POTENTIAL FOR SELF-SUFFICIENCY AND EXPORT OF MODERN PHARMACEUTICAL INDUSTRY IN THAILAND : POLICY ANALYSIS

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The objective of this study was to determine the current status and trends of the pharmaceutical industry in Thailand and to evaluate the potential for self sufficiency and export to ASEAN countries. Methodologies used were quantitative and qualitative design. Quantitative study was combined with economic theories such as comparative advantage and data collection by using questionnaires. Qualitative study used competitive advantage theory.

The results of this study found that drug manufacturers are categorized into 2 groups. The first group desires specialization while the second group wants to expand groups of drugs produced. Both groups of the manufacturers have the potential to increase production for import substitution and increase exports according to the goals of industry restructuring plan 2003. Calculated domestic resource cost of 18 selected drugs demonstrated comparative advantage. Eleven drugs were selected and in terms of trade demonstrated export potential for Thai manufacturers in only Singapore, The Philippines, Malaysia and Myanmar. The weakness of local manufacturers is research and development. Future models suggest that is possible to realize Thailand as a center of drug production for ASEAN but not as a center of raw material production. Thai manufacturers would like deregulation of the domestic drug market.

The usefulness of these findings lie in decision making for the planning and policy of restructuring and development of a modern drug industry in Thailand.

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ผกามาศ ไมตรีมิตร : ศักยภาพในการพึ่งตนเองและการส่งออกของอุตสาหกรรมการผลิตยาในประเทศไทย: การวิเคราะห์เชิงนโยบาย (POTENTIAL FOR SELF-SUFFICIENCY AND EXPORT OF MODERN PHARMACEUTICAL INDUSTRY IN THAILAND: POLICY ANALYSIS) คณะกรรมการควบคุมวิทยานิพนธ์ : อารยัน ตระหง่าน, ศบ.,Ph.D., ลือชัย ศรีเงินยวง Ph.D., สินธุ์ชัย แก้ว-กิติชัย ภบ. Ph.D., ยุพดี จาวรุ่งฤทธิ์ ภบ., Ph.D. 446 หน้า. ISBN 974-665-099-8

การศึกษานี้มีวัตถุประสงค์เพื่อประเมินสถานภาพการผลิตยาสำเร็จรูปแผนปัจจุบันของประเทศไทยในด้านความพอเพียงต่อการบริโภคภายในประเทศและความสามารถในการส่งออกไปยังประเทศในกลุ่มอาเซียน วิธีการศึกษาประกอบด้วยการศึกษาเชิงปริมาณและเชิงคุณภาพ การศึกษาเชิงปริมาณอาศัยแนวคิดทางเศรษฐศาสตร์ ได้แก่ ทฤษฎีการได้เปรียบโดยเปรียบเทียบ และทฤษฎีเศรษฐศาสตร์องค์กรธุรกิจ โดยใช้แบบสอบถามเป็นเครื่องมือในการเก็บข้อมูล และการศึกษาเชิงคุณภาพอาศัยแนวคิดความได้เปรียบในการแข่งขัน

ผลการศึกษาพบว่าสถานภาพของโรงงานผลิตยาแบ่งเป็น 2 กลุ่ม กลุ่มแรกมีความต้องการที่จะพัฒนาเป็นโรงงานที่มีความเชี่ยวชาญเฉพาะ กลุ่มที่สองมีความต้องการขยายหมวดของยาในการผลิตและทั้งสองกลุ่มมีศักยภาพในการเพิ่มการผลิตเพื่อทดแทนการนำเข้าและเพิ่มการส่งออกตามเป้าหมายแผนปรับโครงสร้างอุตสาหกรรมใน พ.ศ. 2545 การคำนวณค่าต้นทุนการใช้ทรัพยากรภายในประเทศปรากฏว่ายาที่ผลิตจำนวน 18 รายการมีความได้เปรียบเชิงเปรียบเทียบ ทุกรายการ ค่าอัตราการค้าแสดงให้เห็นว่าราคาจำหน่ายส่งของยา 11 รายการสามารถแข่งขันได้ในตลาดยา ประเทศ สิงคโปร์ ฟิลิปปินส์ มาเลเซีย และพม่า ส่วนในประเทศลาวและเวียดนามมีบางรายการที่สามารถแข่งขันได้ จุดด้อยของโรงงานยาอยู่ที่การตลาด การวิจัยและพัฒนาวัตถุดิบ รูปแบบในอนาคตของอุตสาหกรรมยาที่โรงงานคิดว่าเกิดขึ้นได้คือ การเป็นศูนย์กลางการพัฒนาด้านยาของอาเซียน แต่การเป็นศูนย์กลางของการผลิตวัตถุดิบทางยาโรงงานเห็นว่าเป็นไปไม่ได้และไม่สามารถพัฒนาให้เกิดขึ้นได้ ส่วนรูปแบบที่ต้องการให้เกิดขึ้นในอนาคตคือ นโยบายตลาดการค้าเสรีภายในประเทศ

ประโยชน์ของการศึกษาคาดว่าจะสามารถนำข้อสรุปที่ได้ไปประกอบการวางแผนและกำหนดนโยบายในการปรับโครงสร้างและทิศทางในการส่งเสริมอุตสาหกรรมการผลิตยาสำเร็จรูปแผนปัจจุบันของประเทศไทยในอนาคต

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CHAPTER I

INTRODUCTION

1.1 Introduction

Modern pharmaceutical industry in Thailand has been developed slowly since its establishment more than 80 years ago. In 1998 Thai people consumed pharmaceutical products worth of 30,000 million baht at wholesale price .The value of imported drugs in the same year was 39.4% of total drug consumption with a growth rate of 15% although the country was amidst an economic crisis (FDA statistic,1998).

Thailand has embarked on manufacturing modern pharmaceutical since 1901 during the reign of King Rama V by the government "Osoth Sala" to produce household medicine for commercial distribution to Thai people and later came private manufacturers in 1920 (Chomchin Chantarasakul, 1995).

State policies in the past obviously affected pharmaceutical industry progress in developing manufacturing standard since government production regulation and control measures have always been lagging .In many cases government supports resulted in both positive and negative effects. For instance, an establishment of a government drug manufacturing plant in 1939 to supply medicines to Osoth Sala for distribution to public health centers. Pra Bumradnaradoon, the then Minister of Public Health merged this government drug factory together with Osoth Sala and renamed the new structure as "Government Pharmaceutical Organization (GPO)" in 1966. GPO is founded with objectives to produce pharmaceutical products, retain drug prices and

maintain inventory during the war period (Report of GPO, 2000). At the outset, GPO was seldom accepted by consumers since it manufactured fewer drug items meanwhile private companies were more aggressive in marketing and thus better recognized. In April 7, 1986 the government issued a regulation for all public hospitals to order essential drugs made by GPO no less than 80% of their annual budget. Although this measure increases GPO revenue to a certain extent, private firms significantly losses their market share in public hospitals channel with its value of 31% in domestic drug market.

Investment Promotion Act has also favorable and unfavorable consequences. In 1960 the government offered various incentives to promote investment with tax exemption for 5 years in addition to zero tariff of imported machines and raw materials. However, only transnational enterprises received such promotional privileges due to their higher potential. This factor made an increase in transnational market share to 16% of total market value in 1980.

Drug Act of 1967 and Good Manufacturing Practice (GMP) program resulted in an escalating operation cost of the industry to ensure high quality of drugs. In 1984 Food and Drug Administration (FDA) initiated GMP guideline to improve the production standard of pharmaceutical manufacturers and yet recommended public hospitals to purchase drugs only from plants with GMP certificate. This Act has undoubtedly prompted drug firms to improve their standard and quality but in practice many of them did not have sufficient capital to upgrade their facilities to meet with GMP requirements.

Following the 1997 severe economic crisis, the government has appointed a national subcommittee in January 1998 to restructure 11 key industries of the country

including chemical and pharmaceutical products. The subcommittee chaired by Mr. Somphob Amatyakul has its main objectives to propose plans at both strategic and operation levels in addition to seeking foreign loans for industrial restructuring to achieve a stated vision. With specific reference to finished pharmaceutical products, those related visions are:

I. Drug manufacturers in Thailand should be able to triple its export value in 2002 to 1997.

II. Drug manufacturers in Thailand should be able to increase its production level to substitute for at least 50% of imported value in 2002..

III. Drug manufacturers in Thailand should become a manufacturing center of finished drugs which is accepted by other less developed countries.

Still there are some controversial issues from the asserted vision in pharmaceutical industry restructuring. For example, whether this industry should be supported at all and in what direction, and whether the industry is sufficiently prepared and capable enough to adjust its structure and expand their production in lines with the government visions. How should the industry be supported? Some crucial factors determining their competitive advantage are cost of production, existence of supporting industry, marketing ability, brand loyalty development capacity and business competition potentials.

1.2 Rationale of the study

Thailand has so far imported modern pharmaceutical products of both new and generic types. The floatation of the Baht in 1977 turned an import value of drugs to reach 39.4% of total drug consumption in 1998. It is noteworthy that such import

contains both new in-patented drugs as well as off-patented generic drugs that can be manufactured locally. In 1997, for example, Ampicillin 500 mg. capsules were imported approximately 5% of total value of domestic production and Ketoconazole 200 mg. tablets were also imported 16% of total value of local manufacturing (Drug Control Division, 1998). The value of domestic production and import of drugs to Thailand between 1987 –1998 is illustrated in Table 1.

Table 1 Value of domestic production and import of drugs to Thailand: 1987-1998 (million baht)

Year	Value of domestic production Million baht	Percentage Change	Value of import Million baht	Percentage Change	Percentage of value of import to consumption
1987	5,145.75	-	2,325.43	-	29
1988	6,708.85	30.38	2,570.98	10.56	30
1989	8,372.85	24.80	3,307.60	28.65	29
1990	8,886.02	6.13	3,449.08	4.28	32
1991	9,657.54	8.68	4,216.41	22.25	32
1992	10,690.54	10.70	4,602.61	9.16	32
1993	11,831.03	10.67	5,075.31	10.27	33
1994	12,969.68	9.62	6,086.63	19.93	39
1995	15,820.87	21.98	9,276.47	52.41	39
1996	18,120.41	14.53	10,676.01	15.09	39
1997	20,221.00	11.59	11,255.00	5.42	38
1998	20,012.00	-1.03	11,676.00	3.74	39

Sources: Drug Control Division FDA, 2000

Customs Department, 1999

It is obvious that although the domestic production has continuously been increased but the growth rate of import has been much higher. The ratio of drug import to domestic consumption has been inflated from 29 % in 1987 to 39% in 1998.

Although the growth rate of export value has been irregular under the export- oriented 6th National Economic and Social Development Plan but it evidently indicated an upward trend. The value of drug export classified by period of National Economic and Social Development Plan 1988-1998 is shown in Table 2.

Table 2 Value of drug export classified by period of National Economic and Social Development Plan 1988-1998

Year	Value of drug export (million baht)	Percentage change (%)	Number of plan
1988	545.10	-	6
1989	480.80	11.80	6
1990	604.10	25.64	6
1991	784.80	29.91	6
1992	920.30	17.27	7
1993	940.59	2.20	7
1994	885.85	5.82	7
1995	1230.88	38.95	7
1996	1245.59	1.20	7
1997	1658.37	33.14	8
1998	2072.09	24.95	8

Source: Customs Department 1998

Value of drug import would somehow diminish if Thai people consume pharmaceutical products made by local manufacturers. Wholesale price structure of original imported products revealed that the CIF value accounted for only 35% (Working Group in National Drug Policy Study, 1991:377-473). In general, production cost of local manufacturers are comparatively lower and accordingly the retail prices of local made products with similar active ingredients and strengths are lower. However, the preference of consumers towards imported drugs has significantly resulted in an increase value of imported drug on the expenses of a decrease volume of domestic production.

Table 3 Price of Paracetamol 500 mg. Tablet (1000 packing) in Thailand

Trade name	Packing	Company	Country	Price(baht)
Paracetamol	1,000 LP	GPO	Thailand	240
Panatab	1,000 LP	Sri prasit dispensary	Thailand	250
Daga	100 FP	Hoechst	German	570
Panadol	100 FP	Stering drug	England	650
Calpol	100 FP	Wellcome	England	700
Tylenol	100 FP	Janssen	Belgium	700

Note: LP = loosed packed, FP = foil packed

Data in table 3 compared the wholesale price of Paracetamol 500 mg. Tablet that produced from local manufacturers with that produced under license of multinational companies. Packaging is certainly one of the important factors that determine the wholesale price. A study showed that if the Thais merely used local made pharmaceutical products, consumption value of imported drugs together with drugs

produced under license from multinational corporations in Thailand would sharply decrease more than 20,000 million baht in retail price per year. This would be possible however subject upon the conditions that local manufacturers could sufficiently produce generic products and market such products in retail price that reflected the local cost of production.

Pharmaceutical industry has inevitably been affected by recent economic crisis, international trade agreement, and related legislation such as Patent Act. This law has been in effect since September 30, 1992 due to the political pressure from the USA. The Act encourages drug development and technology transfer to under-license drug companies but simultaneously increases the production cost of those under-license drugs. PPA reported that under-license drugs simply seizes 8% of market share meanwhile off-patented drugs occupies the rest 88%.Long term impacts from the Patent Act remains unpredictable. In 1992 the Thai government endorsed an agreement under the ASEAN Free Trade Area (AFTA) to reduce import tariff of 15 product categories including pharmaceutical products to 0.5% within 2004. This agreement would allure more foreign investments to ASEAN countries to a certain extent. For Thailand, imported raw material costs would obviously be decreased but concurrently trade competition would be more intense. Therefore, domestic pharmaceutical industry must improve both quality and cost structure before current tariff barrier of imported drugs at the protective 30% would be abolished.

Thai manufacturers should consider attracting raw material producers to invest in ASEAN countries. The government renders more support to foreign investment than native firms because the transnational industry has greater potential. For example, in 1958 Field Marshal Sarit Thanarat promulgated the Investment Promotion Act and 2

pharmaceutical multinational companies were granted promotional privileges. The 2 firms are:

a. Merck Sharp&Dohm Co.Ltd. received promotional privileges on April 1,1959

b. Dumex Co.Ltd. received promotional privileges on March 25,1960

Following these 2 pharmaceutical factories established in 1960, the number of drug plants in the country was increased to 18 in 1961 and subsequently to 117 factories within 8 years In 1981 Thailand had 187 drug manufacturers including 21 multinational or joint-ventured enterprises such as Hoechst, Glaxo, Bayer and Schering etc.. These companies are considerably large in size and obtain GMP approval by FDA. It is noteworthy that they emphasize and possess substantial capability on research and development (R&D) as well. In contrast, local Thai manufacturers are still lagging behind those multinational companies both in production ability and marketing competence.

At present, the Board of Investment (BOI) no longer grants any promotional privileges to pharmaceutical industry. As a result, Thai manufacturers could not obtain any tax incentives to upgrade their production facilities to meet with GMP standard requirements. Small-scale factories contain about 20% of the drug industry.

