Capital investment	240,059,252	258,085,666	**18,026,414**
In 2001 (inflation rate 5%)			**21,911,219**