The reduction from 152 local drug manufacturers located in Bangkok in1988 to 126 in 1997 clearly reflected some consequences from the government investment promotion policy. Due to the government policy to relocate industry to other regional provinces in Thailand under the 6th National Economic and Social Development Plan (1988-1991), the number of local drug manufacturers in regional provinces has been increased from 41 to 49.

This small number of new drug factories in regional provinces was however insignificant since plant relocation was not proved beneficial with no tax incentive and unreasonable high cost of land. In addition, 17 manufacturers closed their plants down since 1958 because of failure to remain competitive in this business.

Local drug manufacturers still lack of financial capital and technical support to undertake fundamental research and development. Thus local drug production can be simply classified as compounding or formulation. If local drug manufacturers aim at specialization, they should allocate more financial and human resources to research and development activity, for instance, development of new dosage form, new formulation etc. In reality, however, financial constraints limit their capability to support research department within their factories.

Problems of pharmaceutical industry in Thailand consist of

a. Production process. Many local drug manufacturers have not yet met with acceptable production standard. The main reasons are limited production areas of local manufacturers since most of plants have been in Bangkok for a long period of time and they hardly find enough space to improve their facilities to meet with GMP requirement. Moreover, their production technology and equipment are not modern and these severely affects quality control, stability test and quality assurance.

To make the matters worst, many raw materials of both active and non-active ingredients could not be produced in Thailand. Drug manufactures must import raw materials from foreign countries. Since the cost of some imported raw materials are even higher than the government controlled price of some finished items, local entrepreneurs are forced to use raw materials from various sources which unavoidably affects standard of production.

Besides, packaging materials have not yet been developed due to unavailability of domestic raw materials and a lack of strategic direction concerning supportive industry.

b. Personnel. There has been a lack of skilled personnel to deal with high technology and complexity in production process especially in small and medium size factories. These skilled personnel consist of pharmacists, engineers, and operating workers such as technicians. Apart from scarce human resources, further education and training are also insufficient.

c. Marketing. Ability for new market expansion is inadequate. The industry lacks of markets for export due also to some tariff and non-tariff barriers in foreign countries such as surcharge and limitation on drug registration. Yet domestic market share has been reduced as a result of the Patents Act. Existing tax structure also hinders competition in the world drug market. Supportive industry by far has not fully developed. All these factors cause fluctuation in production volume as well as distribution.

d. Regulations. Changes in laws and regulations certainly affected pharmaceutical industry development such as generic label, which considered impractical and costly. Besides, there are not enough collaboration between private and public sectors. Inconsistency in management of public sector is also an obstruction to development of production and export such as value added tax and registration process.

All problems in pharmaceutical industry mentioned above emerged from many factors such as manufacturing process, cost of production, marketing, government policies, domestic and foreign trade competition. Although private enterprises and

government sector have made several attempts to solve these problems, the drug industry is still diverse. The government policies toward pharmaceutical industry development should be based upon the principles of efficiency, equity and quality to support the manufacturers as well as to protect the consumers.

1.3 Research Questions

1.3.1 What is the current status of modern pharmaceutical industry in Thailand and what it should be in the future? Could the manufacturers be developed to fulfill GMP standard requirement? Could the industry effectively compete with multinational corporations despite their lower prices?

1.3.2 Do Thai manufacturers have adequate ability to expand production for self-sufficiency? What strategies and direction should be to overcome existing problems and obstacles? . How could private enterprises and public sector cooperate for future development of the drug industry?

1.3.3 Do Thai drug manufacturers have enough potential to export finished products in generic form to drug market within ASEAN countries? What are their common problems and what agency can resolve these problems in the future? What should be the proper role of government to promote drug export?

1.3.4What should be the appropriate government policies toward pharmaceutical industry development in Thailand. What would be a viable strategic plan for modern drug industry?

1.4 Objectives of the Study

1.4.1 To assess potential of Thai's modern pharmaceutical industry in the context of

a. Self-sufficiency and import substitution of modern finished pharmaceutical products.

b. Export of modern finished products to ASEAN nations.

1.4.2 To ascertain opinions and suggestions on possible strategic direction and policy for future development of Thai's modern pharmaceutical industry.

1.5 Scope of the Study

1.5.1 The selected drug items in this study possess following specifications:

- They are classified as finished-modern and dangerous drugs under Drug Act 1967.
- They are not currently under license or off-patented drugs
- They are not categorized in pharmacology as anti-cancer and orphan drug group.
- They can be manufactured by general available technology.
- They are in solid dosage form as tablet or capsule.

Table 4 Selected Products to study potential for self-sufficiency

No.	Products	Pharmacological group	Number of producers	Number of importers
1	Amoxicillin 500 mg. cap./tab.	Antibacterial	26	4

Table 4 Selected Products to study potential for self-sufficiency. (cont.)

No.	Products	Pharmacological group	Number of producers	Number of importers
2	Cefalexin 250 mg. cap./tab.	Antibacterial Cephalosporins	7	2
3	Diclofenac 5 mg. cap./tab.	Anti-inflammatory	37	5
4	Glibenclamide 5 mg. cap./tab.	Antihyperglycemia	17	2
5	Ketoconazole 200 mg. cap./tab.	Antifungal	21	1
6	Nifedipine 5 mg. cap./tab.	Antihypertension(calcium antagonist)	10	7
7	Norfloxacin 200 mg. cap./tab.	Antibacterial(quinolone)	25	3
8	Piroxicam 10 mg. cap./tab.	Anti-inflammatory	25	4
9	Propanolol 10 mg. cap./tab.	Cardiovascular(beta blockers)	16	3
10	Ranitidine 150 mg. cap./tab.	Gastrointestinal	11	2

1.5.2 Selected products are divided into 2 groups as follow:

I. Ten selected drug items will be examined to study the potential for self-sufficiency. An expert on drug specified those items shown in Table 4 using the inclusion criteria whether they are listed as essential drugs in 1999 and whether they are frequently prescribed by physicians.

II. Eleven selected drugs will be examined to study the potential for export. An expert on drug specified those items shown in Table 5 using the inclusion criteria whether they are dispensed in high volume at hospitals and drugstores in ASEAN drug markets.

Table 5 Selected Products to study potential for export

No.	Products	Pharmacological group	Number. of producer	Number .of importers
1.	Amoxycillin 500 mg. cap./tab.	Antibacterial(penicillin)	26	4
2.	Ampicillin 500 mg. cap./tab.	Antibacterial(penicillin)	17	2
3.	Antacid tab.	Gastrointestinal	26	2
4.	VitaminB1-6-12 cap./tab.	Vitamin	19	3
5.	Bromhexine 8 mg. cap. /tab.	Reapiratory tract	18	2
6.	Cimetidine 400 mg. cap. /tab.	Gastrointestinal	28	1
7.	Diclofenac 25 mg. cap. / tab.	Anti-inflammatory	37	5
8.	Ibuprofen 200 mg. cap./ tab.	Anti-inflammatory	27	2
9.	Mebendazole 500 mg. cap./tab.	Anthelmintic	11	1
10.	Norfloxacin 200 mg. cap. /tab.	Antibacterial(quinolone)	25	3
11.	Paracetamol 500 mg. cap./tab.	Analgesics	24	0

III. Survey of modern finished drug firms with valid manufacturing license in 1998

IV. Comparison of wholesale prices with other 9 ASEAN member countries namely, Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore and Vietnam.

1.6 Necessary Conditions

The first step to answer research questions on self-sufficiency and export potential is based upon quantitative survey data by a calculation of an economic index called "domestic resource cost(DRC)". DRC is used here to examine whether 18 selected drug items should be produced domestically or imported from foreign countries. DRC demonstrates opportunity cost of domestic resources for production each drug items in relation to one unit of foreign currency obtained. The country would have "comparative advantage" if the ratio between domestic resource cost and effective exchange rate (DRC/EER) is less than 1.

Another economic indicator used to evaluate comparative advantage of 11 selected drug items for export potential is the "Term of Trade". It reveals possibilities in price competition of drug marketing in each ASEAN countries,

Ability to expand production would also be calculated based upon real and full capacity data in 1998. The calculation assumes that capacity of real production can be extended to 100% of full capacity.

Targets used in this study to determine potential for self-sufficiency and export are based upon the defined government strategy for pharmaceutical industry restructuring under the Ministry of Industry in 1997 since there are no other available government policies with a clear objective concerning self-sufficiency and export. These stated targets according to the strategy formulated by the Ministry of Industry are:

I. The volume of drug export in 2002 would be triple 3 to the volume in 1997

II. The volume of drug production in 2002 would be 50% import-substitution.

1.7 Definition

a. Drug or Pharmaceutical products refer to modern finished pharmaceutical products categorized according to Drug Act 1967 and 1987.

b. Drug manufacturers refer to factories, which produce modern finished drug or raw materials with valid license.

c. Industry structure consists of type, characteristic, production standard, manufacturing process, quality control, marketing and research.

d. Technology refers to the process in compounding the products. The complexity of the method depends upon characteristic of active ingredients to meet stability, duration, metabolism, physical property and appearance of finished products.

e. Capacity refers to the effectiveness of the machine per 1 unit of operation (8 hours). For example a punch machine can compress 50,000 tablets per 1 hour or a mixer can mix 100 kilogram per lot.

f. Supportive industry refers to the industry which supply materials used in drug production including raw materials, packaging etc.

g. Pharmaceutical industry encompasses every manufacturing process for pharmaceutical products e.g. selection, registration, production, marketing and distribution.

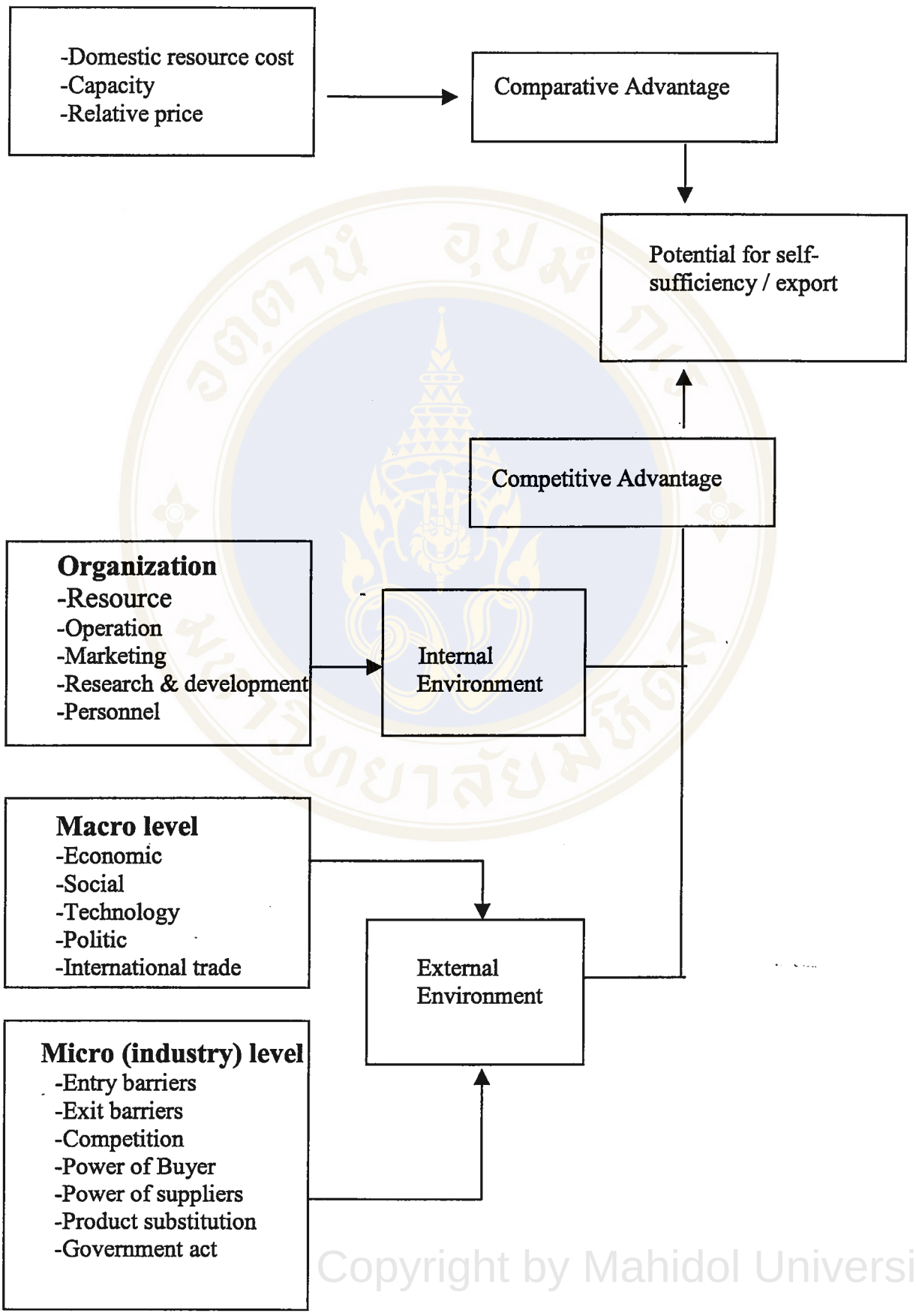
h. Drug manufacturing refer to the whole continuous process of drug production including quality control, marketing and research.

i. Self-sufficiency is defined as the ability to produce adequate volume of drugs for domestic consumption with no import of similar drug items.

1.8 Usefulness of the Study

It is expected that this study would offer some useful recommendations for policy makers to support and develop finished modern pharmaceutical industry in Thailand for domestic consumption as well as ASEAN drug markets. The results of this study can be used for planning and policy formulation in restructuring pharmaceutical industry of the country to attain self-sufficiency of domestic demand and to promote export in the future. In addition, the methodology employed in this study can be simulated to study other items of drug as well.

Conceptual Framework



CHAPTER II

THEORY AND LITERATURE REVIEWED

This chapter is divided into 2 sections

Section 1 consists of 2 parts

Part I presents theories used in quantitative and qualitative study as follows: theory of comparative advantage, theory of the firms and theory of competitive advantage.

Part II concerns techniques used in collecting and analyzing data e.g. Delphi technique and SWOT analysis.

Section 2 literatures about pharmaceutical industry.

2.1 Theory

2.1.1 Theory of comparative advantage

The theory of comparative advantage was a theory of international trade developed by the British neo-classic economist David Ricardo who explained some defects in the theory of absolute advantage of Adam Smith in that one country is absolutely more expert than other countries. The principle of a comparative advantage is that a country should produce the goods that it specializes most in relation to other goods in the country and a country that has low efficient production should not stop producing but should stop producing the goods which have low labor productivity (Voranun , 1987). Or a country should produce the good that has more comparative

advantage when compared with other country and should not produce goods with lower comparative advantage. A country should export the goods that have comparative advantage and import the goods with higher production cost from other countries. Each country will have maximum benefits from this process. So the international trade has occurred from this concept which means each country will export the goods that have a lower cost of production and import the goods that contain higher cost of production

The David Ricardo's theory has some defect in that only the labor factor is considered when determining cost of production. So Eli Hechscher and Bertel Ohlin have developed the theory that integrates other factors. The concept is the cost of production depends on the volume of factor endowment or international factors. Heckscher and Ohlin conclude that a country will export the goods produced from enrich domestic factors rather than the goods produced from scarce domestic factors. It will import the goods which it has few production factors or none locally. This concept leads to development of capital-intensive goods and labor-intensive goods.

Gottfried Haberler applied the theory of opportunity cost into his explanation of comparative advantage. His concept is that relative price is determined by cost. The cost of a goods is not only the labor cost but is the volume of other goods which are not produced. The highest price of other goods is the opportunity cost of these goods.

Index in measurement comparative advantage

a) Domestic resource cost-DRC is the index the measures the true opportunity cost of a domestic resource used to produce goods to exchange 1 unit foreign money in the case of export or to save up foreign money in the case of import

substitution by comparing with the effective exchange rate. This index derived from price, cost, and no tradable inputs and exchange from international trade. For example Juthathip Orarikovit, 1996 calculated DRC to study comparative advantage between Thailand and USA, Europe and Japan from 1989-1993 under tariff barriers (Juthatip , 1996).

Chenery measures DRC in his concept that a country will gain benefit if the cost of production is less than the market price or border price. DRC is a concept used to calculate opportunity cost of the domestic resource used to produce goods for 1 unit of foreign money in the case of export or a saving of 1 unit of foreign money in the case of import substitution when compared with the effective exchange rate. Bruno's concept is based on the hypothesis that an economic activity is operated under the government policy so :-

$$DRC = \frac{\sum_{s=2}^{m} fmjVm}{Uj - Mj}$$

When *fmj* is the volume of domestic resource such as labor, land, capital used to produce j which has value Uj

Vm is a real or shadow prices of factors so $\sum_{s=2}^{m} fmjVm$ is the value of domestic resource that used to produce j which has value Uj

Uj is the value of goods j in foreign unit at market price or border price.

Mj is the value of imported factor that is tradable input used to produce j which value = Uj. Value of Mj expressed in foreign money at market or border price as Uj

Calculated DRC is a domestic resource cost in the unit of domestic currency / foreign currency. The criteria of comparative advantage from DRC will be compared with shadow exchange rate.

If DRC is less than the real exchange rate, the goods have a comparative advantage

$$DRC < V1 \quad \text{or} \quad DRC/V1 < 1$$

V1 is a domestic exchange rate per 1 unit of foreign currency. If DRC is higher than a real exchange rate, it means that this industry uses domestic resource cost more than 1 unit of foreign currency received or could be saved so this industry is said to have no comparative advantage.

b) EER measures all effects from tax under the assumption that technological production coefficient under free trade and limited trade is of no difference. The unit is presented in percent change of value added.

One example is the study of trade impacts on agriculture goods e.g. rice, rubber, corn, cassava and mine and industrialization in Thailand by Jaunjai Acchanan, Supoj and Sorayut. ERP and DRC are used as indicators. It was found that DRC is suitable to use in export oriented because it compares cost and exchange rate with the competitor and demonstrate whether the export production cost consume more domestic resource cost than exchange rate or not. If it does not, the goods have comparative advantage. ERP is suitable in import-substitution to assess trade impact.

An assumption in the study of pharmaceutical industry is on non-trade barriers in the future under WTO and AFTA, so ERP can be used to express comparative advantage in the case of export potential and in the case that domestic resource cost cannot be calculated.

c) RCA is used to express comparative advantage by comparing the rate of the country's export-import with the rate of the world's export-import. This index demonstrates a comparative advantage of production with specialization. The limitation is it does not link to system or process of production of the specialized goods and it can not be used to demonstrate price distortion from trade barriers. Balassa first develops RCA in 1965. The formula are as follows:

$$RCA = (X_A / X) / (W_A / W)$$

When Xa/X is a ratio between the value of export A by country X with the value of export of country X

Wa/W is a ratio between the value of export A in the world with the total value of world export.

RCA>1 means that a country can produce goods with specialization or gain from comparative advantage.

RCA<1 means that a country, capacity to produce goods with specialization has declined or lose comparative advantage in production.

A sample of study based on this concept is the study of Supinda, 1997. She analyzed export potential of jewelry industry in Thailand from 1988-1992. The study of Dr. Makasiri et al in 1997 about the strengthening competitiveness of Thai

industries in food industry, frozen shrimp, frozen cuttlefish, tuna can, frozen chicken, pineapple can and conc., pineapple juice, maize can and asparagus can. Their results can not be expressed about the dynamic of cost of production in labor and raw materials cost or capacity in production. The limitation of RCA used in pharmaceutical industry is as follows:

a. Production of jewelry is different from drug production because the process of jewelry production uses skilled –labors or labor-intensive productivity while drug industry is capital-intensive productivity and specialization. According to the concept of comparative advantage a country that has more labor should export labor-intensive goods or a country that has more capital e.g. U.S.A. should export capital – intensive goods such as electronic equipment so RCA may be a bias selection of analytical tools.

b. Value of export will not express real production in Thailand because movement of multinational companies to Thailand.

Drugs are health products that have specification and standard on quality, physical properties, chemical properties and bioequivalence especially if they are not originally developed in Thailand but are copied from the original companies so competitiveness is seriously for export. The market share of original companies in the world is higher than that of the developing countries and value of export are contained value of original companies.

c. Ratio between value of export from Thailand and world export is suitable to demonstrate the whole image of pharmaceutical industry. It cannot expressed an image of subgroup or items of drugs e.g. Paracetamol which can be produced in

dosage form of tablets, capsules, injection, syrup and each dosage form can be produced in various strength e.g. 120 mg., 325 mg. and 500 mg.

d. The limitation in foreign information makes DRC suitable to present comparative advantage.

The study on comparative advantage in some goods can use more than 1 index. An example of this is Dr.Somchai, 1997's study of social impact and health service preparation for free trade which used secondary data to calculate RCA follow Balassa and Yamazawa to express potential of production and ERP for study impact from free trade. He selected RCA and ERP to be index of comparative advantage in his macro level of pharmaceutical products study. His assumption is that there are no trade barriers and price distortion from taxes.

Another example is a study of comparative advantage by using an economic model developed by Chulalongkorn University to study the impact on health care system from free trade. They analyze inputs e.g. capital, labor, technology by using general equilibrium model that consist of simultaneous equations such as wage equations, price equations, revenue equations, demand equations, production function equation, labor equations and export–import equation. They analyze resource allocation and set up scenarios to predict the free trade impact on pharmaceutical industry and supportive industry. Their objectives are to evaluate if health care services can stimulate other industry. The study also analyses trade stimulation from potential and investment aspects including an impact on drug business which includes domestic drug companies, manufacturers, distributors and consumers. The researchers expect to

evaluate forward potential of Thailand to suggest a guideline and strategy in investment and export under WTO, APEC, AFTA, GATS and TRIPS(Siripen,1997).

Another term used to express comparative advantage in international trade is the term of trade. The term of trade is a ratio between an export price to an import price in a country. If the term of trade is higher a country gains from international trade.

The comparative advantage can be changeable. A country will have a comparative advantage on production and export goods that use domestic factor endowment and cheap when compared and import goods that are domestically and expensive. Price difference in trade countries lead to an international trade and comparative advantage because of rich factor endowment in the country. For example Thailand has more unskilled labors and lacks high skilled labor. According to Hackler –Ohlin's theory, if Thailand has a comparative advantage in unskilled labor productivity and has a disadvantage in capital and skilled labor goods. When Thailand has accumulated capital and developed skilled labors, the country will gain from trade. However, at present Thailand has plenty of low skilled labor and is still lacking capital factor and high skilled labor (Chawaneewan, 1995).

A.H.M. Mahfuzen Rahman, 1973 reported that before considering to promote certain industry after a survey of domestic factors endowment, the government should consider other factors too. Strategic plan to develop industry in developing countries are an import substitution but domestic market is vary small so he advises that a country should develop export market at the same time.

From the reasons mentioned above, the study of potential for self-sufficiency and export of modern pharmaceutical industry has selected DRC as an indicator for comparative advantage of 18 selected drugs. This indicator is used to point whether each item of 18 drugs should be produced by local manufacturers or imported. An indicator for price competition in ASEAN country drug markets is the term of trade to show the advantage in export.

2.1.2 Theory of the firm

The theory of the firm is developed in 18th century from the price theory and the theory of competition by John Stuart Mill, Stanley Jevons, and Alfred Marshall. The principle of theory of the firm focuses on decision making in business to allocate resource in business management. It is divided into 3 theories as follow:

a) Theory of consumption behavior is used to study the pattern of consumption of goods and services. This theory emphasizes on producers so it is not used to study cost of production, instead, it will be need to analyze policy affected by consumer behavior e.g. brand loyalty.

b) Theory of production is used to explain the nature of production, the cost of production, the economic of scale and the employment means of production. This theory is important in determining demand and services which leads to the market structure theory and the competition theory to make a strategic plan for market occupation.

c) Theory of investment is used to help a the decision-maker to evaluate projects for investment and financial resource to increase capacity and extend business for the future.

A useful method in management consideration is an integration of man, money, information (e.g. finance, technology, market) stackholders, management, labor, producer and consumer by using basic model for business called theory of the firm for maximum profit. Stock holder and business managers expect short-term profit maximization but limitation is the decision-making which may be determined by technology, scarce resource and government policies. The decision to maximize profit will have to consider short term and long term internal impacts as well as external factors such as skilled labor, raw materials, energy, equipment, land and capital that affect production and marketing, labor act, safety law and environmental act.

Theory of the firm is used as an approach to categorize the problems of the entrepreneurs in corresponding to their operation and objective which is different from those of the public sector. Private sectors stress on maximized profit so they concern a different public agencies.

2.1.3 Competitive Advantage

The principle of theory of competitive advantage is increased determinants to explain the chance of competitive to export in the model of Diamond diagram in order to decrease the defect of comparative advantage theory. This theory reflect many concepts in competitiveness such as marketing, product, technology and economic of scale.

According to this theory, each country must emphasize on some industry to encourage a cluster in that industry and thus develop power to make long term competitiveness (Michael E. Porter, 1990). An example of the application of this theory is the 2nd master plan of industry in Malaysia of November 28,1996 which is used as a guideline for 10 years' development. It contains a vision of industrial cluster-based development by with an effort to link low production by increasing domestic supportive industry instead of import elements. The purpose of which is to raise export revenue and cover other supportive activities. The plan includes process, research development, process of production, design, education and training, distribution of goods, technology, finance and etc. (Yuttasak Vanasawat, 1997)

Michael E.Porter identifies important determinants of the nation competitive advantage called "Diamond of nation competitive advantage" in 4 aspects as follow:

a. Factor condition. This refers to the maximum utilization of human resources, technology knowledge, capital goods, and infrastructure of natural resource of a country. A country factor endowment is skilled labor or infrastructure necessary for competitiveness of industry. Application of disadvantage factor to make it an advantage one can be seen in the example of Japan's application of automatic machine to reduce the cost of production and increase the quality of goods.

b. Demand condition. This is household needs for products or services. Differences in goods or services demand in each country will affect production and competitive advantage e.g. Caterpillar is the leader company in the production of graders because U.S.A is a large country so there is a great demand for a wide network of road construction.

c. Related and supportive industries. This means how many related and supporting industries a country needs for competition. In globalization the firms can provide raw materials and sell finished products around the world so factories should be spread to gain an advantage in factor endowment and relationship with companies in other countries. In Porter's opinion, an aggregation of related industries is not enough but there should be a cooperation among one another. An example of this is in case of Switzerland who has advantage in pharmaceutical industry because it has dye industry.

d. Firm strategy, structure and rivalry. The government condition on an to establishment of company, organization and management. Domestic rivalry will help strengthen industry e.g. Germany has an advantage in chemical production because it has many chemical companies such as BASF, Hoechst, Bayer.

Michael E. Porter uses the word 'Diamond' to illustrate the system because 1 factor depends on other factors e.g. a demand condition cannot make competitive advantage unless there is enough rivalry to attract the firms as seen in figure 1

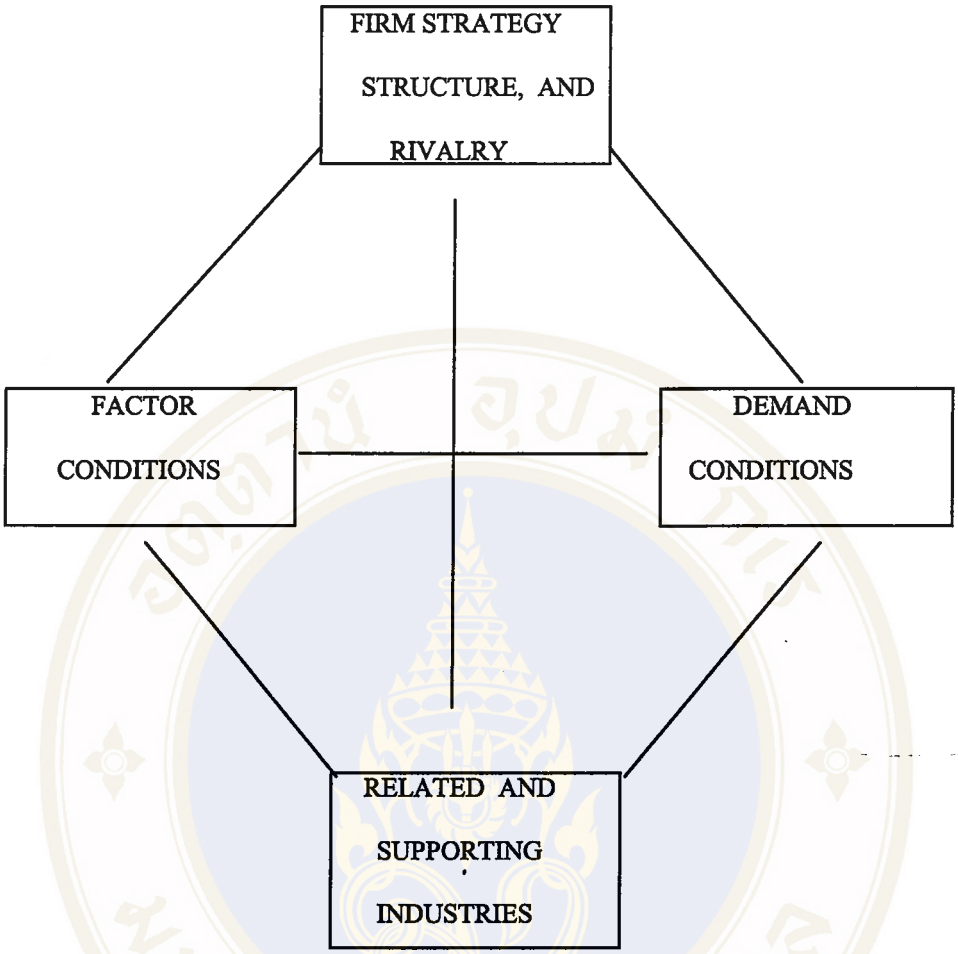


Figure 1 Determinants of National Competitive Advantage

The theory of competitive advantage explains international trade better than the theory of comparative advantage because the latter ignores economic of scale.

And also the theory of comparative advantage does not cover an explanation of export-import of the industry because at present there are unequal technology, non-different products and limitation of factors in each country.

Porter suggests that the role of government should cover 4 points as follows:

a. Factor endowment e.g. promotion of people's education, promotion and development of technology, establishment of infrastructure e.g. seaports, roads and air ports.

b. Demand e.g. allowance of private sector to operate mobile telephone business.

c. Promotion aggregation of related or supportive industry e.g. research triangle park (RTP) which is a cooperation of 65 companies such as IBM, Glaxo, Dupont to conduct research and development innovation. Porter does not agree with the movement of the Japanese companies to other countries because it will pose difficulty in linking and will lose competitive advantage in the long run.

d. Structure strategy and company rivalry. The government should not control the technology transfer and should reduce domestic industrial protection. The government should stimulate drug companies to compete with each other so that they will be strengthen and enthusiastic. We can see an example from the economic growth in Japan which does not arise from an industrial protection or a financial support from the government or by low wage but it arises from fierce competition among industries. The Thai government should allow freedom of industrial establishment, to reduce monopoly and support free trade in private sector.

Michael Porter's concept concerns rivalry in business and each factor link to national competition. So the consolidation of competitive advantage with comparative advantage to evaluate potential of pharmaceutical industry in Thailand will be more complete to explain the competitiveness because comparative advantage is the only first indicator about cost and price but is not the one factor to determine the competitiveness in a drug market. Determinants in competitive advantage are necessary used to accompany with other indicators to completely explain to end-users.

2.2 Analytical Method

2.2.1 Future forecasting by Delphi technique

Delphi technique was developed in 1950 to estimate atomic bombs used to reduce other weapons of U.S.A. army because other methods used to collect data required more money and were difficult to interpret the result. This method concerns technical forecast by expert opinions. It uses open end questions of which the answer is varied if the informants are real experts.

Delphi method becomes a pattern of study at present. The example is the research by Rand "Report on a Long - Range Forecasting Study" which assesses the future trend effect of science and technology on U.S.A. and world society by T.J. Gordon and Olaf Helmer(1964), and the health service evaluation. This method is widely used at present and is expected to be used in psychological research in the future.

The Delphi technique is applicable in 2 case as follows:

a. Management of data in social science study in the case of a difficulty in data collecting and high cost e.g. the study of social economic strategy for the country development. Data from the experts can be used instead of rare and impossible data.

b. The results are accepted by the decision making authority of the government policy e.g. the collecting of data from the experts in the country. In addition Delphi technique is used in such cases:

- Present data or previous data is incorrect or unknown.
- Verifying previous situation.
- Evaluation possible budget distribution.

- Finding option in city and region plan.

- Planning to develop university curriculum.

- Integration structure or models.

- Implementation plan with policy

- Development rational relationship in social and economic phenomena.

- Identification and acceptation of human motivation.

- Finding a person's value and social aim.

Characteristics of study which prefer Delphi technique

a) No method can be used to analyze the problem accurately but it will be useful if decision is shared.

b) It is necessary to investigate complex problems that have not enough time to communicate or accept the expert opinions.

c) Individual idea is more effective than face to face conference.

d) Budget and time for meeting can not be managed.

e) Effective meeting gained from increasing ideas.

f) Conflict of experts' opinion will create serious impact.

g) Varied participants in meeting may be led by someone personality that affect quality and accuracy of ideas which is called "Bandwagon effect".

Processes in Delphi technique are as follows:

Step 1. Find out the problem by discussion. Each person gives more data from their own feeling.

Step 2. Understanding how the experts approach this issue e.g. the number of experts who agrees and disagrees, the importance of definition requirement and possibility.

Step 3. If there is an obvious disagreement, this step should search unanimous opinion and reasons.

Step 4. Last step evaluation is conducted when the process begins to analyze and evaluate the collected data.

Delphi technique is not useful in 6 cases.

a. Too more wide aspect before setting up the concept of problem to the experts by Delphi structure.

b. Failure to bring other aspects which relate to the problem.

c. Inappropriate technique in conclusion and representation of results.

d. Mistake in evaluation score.

e. Failure to survey disagreement, uninterested by the experts who disagree with other experts.

f. Eliminate some agreement or construct some agreement.

Caution to Delphi technique is that it cannot be used with all situations and it should be realized that the informants are very important so the researcher should adjust time if the interview interferes the experts (Harold A. Linstone & Murray Turoff, 1975).

Sample interpretation of answers.

Question 1. When are there automatic translate machines?

Question 2. When is there an economic possibility that any company can produce synthesized protein for food?

Question 3. When can the clever animals be bred, for example ape, to be used as a low level labor?

Question 4. When are there 2 way communications in long distance area?

Question 5. In what year does the number of electric car reach 50% of total number?

The expert must answer exactly according to time of Christian or Buddhist era or infinity. Other questions appear as question 6.

Question 6. What will be the factors causing world war III in the next 20 years.

Answer is the numeric from 0-1

The answer will be returned to the researcher. Next, the result is calculated by means of date or number of experts' agreement. Method used is the calculation of median year and quartile of distribution of answer for example the answer from the experts are total 12 years respectively

1979, 1980, 1983, 1985, 1986, 1987, 1989, 1990, 1990, 1990, 2010, ∞

first quartile median last quartile

Median is between 1987 and 1989. Volume recorded for average year is 1988. First quartile is between 1983 and 1985 (read 1984). Last quartile is between 1990 and 1990 (read 1990). The year submitted is 1998 range (IQR) 1984-1990. These answers will find number of expert who agree or disagree again. These answers are accepted because they are easy to calculate and there are no problems when analyze (C.W.J.Oranger, 1983).

The usefulness of Delphi technique research is a gain in integrated opinions of the expert or persons who have experience in the issue and are not necessary to confront each other because the experts do not know who participates in the study and what are other expert's opinions. Furthermore the experts should answer every step of the questionnaire which may be sent to them again for 2-4 times. The first question

should be open-ended and the next time will be in rating scale. The experts can review their answer every step; they can consider their answer carefully until there are firm in their answers and they also feel free to express their opinions.

The experts should be familiar with the issues. They might be the one who has conducted the study on this issue for a long time, or in the position which his responsibility concerns this issue or they may have direct experience in the issue. In the selection of the experts one must take careful consideration and ask the collaboration in the study so that the answer will relate with confidence data. The number of experts depends on the characteristic and issue studied. If the expert group is unique, 10-15 experts are adequate enough but if they are different, many of the experts are used. Thomas T. Macmillan found that the number of experts exceeds 17, error reduction is least (Chanita Ruxpollamuang, 1996) seen in table 6.

Table 6 Reduction of error by number of participants

Panel size	Error reduction	Net change
1-5	1.20-0.70	0.50
5-9	0.70-0.58	0.12
9-13	0.58-0.54	0.04
13-17	0.54-0.50	0.04
17-21	0.50-0.48	0.02
21-25	0.48-0.46	0.02
25-29	0.46-0.44	0.02

Source: Thomas T. Macmillan, The Delphi Technique refered in Kasem Boonaun, Delphi : Technique in research

The questionnaire used in Delphi technique will have many sets because researchers require exact opinion of the experts.

The first questionnaire consists of open-end question. The experts can express their opinion extensively within the framework

In the second questionnaire, the data gathered from the first are integrated and repeated opinions are eliminated or cut off the framework. The information is assessed in scale 1-5, 1-6, 1-7 according to importance.

The third questionnaire consists of the same context as the second one but add the mode or median and inter-quartile range of each question and the opinion of that expert to enable him to know the similarity or difference of his answer. The expert can change his answer to the range but should address the reason.

The fourth questionnaire ,like the third one, considered from range change. If there are few changes or no change, the researcher can stop the process

The advantage of the Delphi technique

a. Delphi is the process that helps the researcher to collect the opinions from many experts and do not require time to arrange the conference.

b. Delphi gives an opportunity for the experts to equally express their opinions. They will not be dominated or having a conflict if confronted with other experts.

c. The result of Delphi technique is gained through many steps of consideration so it has high reliability.

Precaution in Delphi technique research

a. Criteria for the selection of the experts should screen on those who are erudite willing and realizing the importance of the expression of idea.

b. Boredom and the feeling of being interfered may affect the collaboration of some experts.

c. Some experts' opinion may bias.

d. Determining future forecasting period has to be careful, otherwise there would be some errors.

Masco Hanaoka and Tomasz Mroczkowaski, 1994 used Delphi technique to predict management model in Japanese business. They collected the administrators' opinion for future model of the Japanese trust. They used two sets of questionnaires to collect the administrator's opinion. This study forecast future characteristics of business e.g. human resource and reflected organization and government plans.

In Thailand researchers have used a similar process (not Delphi) to study health care administration so the results are not complete. If the study was continued with Delphi technique, it would have more value results.

There was a study on future administrative model of Public Health in Thailand in 2020 by using Ethnographic Future Research (EFR). The study assessed strength, weakness, opportunity and threat to public health administration .The study suggested the future missions, roles, crisis, authority and administrative structure, response and process by using semi-structured interview and non-directive open ended questions for experts to express their opinions freely. Most experts, normally, had never looked beyond the next five years and most of them were trying to find a method

to cope with the existing problems. These weak points could be overcome by the use of Delphi technique.

Forecasting future model of drug industry by using Delphi technique combined with strategy of working committee to restructure the industry because this technique can collect the opinions of drug manufacturer experts who are representations. The result from this technique is useful in sequential operational plans to develop drug industry that corresponds with competence of local manufacturers.

2.2.2 SWOT Analysis

SWOT Analysis is the analysis of strength, weakness, opportunity and threat of a product or a business organization to analyze the situation of a business by taking into consideration:- -

a. Strengths or prominent points of products or business in an internal environment by using 4P's factors which are product, place, personnel and price. Strength analysis helps decide market strategy, sales target, advertising and also sale promotion

b. Weaknesses or problems of products or business in an internal environment. Weakness analysis will help administrators solve the management problems. In some business the administrators are able to turn weakness into strength.

c. Opportunity which are the advantages or supportive factors of a business in an external environment. The analysis help the administrator to set market strategy corresponding with opportunities.

d. Threats which are the limitation from external environment. Some business use this analysis to improve market strategy to overcome organization treats (Amnat, 1993)

Achara Janchai, 1998 evaluated the present status of industry by looking up strengths, weaknesses, opportunity and treats and used the 7S's Model of Kinsy which concerned strategy, structure, system, style, staff, share value and skill

Value chain of Michael E.Porter evaluates primary activities. These are import system, inventory control, production and production process, packaging, construction, maintenance, auditing, quality control, ordering, supply and transportation, marketing and service e.g. installation, restoration, training, procurement of raw materials, materials assets, technology development in activities, human resource administration, screening and selecting, evaluation, development salary system, official relation and structure of organization e.g. management, planing, work system and quality management

Business function is an evaluation of business function namely:

a. marketing evaluation

A successful marketing management should have a good market strategy such as product strategy, price strategy, sales promotion strategy, place strategy, corporate image evaluated from good service and support and ethical company. These factors create moral development of a country, attempt to be the excellent, vary in products and services, uncomplicated to deal with, high quality to good and service, disclosure activities and honest to public

b. Human resource management evaluation. The process starts with authorized the employed, salary, facility, training to raise, potential for working and personal evaluation.

Opportunity and threats analysis is an evaluation of extended environment analysis namely:

a. Economics. Economic factors that affect opportunity and threats in business management are economic growth, economic structure e.g. exchange and interest rates, inflation rate, GPD, wages, government budget for investment and other expenses.

b. Social such as the amount and growth rate of population, family size, occupation, age distribution, education and training quality of life, social variables, analysis such as the impact of down size families which affects the number of residential and facilities like area, television, both in volume and in size

c. Technology. Technology change affects both opportunity and limitation. This includes communication progress, technological advances, transportation, computer, product research and development, technology transfer and product life cycle. The impact of technology is considered such as whether there is an increase in the sales value and effective sales when internet system is introduced into marketing department.

d. Public and law. These are value-added tax, labor law, environment law, stable government, international standard regulations, free trade policy, Patent Act and the effect of ISO 14000 on export business.

Competition of business analysis

a. To study comparative advantage with present competition. Analytical variable is Portor's 5 Forces that can be analyze both present and future competition. It can also study new enters to industry. This study considers

- An entrance to industry.If the entrance is easy, competition will be serious and thus pose a threat to business.

- An exit from the industry.If difficult, the number of competitors will not decrease. They will resort to various strategies to struggle for their firms' survival.

- Present business competition is considered from the number of competitors, the technological development of competitors and a growth rate of the market. If the growth rate of the market increases, the competition is not serious

- Availability of substitute products. If there are many substitute products, the competition is serious.

- Bargaining power of the customers. If the customers have bargaining power, the competition is serious because the customers can change to other products.

- Bargaining power of suppliers. The competition will be serious if suppliers have bargaining power because they can raise the price of raw materials.

- Effectiveness of government regulation.

Worawannee Tungsirikulwong, 1997 studied comparative advantage and competition advantage of semi-conductor industry in Thailand, Malaysia and Indonesia. She calculated the comparative advantage by using Revealed Comparative Advantage (RCA) as an index. Then she studied comparative advantage by SWOT Analysis applied from Diamond Model of Michael E. Porter. She compared export markets in these 3 countries by weighing each factor from 0-1.00 and setting criteria

that if the total score is more than 3.3, that country has a competitive advantage. If the total score is less than 1.67 a country loses competitive advantage. RCA is used to compare comparative advantage of the 3 countries and trend from 1989-1994 in the aspect of the comparative advantage among the 3 countries.

SWOT analysis is selected to explain pharmaceutical industry because it can concluded the current operation of drug business. The results especially stated weaknesses and threats in the operation and the intensity level of these factors. This study used both theory of comparative advantage and competitive advantage to explain the status of industry. SWOT analysis is especially used in competitive advantage to evaluate quantitative data. In clarifying their effects the factors, are grouped by using factor analysis statistic.

2.3 Literature reviewed on pharmaceutical industry

There are few researches on pharmaceutical industry except from pharmaceutical science study. The limitation is some details are not collected and the data in many agencies vary. The most obstruction is the concealment of data by some entrepreneurs.

Robert Ballance,1992 studied world pharmaceutical industry. He found that pharmaceutical study has become important since nineteenth century or after World War II. This industry can be divided into 3 groups as follows:

a. Large size industry that has annual sales of US$ 200 million to more than $1 billion.

b. Progressive industry which is a multinationals industry whose operation engages in three steps of drug production.

- Drug research
- Drug manufacturing
- Drug distribution

Although smaller than the first group, these companies are a large business operation with the volume of distribution between 200-1,000 million US dollars. They can synthesize chemical reagent to generate the new molecular entities which are essential for their research and production activities. This group of industry needs patent law for protection and stimulation more investment in research invention.

c. Production industry. It's activity concerns only production or a few more activities. They may develop active ingredient or new raw material but produce only patent-expired pharmaceutical products. It's annual sales is between 25-200 million US dollars. The factories are of small size (according to the world's standard). They do not conduct research and use the invented technology.

Robert Balance categorized the countries according to their characteristic described as follows:

a) The countries that have advance pharmaceutical industry and important research base such as France, German, Italy, Japan, Sweden, UK and USA

b) The countries with innovative capabilities such as Australia, Austria, Canada, China, India, Korea, Spain, Russia and Yugoslavia.

c) The countries with productive capabilities.This group is divided into 2 subgroups.

- The countries which produce raw material and finished product e.g. Brazil, Egypt, Indonesia, Norway, Turkey.

- The countries which can produce only finished product e.g. Brunei, Cambodia, Chili, Greece, Iran, Malaysia, Philippines, Singapore, Saudi Arabia, Myanmar, Vietnam and Thailand.

d) The countries which do not have pharmaceutical factories such as Laos, Rwanda and Phutan.

Drug production in most ASEAN countries belong to group 3 catagory which means that these countries can produce some raw materials for finished products called "Manufacturing" and they can produce finished products called "formulation" as well.

The volume of world pharmaceutical production from 1975-1950 is more than 2 times in developed country. In developing countries the volume of production increases slowly and varies in each area. Growth rate is high in Southeast Asian as seen in table 7.

Table 7 Growth of drug production by group of countries 1975-1992

	Proportion of world production (%)		Growth rate (%)
Countries	1975	1992	1975-1992
Eastern Europe and Russia	**10.2**	**8.6**	**4.0**
Developed countries	**67.2**	**73.0**	**5.8**
North America	20.4	22.7	5.9
EC	28.6	24.3	4.1
Other Europe	2.7	2.6	5.0
Japan	14.2	22.3	8.4
Others	1.3	1.1	4.1

Table 7 Growth of drug production by group of countries 1975-1992. (cont.)

Countries	Proportion of world production (%) 1975	1992	Growth rate (%) 1975-1992
Developing countries	**22.6**	**18.4**	**3.8**
Latin America	10.0	7.9	3.5
North Africa	0.5	0.4	3.6
Other Africa	0.8	0.4	0.9
South East Asia	*3.6*	*4.9*	*7.3*
China	5.6	3.5	2.1
Others	2.1	1.3	1.8
World	100.0	100.0	5.2
Total World Production (constant 1,000 million US$)	70.1	150.3	

Source : Robert Ballance ,1992

Cost structure of each item is less different between developing and developed countries but the proportion is different. The proportion of cost difference between developing countries and developed country is the cost of research and development. The advantage of developing countries is low labor and research costs.Cost of productions is divided into 6 components: production, marketing, research and development, management, profits and others as seen in table 8.Table 8 compares percent of cost components between developed and developing countries. The table shows that there is relatively a few changes in the cost proportion during the 5 years.

Table 8 Cost of production of developing and developed countries

	Cost of production 1975				Cost of production 1980(late)			
Countries	Factor of production	Labor	Research &development	Others	Factor of production	Labor	Research &development	Others
Developing countries(26)	54.5	14.0	---31.5--		55.4	12.9	--31.7--	
Developed countries(12)	46.0	21.6	7.1	25.3	42.1	16.5	10.0	31.4

Source : Robert Ballance ,1992

World's cost of production in pharmaceutical industry by comparing

- Fundamental factors are wage, operation cost, depreciation, net indirect tax and others. This equals to 12.47, 16.93, 2.53, 2.29 and 17.85 percent respectively.

- Intermediate factors are raw materials, chemical products, finished products, equipment and packaging e.g. glass, paper, plastics which equal to 27.44, 9.00, 0.26 and 11.49 percent respectively.

Components of cost of production in ASEAN countries are different from those of developed countries. The difference lies in cost of research and development such as the cost of production in the Philippines and Singapore as shown in table 9.

Table 9 Proportion of structure of production cost.

List	Philippines	Singapore
	Cost 1985 (%)	Cost 1986 (%)
Production	48.4-58.6	92.5
Research & development	0.0-0.5	-
Marketing	30.6-33.0	1.7
Management	7.1-12.8	1.6
Labor	-	3.1
Others (energy, electric, water, transportation)	1.3-7.7	1.2
Devaluation	-	-

Source : Robert Ballance ,1992

The government policy in developing countries is significantly different from the developed country. The government policies on pharmaceutical products are of 3 features:-

a. Price Policy of Developed Countries. The pharmaceutical industry in developed countries enjoyed freedom in price setting while those in developing countries have to face price control policy due to the population's low income and an access to health service.

b. Patent Act that protects both products and processes for 20 years in developed country. In developing countries there are only 45% of drugs under patent and these are usually valid for a short period of time.

c.Good Manufacturing Practice (GMP) is a guideline for quality assurance for products. In the industrial countries GMP is applied both in finished products and pharmaceutical substances. WHO has developed an international standard for the world's pharmaceutical industry since 1987 but there are few countries have accepted this GMP standard. In the developed countries, the governments support research both directly and indirectly throygh tax reduction and other financial supports. In the developing countries, the government can afford least support although they have stated this in policy declaration.

Amnat Thanpaisarnkit, 1993 conducted drug a study on the market in Laos in 1993 and found that Laos have 4 pharmaceutical factories. Of these 2 factories are owned by the government. The study concluded that at present Thailand has a high potential for competition in the drug market of Laos among ASEAN countries.

Pattamawadee Zusuki, 1996 studied pharmaceutical industry in Thailand to seek the way for expertise. She divided the production industry into 3 types as follows:

a. The production of raw material such as active ingredients, adjuvant and pharmaceutical necessities accounts for 5 percent of total domestic demand. Another 95% has to be imported because the production requires high technology and cost. Most of these factories are joint ventured with foreign companies. At present they produce 26 raw materials.

b. The production of finished products from imported raw materials namely:-

- Solid dosage form e.g. powder, tablet and capsule
- Semi-solid dosage form e.g. cream and ointment
- Liquid dosage form e.g. emulsion and solution

- Miscellaneous dosage form e.g. inhaler and aerosol

c. Repackaging imported finished products such as repackaging labeling bulk from the second step.

Table10 illustrates the export from ASEAN countries.Singapore is a large exporter of both ASEAN and outside market. Thailand comes fourth after Malaysia and Indonesia. In other markets outside ASEAN Thailand is second after Singapore.

Table 10 Value of export of Asian countries 1991

Export countries	Import countries						Asian countries	Out of Asian	World market
	BruNei	Indonesia	Malaysia	Philippines	Singapore	Thailand			
Brunei	+	0	0	0	0	0	0	0	0
Indo-nesia	0	+	336	37	421	83	877	2,512	3,389
Malaysia	568	105	+	7	983	91	1,754	480	2,234
Philip-pines	16	0	567	+	71	69	723	616	1,339
Singa-pore	423	0	4,008	1,024	+	507	5,962	41,145	47,107
Thailand	0	0	128	0	298	+	426	5,395	5,821

Source: United Nations

The Industrial Finance Corporation of Thailand, 1996's overview of chemical and drug industry in Thailand reports that in 1998 Thailand has 176 drugs manufacturers. Because of excess production capacity, the factories that produce finished produces use about 57-62 percent of their full capacity. So they turn to produce for export. Production that does not use full capacity will result in high production cost/unit. The survey also found that GPO's actual capacity exceeds those of other manufacturers. Drug factories resort to solve this problem by using each machine in producing every

formula of the same dosage form. The production capacity in this study is defined as an ability of a machine in producing each item so the results do not correspond with the real situation.Real capacity are slowly increasing which may be the result of market competition. Thus the solution will have to consider along with other factors.

The finished products in Thailand are divided into finished product for human and for veterinary. The value of production has continuously increased. There was more than a 20 percent increase during the first phase of 6th economic and social development plan which emphasized on export promotion but 2-3 years later the growth rate of an increase in value of production has begun to incline slowly since 1990. While the value of production increased slowly, the value of import increased quickly until the proportion between production and import was 74:24 in 1990 and went on to 68:32 in 1995 as shown in table 11.

Table 11 Value of production and import of pharmaceutical products unit: million baht

Year	Production of modern pharmaceutical products			Import	Proportion	Total
	For human	For veterinary	Total		Production: import	
1987	5,145.75	309.15	5,454.90	2,163.15	71:29	7,618.05
1988	6,708.85	181.27	6,890.1	2,531.80	73:27	9,421.9
	(30.4)	(- 41.4)	(26.3)	(17.0)		(23.7)
1989	8,373.28	223.98	8,596.8	2,855.00	75:25	11,451.8
	(24.8)	(23.6)	(24.8)	(12.8)		(21.5)

Table 11 Value of production and import of pharmaceutical products unit: million baht. (cont.)

Year	Production of modern pharmaceutical products			Import	Proportion	Total
	For human	For veterinary	Total		Production: import	
1990	8,886.02	290.50	9,176.52	3,266.10	74:26	12,442.62
	(3.6)	(29.5)	(4.3)	(14.40)		(6.78)
1991	9,726.66	325.68	10,052.24	3,727.50	73:27	13,779.74
	(9.5)	(12.1)	(9.5)	(14.13)		(10.75)
1992	10,696.55	385.05	11,081.60	4,858.10	70:30	15,939.70
	(10.0)	(18.2)	(10.2)	(30.33)		(15.67)
1993	11,831.03	275.66	12,106.69	5,141.30	70:30	17,247.99
	(9.6)	(-28.4)	(9.3)	(5.83)		(8.21)
1994	12,969.67	284.35	13,254.02	6,118.78	68:32	19,372.80
	(9.6)	(3.2)	(9.5)	(19.01)		(12.32)
1995	16,694.06	461.73	16,155.79	7,484.63	68:32	23,640.42
	(21.0)	(62.38)	(21.89)	(22.32)		(22.03)

Source : Drug Control Division, FDA

Note the numeric in the brackets is the percent of growth rate based on previous year.

Imported drugs came from German, USA, France, Switzerland and Belgium respectively. Value of import is highest in products code 3004 which are finished

products used for treatment or prevention. The second group is code 3002 serum and vaccine.Thailand also exports raw materials and intermediate products.Thailand's export markets are India, Africa, Malaysia and Indonesia.Export drugs divided by pharmacological action are antibiotic, neuromuscular and dermatological respectively. The research found that Thai pharmaceutical industries is different from the world's industry as follows:

a) Type of production is formulation by import raw materials from foreign countries.

b) Producing with noncomplicated technology.

c) Producing off-patent drugs and extracted herbal medicine.

e) Producing for domestic need while imported volume is more than exported volume.

f) Most imported drugs come from Germany and U.S.A.

g) Large export markets are Singapore, Malaysia and Indonesia.

h) The price of exported drug is higher but is still 3 times lower than the price of the imported ones.

C. Sepulveda and E. Meneses, 1980 collected data of pharmaceutical industry in 1980 from Asian countries. They found that Indonesia was the only country which could produce both active and non active raw materials because it required the manufacturers who had operated for more than 5 years to produce 1 item raw material. Laos was the only country which had no pharmaceutical factories. Thus it had to import drugs from Europe, Japan and U.S.A. There were no master plan or strategic plan for expansion in ASEAN countries both in central or regional area. Every country

did not have a mutual plan for future expansion development so there were conflicts about interests and productions. Failure to conduct development due to population and economic factors results in small market size. About 10 percent of the total factories are foreign or joint venture. The government factories only have 0.7 to 6.3 percent market share of total wholesale value. Philippine is the only country where the government doesn't own drug factory although it has laboratory unit to produce and experiment vaccines and serums. In 1966 the Asian had 708 pharmaceutical factories in Philippines (37.6%), Indonesia (33.8%), Thailand (25.8%), Malaysia and Singapore have 3.1 percent. The influence of the governments on drug industry in the Asian countries is the gaining more of market share than private manufacturers. For example, some factories are owned by the government because they can have a direct contact with the government health center. Although they gain less, the results are more retail value and an accessment to low income clients. Some consumers are satisfied with these drugs except for self-medication consumers. The importance role of government is pricing and issuing of production policy.Thailand and Indonesia for example have extended their raw materials production. In Thailand, there is a regulation that the government hospitals have to order products from government producers. In Asia Indonesia and Malaysia are the countries self-reliance in formulation. First priority in ASEAN countries is trade policy, consumers, tax and foreign investment because there is no co-operation in pharmaceutical industry. The cooperation of ASEAN countries's drug markets will have an effect on production technology of drug and raw materials. This is important in economics of scale.

The characteristics of pharmaceutical industry in ASEAN countries is formulation, with low utilization of capacity. The industry gains a lot of profit from trade and from health care system which specifies that some drugs must be dispensed with physician prescriptions. Although drug manufacturers have increased to 10-20 percent per year, this industry is not developed. The real capacity is 50-60 percent of the full capacity.

The export value of ASEAN countries in 1966 was 686 million US dollars in wholesale price that divided to Indonesia 40%, Thailand 22.7%, Philippines 22.1%, Singapore 9.8% and Malaysia 5.4%. Thailand is the second countries of export value next in Indonesia.

Relation Commence Department, 1984 reported that the real capacity of pharmaceutical industry in Thailand is less increased from 21.6 percent in 1982 to 22.5 in 1984 as shown in real the capacity in tablet production.

Table 12 Capacity and Production of pharmaceutical products 1982-1984

Products	Unit	1982		1983		1984	
		Capacity	Productivity	Capacity	Productivity	Capacity	Productivity
Tablet	Million tablet	23,600	5,100	23,600	5,315	23,600	5,317
Capsule	Million capsule	3,000	603	3,000	635	3,000	640
Liquid	Million lit.	440	69	440	73	440	75
Powder	Ton	6,400	1,200	6,400	1,300	6,400	1,320
Cream & Oinment	Ton	920	205	920	228	920	230

Table 12 Capacity and Production of pharmaceutical products 1982-1984.(cont.)

Products	Unit	1982		1983		1984	
		Capacity	Productivity	Capacity	Productivity	Capacity	Productivity
Parenteral	Million lit.	40	8	40	9	40	10

Kwanchai Ratanarolsakul, 1986 studied the undercapacity in pharmaceutical industry in Thailand: Average percentage on real capacity per full capacity of all dosage form is 16% (table 13) and average 65% in highest sale value.

Table 13 Real capacity and full capacity of 5 manufacturers in Thailand 1984 (unit : tablet or capsule)

Company	Selected drugs		
	Real capacity	Full capacity	Percent of real capacity to full capacity
A	1,426,237	5,000,000	28.52
B	2,202,500	5,000,000	44.05
C	784,788	939,984	83.49
D	-	-	-
E	2,569,600	31,800,000	8.08
Total	6,983,125	42,739,984	16.34

The pattern of drug production in Thailand shows that most factories have a production plan but only 71 percent follow their plans. The factors that affect their

production plan are the amount ordered, the amount expected for sales, and the 3 year production plan. These factors depend on the country's economy, market extension, and product designs such as color and packaging. The factors affecting drug designs are consumers. Color and shape of tablets and capsules change only a little. This makes pharmaceutical products differ from other goods. Most of the manufacturers will not produce other medical devices such as cotton and gauze because they must separate machines. Furthermore there are different factors in the production of drugs and other goods. For example the machines and raw materials must be imported. Drug production requires skilled labor butin practice, these labors have never been tested before being employed. There are few factories which have a budget for training courses. Percent composition of finished drugs price is

70.53 percent belongs to manufacturers.

4.23 percent belongs to wholesalers.

18.69 percent belongs to retailers.

6.55 percent belongs to value added tax.

Cost structure of drug production is presented in table 14.

Table 14 Structure of production cost in pharmaceutical industry in Thailand

List	Cost of production
	1986 (%)
Production	88
Research&development	-
Marketing	-
Management	-

Table 14 Structure of production cost in pharmaceutical industry in Thailand.(cont.)

List	Cost of production 1986 (%)
Labor	6
Others (energy, electric, water, transportation)	1
Devaluation	5

Pricing in Thailand depends on drug distributors of transnational companies such as raw materials and finished-products. Pharmaceutical products are different from other products such as image of the company, low demand elasticity and consumer's selection. So drugs companies can use many tools for sales promotion with no price competitors. The factors affecting drug price are raw material cost, consumer loyalty volume of production and advertisement cost. The drug market in Thailand has price discrimination by groups of consumers although it is the same generic drugs or the same consumer group. The purchasing amount is another factor that affects drug prices. If buyers order large volume of drug, they will received 5-10% discount. The channel of distribution is the test factor that affects drug prices. Buyers who are retailers, government hospitals and private hospitals can buy the same items from the same company but with a defferent price as seen in table 15

Table 15 Difference of drug price in Thailand by items

List	Unit price (Baht)	Dosage form	Max./Min. price
Ampicillin	0.88 - 15.32	capsule - syrup	17.41

Table 15 Difference of drug price in Thailand by items.(cont.)

List	Unit price (Baht)	Dosage form	Max./Min. price
Aspirin	0.044 - 0.22	tablet – syrup	5.0
Isoniazid	0.044 - 0.109	tablet - n.a.	2.48
Paracetamol	0.131 - 8.75	tablet - injection	66.67
Penicillin	0.350 - 3.5	tablet - syrup	10.0
Quinine	1.53 - 3.94	tablet - n.a.	2.58
Sterptomycin	2.189 - 5.25	injection - n.a.	2.40

In the study of drug price one should compare the same generic name, dosage form strength and presents it as price per unit. This study illustrates the differentiation of drug prices divided by generic names and is not concerned about dosage form so the ratio between maximum price per minimum price cannot present price discrimination significantly.

The subgroup to study drug system in Thailand, 1994 and collected value of drug imported found that in 1992 the growth rate of import increased highly so drug expenditure was 35 percent of health care expenditure. In developed country this amount was between 10-20%. This evidence showed that in 1992 Thailand was at its highest economic growth period so consumers prefered to use imported drugs and services from health cares.

Table 16 Value of drug imported in Thailand 1982-1997

Year	Value of import (Million Baht)	Growth rate (%)
1982	1,632.07	-
1983	1,833.67	12.35
1984	1,875.07	2.26
1985	2,055.39	9.61
1986	1,937.78	- 5.72
1987	2,163.15	11.63
1988	2,531.80	17.04
1989	2,855.00	12.77
1990	3,266.10	14.4
1991	3,727.50	14.13
1992	4,682.61	25.62
1993	5,075.31	8.39
1994	6,086.63	19.93
1995	7,484.63	22.97
1996	8,162.5	9.06
1997	10,682.6	30.87

Source : Drug Control Division, FDA

IMS, 1997 who collected drug statistics of the world, region and Thailand forecast that the world drug market will have a growth of 6.2 percent from 1997-2001 or equals to 378,000 million US dollars in 2001. This growth rate is a 1.6 percent increase from

1996. The factors that limited the growth rate in 1996 was a low economic growth in Japan and Eu., together with the revaluation of US dollars when compared with theYen and the Euro. Drug market in USA increased to 87.7 billion dollars or 7.5 percent in 1996. The data from 1992-1996 showed that the growth rate of the world drug market decreased while that of south east Asia and China increased (table 17). In 1997 the value of drug market in Thailand was 1,071 million US dollars which was a decrease in the growth rate. This is due to the economic crisis and the unpredictable exchange rate. After 1997 drug market in Thailand has increased from the consumption of 17.64 US dollars per head / year to 39 percent in government hospitals to 34percent for the drugstore.

Table 17 Growth rate of world pharmaceutical market

Region	Average growth rate (%) 1992-1996	Average growth rate (%) 1997-2001
North America	5.7	6.5
Europe	3.9	5.7
Japan	11.7	-0.7
Latin America & Caribbean	14.7	10.6
South east Asia & China***	10.4	12.3
World market	7.4	6.2

Source : IMS (16 July 1997)

Table 18 Growth rate of Thailand drug market

Growth rate	1993	18.52 %
Pharmaceutical market for	1994	13.83 %
The past 5 years	1995	14.82 %
(percent)	1996	19.13 %
	1997	- 11.43%

Value of world's pharmaceutical market in 1997 is 167,188 million US dollars (Retailed price collected from drugstores) and is divided by countries as follows:

North America 70,525 million US dollars

7 countries concentration German, France, Italy, UK, Spain, Holland, and Belgium 53,575 million US dollars

Japan (including hospital) 43,088 million US dollars

The pharmacological groups which is highest value of distribution is cardiovascular group, gastrointestinal, central-nervous, antibacterial and respiratory tract respectively.

The journal of business development Asia LLC, 1997 in its study of drug market in Asia found that Singapore is a country which can increase productively because in 1972 Beecham, the large multinational company moved its factory to Singapore so its productivity exceeded domestic demand and they began to export. The demand of pharmaceutical products in Asian market is divided by pharmacological groups as antibiotic, vitamin, nutrition and analgesic respectively. In Indonesia the value of these 3 groups is more than 60 percent of total value of distribution produced by leading

companies in various countries such as CCM/UPHA company in Malaysia and Kalbe Farma in Indonesia. Also mentioned in the journal was Siam pharmaceutical Co. Ltd. which ranked among the top ten the drug distribution in Thailand. The company produced both registration and patent drugs. The list of the product includeed antibiotic (40%), GI drugs (15%), growth factors (5%), cough and cold drugs, analgesics, antidibetics and cardiovascular (20%). They also produced drugs bearing the trade name of CEF-3, Claraxim, Granocyte, Ibiamox, Ibelex and Metrolex. The company's revenue in 1996 was 32 million US dollars and was increasing to 38 million US dollars in 1997. The company received GMP certificate from the Ministry of Public Health. This shows that Thai pharmaceutical industry is accepted in the Asian countries.

The Research Center of Thai farmer's bank, 1998 conducted a study on pharmaceutical industry in Thailand and found that the leading companies in the drug market not only have a capacity of developing new formulation, but also have a potential for export too. (table 19). The Asian countries which are large markets for our export are the following:

- Myanmar and Laos are large markets for insulin. The value of export is 0.3 and 0.09 million Bath respectively.

- Myanmar, Laos, Cambodia and Singapore are large market for penicillin syrup with the value of 24.1, 9.8, 2.7 and 0.7 million Bath respectively.

The forecast is that Myanmar will be a large market for hormones drugs which increased to 65 percent value of export in 1998. The countries that import pharmaceutical products from Thailand are Vietnam, Cambodia, Malaysia, Singapore

and Myanmar in 270.2, 246.6, 173.3, 124.9 and 111.5 million Bath respectively. Growth rate are 100 percent in Vietnam, 57 percent in Cambodia, 35 percent in Malaysia, 53 percent in Singapore and 72 percent in Myanmar.

Table 19 Leading companies that have high market share in Thailand drug market

Company	Pharmacological group	Market share
Atlantic company co.Ltd.	Antibacterial	33%
Takeda(Thailand) co.Ltd.	Antibacterial	
Osothspa (Tek Heng Yu) co. Ltd.	Analgesic, antipyretic	60%
Jawarad co. Ltd.	Analgesic, antipyretic	20%
Thai Nakorn Patana co. Ltd.	Cold remedy	80-90%
Si American co.Ltd.	Cold remedy	
Thai Nakorn Patana co. Ltd.	Gastrointestinal	80-90%
Osothspa (Tek Heng Yu) co. Ltd.	Gastrointestinal	

Dr. K. Balasubbramaniam, 1995 studied retailed price of 22 items of generic drug from 29 countries in Asia Pacific region. He found that there was a price discrimination between countries.

The pharmaceutical companies fix a price according to the purchasing power in the market. Manufacturers reveal drugs price while concealing the raw materials cost because transnational industries use transfer pricing to gain profits from developing countries. Table 20 showed the price difference between some generic drugs, packaging 100 unit in 4 countries such as Indonesia, Malaysia, Philip[pines and Thailand. Price is of presented in US dollars of 1991 rate of exchange. From this table

we can see that most of generic drug prices in Thailand are cheaper than the price of other countries.

Table 20 Compare drug price among ASEAN drug markets.

Countries		Indonesia	Malaysia	Philippines	Thailand
GDP/CAPITA (PPP$)1991		2,181	7,400	2,440	5,270
Drug name	Strength (mg.)				
Amoxycillin*	250	10	16	22	05-24
Amoxil	250	40	34	29	17-26
Cimetidine*	200	06	20	-	03-12
Tagamet	200	56	35	95	34
Diclofenac*	50	48	16	25	04
Voltaren	50	52	29	37	40
Propanolol*	40	04	05	12	04
Inderal	40	74	12	25	13

Note : * is generic products produced by local manufacturers in Thailand

Table 21 compares minimum and maximum drug prices of the same generic drug in developed countries and developing countries. The retail price of drug under the same trade name in developing countries is lower than that of the developed country although these drugs come from developed countries as shown in table 21

Table 21 Comparison between maximum and minimum drug price

		Developing countries			Developed country		
Drug name	Strength (mg.)	Min.	Max.	% different	Min.	Max.	% different
Amoxil	250	08	40	400	14	40	257
Cimetidine	200	02	20	567	05	70	1,300
Tagamet*	200	14	95	579	23	93	304
Cotrimoxazole	480	06	20	233	06	63	950
Septrin*	480	03	53	1,667	06	95	1,483
Diazepam	10	0.14	46	32,757	0.5	92	1,740
Valium*	10	03	52	1,633	10	116	1,060
Diclofenac	50	01	48	4,900	21	47	124
Voltaren*	50	02	52	2,500	21	108	414
Erythromycin	250	05	26	420	06	110	1,733
Erythrocin*	250	02	37	1,750	09	79	778
Lasix*	40	02	33	1,550	05	44	780
Adalat*	10	09	41	356	15	66	340
Inderal*	40	05	74	1,420	06	50	733
Ranitidine	150	03	40	1,233	31	84	171
Zantac*	150	03	150	4,900	52	284	446

Note ; * is trade name of pharmaceutical products in developed countries

The result of the survey showed that drug prices are highest in Indonesia and Philippines. Countries with low drug prices were Bangladesh, India, Pakistan, Nepal and Srilanka. However , the GDP in this countries was low too.

The reason for the difference of drug pricing are

a. Drug price relates with GDP per head. If GDP increases to10 percent, drug price will increase to 8 percent, this explains why countries with less GDP have lower drug prices.

b. The factors that make drug prices different among countries are the government regulation, the exchange rate, the period of registration the public health budget, and others. If these factors do not exist, drug prices in each country will be similar.

Madhu Agrawal, Roger Calantone and Robert W. Nason 1998 studied the competition potential of pharmaceutical manufacturers. They found that besides the invention of new active ingredients, drug companies also have to embark on new innovation such as investment. Innovation increases a competitive ability in the world drug market. The researchers compared pharmaceutical industry in USA with Europe and Japan from 1980-1990 by using Global innovation model. They found that factors like economic regulation, and industrial market structure can be supportive or impediment to the drug industry in global competition. Thus expansion on innovation investment affected foreign investment and world invention.

No price regulation is an important factor in the increasing competition capability of pharmaceutical industry in USA because USA has higher per capita income which enable a larger size of drug market and higher expenses on research and development. Price regulation has a negative effect on to research and development. Because manufacturers will used their profit in research and development which help expand foreign investment. So manufacturers with high technology are owned by foreigners.

The world market share related with the number of new chemical entity invention of new chemical entities depend on usual and development expenditure.

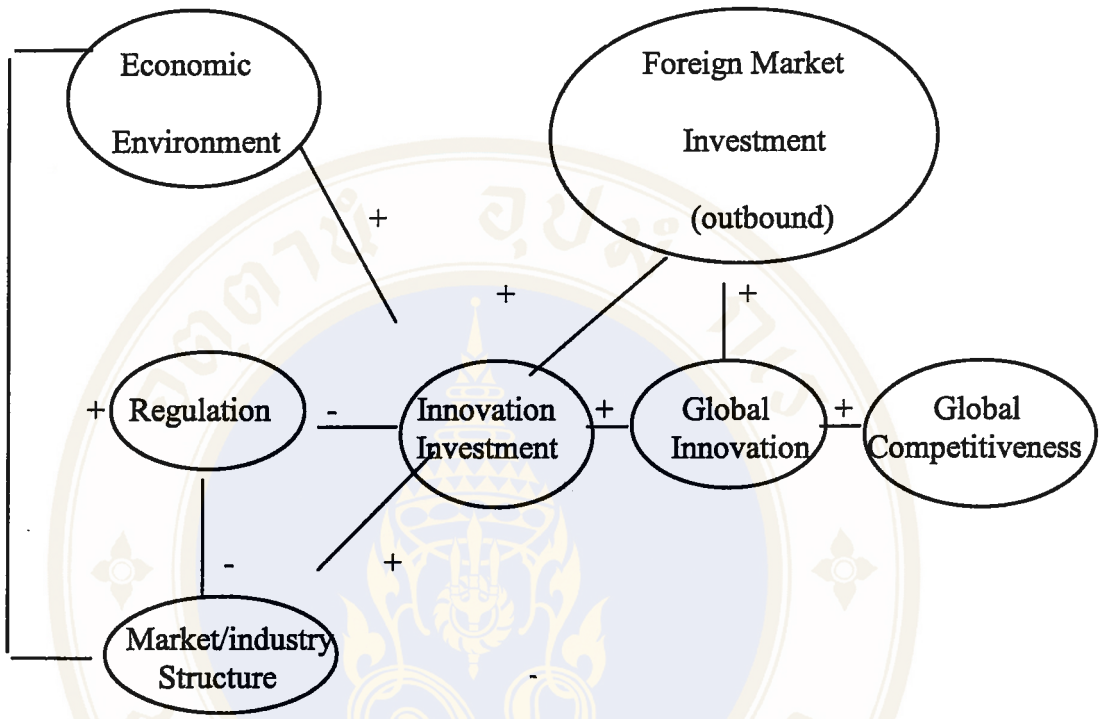


Figure 2 Global Innovation Model (GIM)

The Ministry of industry, 1997 studied potential of pharmaceutical industry in Thailand by comparing it with neighboring countries. They found that potential high are production quality, production standard, clean production, protective technology, value added productively. Median potentials are management and financial system production effectiveness, international standard planing and administration, effectiveness of export management foreign market. Potential should be improve are products research are development, effectiveness of labor, business information, cost of production, human resource development, effectiveness in domestic market

management, business improvement and development. Activities to increase potential are decrease cost of production.

Product development for raising value added, research and development, strategic alliance and environment operation to unit ISO 14000. Ministry of industry rank competitive ability among 7 Asian countries found that Thailand is third order next to Malaysia and Singapore, Indonesia, Philippine, Vietnam and Brunei are in 4^{th}, 5^{th}, 6^{th} and 7^{th} order respectively.

Mickey C. Smith, 1991 contracted competitive model in drug market using competitive advantage model of Michael E. Porter. He listed factors effect determinants as shown in figure 3

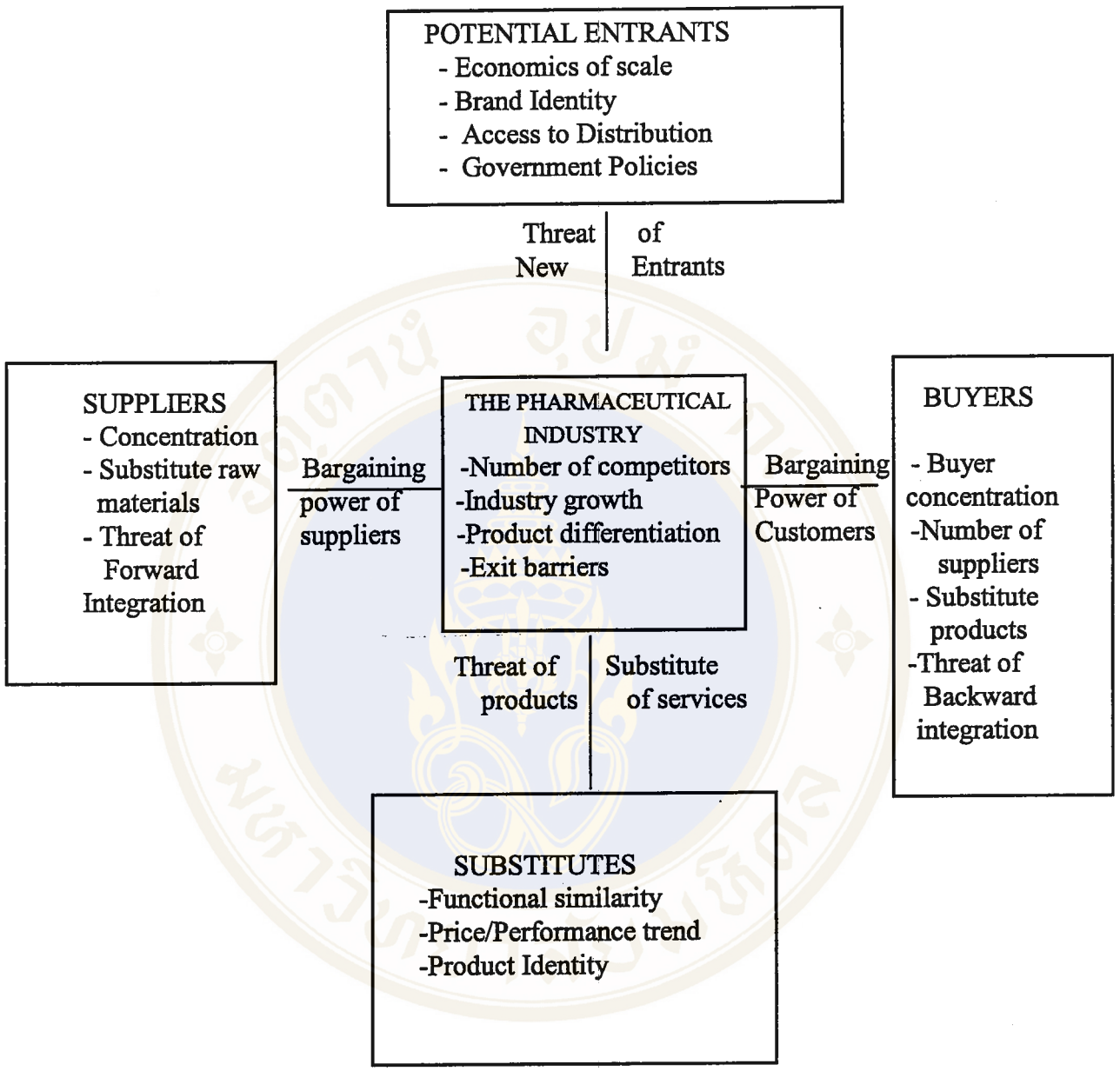


Figure 3 Determinants of competitive advantage in drug market adapted from Porter's model of competition

Source : Mickey C. Smith, 1991

From the above model determinants in competitiveness of Mickey C. Smith combined with SWOT analysis, we can explain the current operation of drug industry.

It is partly suitable to explain competitiveness in the domestic drug market among local manufacturers. Competitiveness between local manufacturers and multinational companies in domestic and foreign drug markets can mainly be explained by using determinants in Diamond diagram.

Vanida Chitman,1993 collected obstruction factors of pharmaceutical industry development in Thailand in the world drug market as follow.

a.Domestic environment, such as industrial production or pharmaceutical products are special control products .More than 60 percent of manufacturers do not improve themselves to meet the GMP standard.

b. Trade barriers will be quoted because Thailand is a member of Asian Free Trade Agreement (AFTA).The government has to reduce taxes for finish products from 20-30% to 5%.Differentiation of tariff between Thailand and ASEAN country will end up soon.

c. Mechanism to control drug price. Drug price is 1 among 20 products which are controlled by the internal trade division.The ministry of public health has authority to control drug price by using the National Essential Drug List.

Joint venture regulation in Thailand as declared by Dr.Amnua Weerawan reduced obstruction of foreign investment. AS the result of this regulation, there will be an increase in foreign investment and more co-operation with domestic manufacturers to produce raw materials for finished products and export to ASEAN countries.

Sunipon 1995 recommended the direction to develop pharmaceutical industry in Pharmaceutical orientation such as improvement of finish products, development of

formulation, development of stability and bioavailability of products. New formula will be developed from new active ingredient, or mix of more than one active ingredients in one formula. This improvement will develop pharmacological action and new (drug) delivery system so that products will have new indication and new dosage form which may increase the market share too. Further more Thailand has strength in transportation so manufacturers should develop their products for exporting to ASEAN & China market. He stated the problems of pharmaceutical standard as follows:

a. Problems in process of production of finish products are not equivalent to original products.The reason for other obstacle is active ingredients which cannot be produced in Thailand. The manufacturers import active ingredients from various sources so their products have inconsistency of quality including packaging materials which do not contribute to production development.

b. Personnel insufficiency of skilled worker who can work with high technology and production process especially staff such as pharmacists, engineer and operators or workers such as technicians. A part from the questions of insufficiency, these personnels also lack opportunity to continue education and training.

c. Marketing. Thai manufacturers do not have enough competency to expand into foreign markets because of non-tariff barriers such as limitation on registration, surcharge increasing while domestic drug market share is reduced as a result of patent act, tax and supportive industry. Marketing will affect the volume of distribution and the volume of production too.

d. Regulations that are improved and are more complicated which pose a threat on development such as generic labeling, the co-operation between the government and the private sector in research and development, government administration, VAT and registration procedures. Effects from these regulations are complication, loss and slowness of pharmaceutical industry development.

The working group on industrial restructuring, Ministry of Industry reported on March 30, 1998 about the problems of chemical-pharmaceutical industry as follow:

a. Small and medium sized industries use uncomplicated technology and lack specialization.

b. Regulations of production, distribution, import and export, standard and quality control are complicated, non flexible and unfavorable to development.

c. Insufficiency of professionals such as pharmacists, scientists and mechanics both in the amount and ineffectiveness.

d.Raw materials can not be produced in Thailand. Manufacturers must import raw materials to produce products which are price controlled in domestic market so producers resort to import raw materials from a cheaper source. This practice results in a substandard quality of the finished products.

e.Development of raw materials, products and packaging are not enough to support pharmaceutical industry .

f.Export promotion to foreign market is not adequate because of high competitiveness and non-tariff barrier such as the condition on drug registration, high surcharge while domestic market is exploited by patent drugs.

g.Process of import-export and taxes do not support industry.

Strength of pharmaceutical industry are:

a. Entrepreneurs are experts of long experience.

b. Skilled labors with conscience in quality.

c. Real capacity is less than full capacity so it can increase productivity for export.

d. FDA inspects standard of industry stronger than what is done by FDA in neighbor countries.

e. Personnels. Academic curriculum especially that of the university produce high quality of human resources.

Weakness in industry consists of:

a.Raw materials are still imported.

b.Image of some drugs or chemical substances is not accepted in domestic and some foreign drug markets.

c. Non –sufficient number of personnels.

Opportunity of this industry is as follows:

a. Free trade agreements are varied such as AFTA, APEC. This gives a chance for manufacturers to export finished products and import raw materials.

b. Amazing Thailand Year is a chance to promote an image of pharmaceutical products and standard of manufacturers.

c. Regulations of customer announcement 281 motivate foreigners to invest in Thailand.

d. Devaluation of the baht exchange rate increases competitiveness in the world pharmaceutical market.

e. Some raw materials can be produced enough for production needs such as saline solution.

Threats in pharmaceutical industry are:

a. Domestic drug market is small when compared with a number of manufacturers investment because some part are occupied by patent drugs which local manufacturers are not allowed to produce while other parts are is occupied by government pharmaceutical organization and government hospitals.

b. Regulations about production and distribution do not support production development for export for example the regulation on the production of traditional medicines.

c. Raw materials tariff is higher than that of the neighborhood countries.

d. Non tariff barriers such as high surcharge rates or non-permission of registering imported drugs.

The Ministry of Industry has established 7 visions in pharmaceutical and chemical industry development. This includes a strategic plan to achieve the visions. They are as follows:

Vision 1 The most important vision is an image of Thailand pharmaceutical products which must be accepted both in domestic and foreign markets. The strategic plan to attain this vision is an establishment of a drug institute for education and training of pharmaceutical technology and quality control. Also there must be an institute to certificate drug quality in cooperation with foreigners and encourage awareness of entrepreneurs and their personnel about GMP, ISO 9000 and ISO 14000. This can be done through public relation and awards offered. Foreign investment or

joint venture for technology transfer to gain value in using domestic products must be campaigned and lastly the government should promote image of Thai products by participate in exhibitions or advertisement.

Version 2 Thailand is a center of finished products and some chemical substance production that are accepted by developing countries. The strategy to attain this vision is by promoting manufacturers to develop their process to meet an international standard, giving support in using new technology and machines in production and quality control. At the same time investment is done by granting highest privilege to every region. The government should adjust some regulations that hinder industrial development. Development personnel namely pharmacists and scientists must be increased both in amount and in competency. Promotion of international trade in bargain system. Promotion operation between private sector and academics to transfer and improve technology in production. Support and promotion on the production of non-patent drugs still used in developing countries.

Vision 3 Thailand is the leader of ASEAN countries in drug and chemical export. The value of export in the year 2002 will be 3 times the value of export in 1997. To fulfill meeting this vision the government and private sector must work together in seeking foreign markets; reducing obstacles of export; rendering rights and benefits granted by the Investment Promotion Act; replacing the out of date machinery to increase productivity; strengthening database on ASEAN marketing and technology; improving quality control system for quickness and convenience; upgrading quality management to international standard and GMP; and developing personnel on international marketing for the expansion of foreign markets.

Vision 4 Thailand will increase 50% of its production by the year 2002 to substitute imported drugs by campaigning for recognition of drug and chemical of Thailand; improving process of production and management according to ISO standard GMP and quality assurance system, improving tax structure and import-export procedures; promoting joint venture with foreigners to produce drugs; rendering rights and benefit to manufacturers on plant transfering investment or the replacement of machinery; information amd marketing development; selecting market potential drugs especially the off-patent drugs to be produced by local manufacturers as soon as possible

Vision 5 is the second priority next to vision 1-4. This vision is the production of some active ingredients with commercial potential for import–substitution. Promoting the use of domestic raw materials such as cassava flour in producing high value added products. Encouraging the use of some chemical substances which Thailand has comparative advantage in the production. Development staff on science and pharmacology by supporting cooperation among private sector and education institutes for technology transfer.

Vision 6 Some Thai brand name products must gain recognition by developing countries. This can be acheived by; building confidence in the quality of the products through continuous public relation and advertising; giving financial support and motivating exporters and distributors; conducting market research on consumers' behavior in target channels for product improvement products and packing that correspond to consumers' choice; making alliance or trade agreement to exchange

products among developing countries e.g. Thailand want herbal medicine from Vietnam while Vietnam want finished products from Thailand.

Vision 7 Thailand will be a source of the production of herbal medicine and extraction in Asia for commercial products by using modern production process.

Suda Dilokpatanamongkol et al study the needs for training and development of industrial personnel from administrators and pharmacists. They found that 64.8% of total number of the factories train their staff by means of learning by doing, 50.8% of factories have no training. The most mentioned reason is the lack of training organizers. Second one is the lack of instructors and budget. The last reason is the unconcern of administrators. The desired training methods are participating in training course; or workshops. Topics required for training pharmacists are GMP, effective methods of production and new technology.

Siripen Supkankul et al 1999 study the impacts of WTO, TRIPS on pharmaceutical industry in Thailand. They found that TRIPS agreement affected pharmaceutical industry in Thailand as follows:

a. The increasing of foreign investment in pharmaceutical industry is higher than other industries-assuming that pharmaceutical industry is a subgroup of chemical industry. Chemical industry has grown from 13% in 1988-1991 to 14% in 1992-1998 or 22% if economic crisis period is excluded.

b. Technology transfer from transnational industry is very little. The only strategy of these companies in moving their production bases is to seek for low cost resources. Since product development is a complicate process. It will be done only in

the main target countries. Furthermore, the revelation of research and development of products that required expertise and technology will create competitors in return.

c. Patent affects a drug price as a result of the protection right. Profits depend on remaining time of protection from the patent and sales volume and "me too products". These prices change if there are new local manufacturers. However the original products are still higher than the imported generic products and local products.

d. Cost of imported drugs increasing from the floating exchange rate in 1997 Drug expenditure in Thailand is partly imported drugs so value increases in correspondent with an exchange rate. This is true with health care expenditure.

e. The proportion between patent drugs and patent-expired drug in domestic market. In 1997 the market share of original products are highest with an increase of 1-6% every year. The proportion between generic products and original products is 33:67 respectively and the growth rate of the value of original product is 2-3 times of the growth rate of GDP in 1977. From 1998 the market share of original products is decreased by 13.3 % but the proportion is still more than 50% of total drug market.

f. Drug price control in Thailand. The adoption of patent act and new drug registration are the factors that affect drug pricing in Thailand because it reduces competitors of multinational companies and also the competency of health professionals and consumers who can make drug price lower.

Rachot Takolsin, 1999 presented 4 groups of problems in pharmaceutical export and supportive requirement from the government as follows:

Group I Non tariff barriers

Group II Image of Thailand in producing substandard pharmaceutical products, value of imported drug consuming and standard of products. Developed countries do not accept products from Thailand because they are not familiar with Thai pharmaceutical products.

Group III Non cooperation of strategy between public agencies and government's definite policy for restructuring the industry, export promotion, and investment support from BOI.

Group IV Accuracy indicators. Useful data cannot be retrieved Pharmaceutical products differ from other products in that they require considerable time to market. Promotion of trade names is difficult; company's name and reputation is still mostly stressed. Following are promotion approaches by the government.

Successive plans to restructure the industry by setting up a working group from both public and private sector, long term goals, and successive financial support.

Strategy for reducing non-tariff barriers. Increasing marketing opportunity and fighting back non-tariff barriers.

Development of quality assurance in pharmaceutical industry by lending encouragement to enthusiastic factories, promoting standard plants, and supporting agencies involved.

Promote an image standard of pharmaceutical industry in Thailand by conducting strategies to show potential to be a leader in drug quality among neighboring countries.

Dr. Ninsuwan Lelarassamee,1999 concluded some type of registration barriers to export as follows

Types of barriers in general

a. Product registration timing approval: delay: too long

b. Specific labeling requirement: different in details

c. Classification of drug groups: differences

d. Registration license time: too short

e. Documentation requirement for registration process: varies

Dr. Surirat Prajaktum, Rachot Takolsin and Dr. Nin suwan presented technological problems in export as divided by countries namely:

Malaysia

a. If imported products have no therapeutic advantage when compared with other items in the domestic drug market, they will not be permitted to registered new items.

b. Accept only a long-term study of stability data, not accelerated data so shelf life predicted by accelerated data is reduced to 2.5 years instead of 5 years.

c. Using related substance test as barriers because some related substance test requires reference standard which is expensive and rare. They do not accept the test reference of standard that compared Rf value.

d. They limit the quota to 5 brand names per item for registration and distribution in their country. If 5 local manufacturers can produce any of these items imported. Imported items are allowed to register.

e. Some generic drugs are not permitted to register e.g. Aspirin, Paracetamol and Chlorpheniramine.

f. The government sectors give first priority in drug purchasing to local manufacturers although the prices are 20 percent higher than imported products.this is to prevent a dumping of drug prices.

g. The government gives first priority for registration to local manufacturers.

Cambodia

a. Period of registration procurement takes more than 2 years.

b. Samples tested for registration are kept for 1.5-2 years so 80% content decreases due to storage conditions.

c. All items are tested for bioavailability even drug belonging to cold remedies group are of no exception. Requirement of certificate of raw materials from drug manufacturers are made but not from raw material producers. This requirement proves difficult for manufacturers because some test are complicated e.g. Lincomycin B.P. test that uses histamine test.

Laos

a. Imported drugs must be registered in other countries and must be launched at least 5 years before they are imported..
b. Leaflets must be translated into French and English.
c. Prohibition of sodium cyclamate in products.
d. Imported drugs must state generic names, manufacturing date, and expiration date in the invoice.

Vietnam

a. Registration of imported drugs was closed with no reason for year. Transnational companies must set up pharmaceutical plants first before procuring registration.

b. Trademarks of products from Thailand are copied.

c. Registration documents must be in the Vietnamese language.

List of de-registration drug.

d. Local importers are state –owned companies and import license is granted for 1 year.

e. Licenses are divided into 2 types according to their duration. These are

- Product registration has a period of 5 years and the registration process consumes considerable length of time..

- Temporary license has a 1 year life and it is not certain whether the license requested will be granted.

Indonesia

a. Promotion and support investment to establish factories in the country by requirement that drug plants be set up before importing some drugs, or employ domestic industry to produce.

b. Permission to import only products which can not be produced by domestic industry.

c. Period of registration is not consistent.

Philippines

a. Surcharge rate is 22% form C.I.F. so imported drug prices are very high

Export Promotion Department (1995:1018) reported that good such as pharmaceutical products from Europe and USA are beginning to gain market in Vietnam because the Vietnamese basically favor products from U.S.A.. Besides the well-known trademarks of U.S. pharmaceutical products are prevalence here. At present foreign companies are moving their production base to Vietnam and begin to gain more market share of Thai products. Foreigner products which are very popular in Vietnam are those from U.S.A, Japan, South Korea, France and Thailand respectively. However there are some weakness. They are

a. The private sector lack information of Vietnamese market, for example , the importers must be government companies. They also lack the knowledge of Vietnam's purchasing power and a trade risk as well.

b. Lack of successive marketing. Companies run short time marketing so they are not interested in emphasizing the product image from Thailand.

c. The private sector is not interested in embarking on Vietnam market directly

d. The private sector does not improve the marketing strategy.

e. Limitation of ship transportation which pertains less freight and higher cost.

Punlapa Sukdaruk , 1996 (70-88) predicts that Singapore will greatly develop according to the year 2000 economic policy. The progress will cover the following aspects.

- Industrial goods production (M2000) to be more than 25% of GDP. There will be a promotion of research and development especially on pharmaceutical industry. Singapore also attempts to be the center of value added manufacturing

- Singapore will be the center of international Business HUB – IBH 2000

- Singapore will be the center of information (IT2000)

- Singapore will develop small and medium enterprises (Local enterprise 2000)

The 5th National Development Plan of Malaysia (1991-1995) which stresses on the population increase from 18 million to 70 million in 2025 will give an opportunity for Thailand as there will be an increase demand for food and drug consumption. Besides Thailand also has an advantage in transportation.

Export Promotion Department suggests that the exporters to the Vietnam market should have capital, working team, operation means and threats endurance.

Sinchai Kaitkitichai 2000 (126–157) recommend mission 1 on research and development of pharmaceutical production pertaining to standard quality based on self – sufficiency. The aim of which is to construct a master plan of pharmaceutical industry development and be a center of drug research and development in Thailand. The master plan will contain various approaches as follows:

- Direction of National Social and Economic Development Plan.

- Policy in Science and Technology development.

- Philosophy of education and higher education.

- Basic need of Thai people.

- Policy and strategy on the development of national public health.

- National drug policy.

- Drug system and drug development process starting from drug selection, drug production and procurement, drug distribution, and drug utilization. Strength, weakness, opportunity and threats of the public sector are as follow:

- Policy/Management Administrators are not concerned about research and development. Other factors include: lack of operation plan and evaluation. There is an expansion of international free trade. The effect of economic crisis. The human resource development plan does not correspond with demand. Development of latest technology is slow. Growth of health care expenditure is rapid. Lack of investment promotion. Non-strict inspection under GMP standard. Lack of vision in the part of administrators both in public and private sectors. There is no motivation for research and development especially quality development. Increase competitiveness both in internal and external market.

- Combating on counterfeit drug. ACCSQ will stress on technical procedure and requirement. Impacts are that entrepreneurs have to study and improve their production to meet the required standard. Competition will increased due to non-tariff barriers. However, it is a chance for high potential producers to expand their export (Mongkol at Songkla, 1999:1-5).

Jomjin Chantarasakul 1995 suggested the pharmaceutical industry model in the future that it should have specialization. The development of drug industry depends on:

a. Supportive policy for research and development.

b. Supportive policy to d elopment quality of drug in Thailand.

c. Change of patent act and drug act.

d. Generic names.

e. Pharmaceutical academics.

f. Personnel

g. Operatic and form for drug market.

h. ASEAN free trade area agreement

i. Cost of production

It is suggested that the government should increase its role in public sector revolution to have more effectiveness, conduct tariff press negotiation with neighboring country to reduce non tariff barriers, select target industry to continue the development plan, and establish human resource development institute to reduce the problems of insufficient personnel.

CHAPTER III

MATERIALS AND METHOD

Research design

This study used quantitative and qualitative research design:

3.1 Quantitative study

Quantitative method has an objective to (a) view modern pharmaceutical industry in Thailand. (b) Calculate domestic resource cost in drug production for comparative advantage of 10 selected drugs studied to assess potential for self-sufficiency. (c) Calculate term of trade for price competitiveness of 11 selected drugs studied for export potential to ASEAN countries. 3 items are studied to ascertain potential for both self-sufficiency and export). (d) Calculate capacity increased for self-sufficiency and export. Volume and Value of production is collected for the past 3 years from 1996-1998.

3.1.1 Population for quantitative study

Population studied by quantitative is 176 licensed pharmaceutical manufacturers of 1998. One hundred and twenty seven factories are located in Bangkok and the 49 are located in the other provinces. The factories are divided into three sectors.

- 1 Academic factory from Mahidol University
- 1 state enterprise Government Pharmaceutical Organization

- 174 Private factories, 125 are located in Bangkok 125 and the other 49 are regional.

The total population is 169 factories. Other 7 factories are excluded from the population. The reasons are as follow:-

a. N.P.L. Co. Ltd. is license withdrawn.(News from FDA no. 115/1999)

b. Standard Pharma Limited Partnership closed down business.

c. T.O Chemical, T.O Pharma and T.O. Lab belongs to the same owner.

d. New Life Pharma Co. Ltd. is co-operated with Neoplast Co. Ltd.

e. Unichem Pharmaceutical Co. Ltd. closed down business.

f. Amornkiat Trading is co-operated with Bangkok Lab and Cosmetic Co. Ltd.

3.1.2 Tools for quantitative data

a. Questionnaires are divided into 2 parts. Part one is general information of pharmaceutical industry. Data collected are to be used to describe present situation of this industry e.g. pharmacological group of products, capacity, capital, pharmacists. Part 2 concerns information of 18 selected drugs e.g. price, volume of production and cost of production. Data required for calculating domestic resource cost (DRC), the index to indicate comparative advantage.

b. An application form of 11 selected drug to study export potential to ASEAN countries namely Brunei, Cambodia, Indonesia, Laos, Malaysia, Philippine, Singapore and Vietnam. This data are required for calculating term of trade.

Note : see appendix

3.1.3 Evaluation of tools

Pretest the first questionnaire by contacting with plant managers. Twelve managers'response are collected. Procedures are as follow:

a. Questionnaires are sent by registered mail to 12 factories that accept and agree to answer and make recommendation within deadline (April, 30, 1999). The factories are

- Government owned factory - GPO
- Private owned factories. They are
  - 3 joint venture factories
    - Olic (Thailand) Co. Ltd.
    - Glaxo-vidyasom Co. Ltd.
    - Thai Osuka Co. Ltd.
  - 8 factories which produce tablets and capsules they are
    - Thai Nakorn Pathom Co. Ltd.
    - A.N.B. Co. Ltd.
    - Silom Medical Co. Ltd.
    - Sang thai Medical Co. Ltd.
    - Medic Pharma Co. Ltd.
    - Public Pharma Co. Ltd.
    - Udomporn Pharma Co. Ltd.
    - Seven stars.

b. Results.of pretest

- The questionnaires are returned from 11 factories equivalent to 91.67%

Because the questionnaires are open-ended when the respondents are requested to supply their own information, it is then not possible to evaluate the correctness of the information given. So it is evaluated from the correctness of the questionnaire questions and the respondents' understanding. This is done by evaluating grammar accuracy and comment from the respondents.

Question 11th wholesales price equals to all factory price of 1996, dosage form should be separated from name of drug, definition of factory price either include VAT or not stated.

Question 12th Some factory filled value of capacity as percent (If capacity wanted as values, informant use more time than pretest). Unit capacity is real production in 1998.

Question 13th Real capacity in each items can not be calculated so real capacity is actual amount of production in 1998.

Question 14th Volume of production in weight can not be answered by some factories because they did not have a record. Volume of production in 1996 can not be searched in some factories.

Questionnaire part 2, Details in cost of production make the informants confuse. These details are not effect calculation DRC only cost structure of production may be unclear but convenience of informants is more important, Value of cost are provided as both per pack and per lot.

c. Suggestion from Informants

- Researcher should cut off some questions that are not necessary because this questionnaire require a considerable time to answer and it depends on collaboration of the informants.

- This questionnaire should be sent directly to the owners because the data involved many departments and some data must be allowed to disclose by the owners.

- Data on cost of production is confidential. Some organizations had done a previous research on this and received few returns so this questionnaire may not receive the full information.

d. Adjustments of 1st questionnaire are as follows:

-Add export plan column together with the reason why or why not export.

-Combine all 18 selected drugs tables into to be in one and they should take only one page. Examples are factory price and volume of production which is the same in each table.

-Improve cost of production table by reducing the number of tables and make them easy to fill out.

-Add definition and explanation to ensure correct understanding but exclude details of each items, cost of production because if the details limited do not correspond with the factory's data, they might not fill in this part. Hence the cost of production might not be completely filled.

-Use defferent colours for different pages of questionnaire. Use yellow papers for part 1 and green paper for part 2. This is more attractive and easy for the researcher to work out.

3.1.4 Control for error

Control error in sampling, collecting data by

a. Reduce sampling error in the first group of sampling by using inclusion criteria that researcher expect that the factory passed this criteria will give available data.

b. Reduce information error by counter check price lists of the companies. For example information on the production volume of 18 selected drugs are collected from information given by the respondents and from calculation.

3.1.5 Process used in collecting data

I. Collecting data by using the first questionnaire from June 1, 1999 – December 31, 1999 are conducted as follows:

a. The letter of introduction signed by president of TPMA (Jaruroj Dankiatkong) sent together with first questionnaire

b. The first questionnaires were sent by registered mail to 176 drugs manufactures who received license for operation in 1999. Two other factories permitted in 1998 did not ask for license in 1999. They were Norvatis Co. Ltd. and HLP Limited partnership. Two more factories were permitted in 1999. They were Umeda Co. Ltd. and F.E. Pharma Co. Ltd.

Before distributing first questionnaire, the researcher had contact with both production and marketing managers by telephone or in person to explain the research

objective and assured them for confidential of data. Follow up will begin in 3 weeks after distribution. This is to ascertain whether the factories had received this questionnaire and request their cooperation in answering it.

Follow up first questionnaire. There was a delay from some factories due to the midyear inventory check up or GMP inspection so they could return the questionnaire after 2 weeks. The questionnaire from 26 factories or equivalent to 14.77% were returned from 176 factories. The researcher began to follow up on June 30 by

a. Contact directly with plant managers by telephone whether they received the questionnaire and requested them to return the completed form to researcher. If they do not researcher would send it again by registered mail.

b. Contact directly the staff to follow up the questionnaire. If the manager did not receive it, researcher would send it again by registered mail.

c. Contact 59 factories that did not acquire GMP certificate in tablets and capsules in 1998 by telephone to ask whether they produce tablets and capsules or not. Researcher assumed that the factories that did not produce tablets or capsules might not answer the questionnaire because the 18 drugs selected for the study produced tablet or capsule in dosage forms. Since these factories did not have any data so they did not return the questionnaire. Researcher requested them to return their questionnaire whether it was answered or not.

d. Joint meeting with professional organization to follow up the pharmacists who were owners or workers in drugs factories. In addition researcher participated in the

meeting with associations involving in drug industry to meet with some owners or managers.

e. Follow up through drug representatives by giving them the questionnaire to see whether their bosses had received it or not. In case their bosses did not receive it they would be given another copy.

f. Send the first questionnaire to the 121 factories who did not return the previous one to the researcher on November 2,1999

II. Collect wholesale price of 11 selected drugs studied for export potential as follows.

a. Wholesale price of 11 selected drugs studied for export potential in domestic market collected from price lists of drug companies

b. Wholesale price of 11 selected drug studied for export potential in foreign drug markets from certain resource by:

- Contact the representatives of drug companies in that country to survey the wholesale price from drugstores or drug companies and record them into the forms provided.

- Contact commerce ambassadors in ASEAN for the wholesale price of the drug or request them to recommend the one who can help to give the information. The price list forms are forwarded to survey these data.

3.1.6 Statistical Analysis

Statistical analysis is divided into 4 sections. They are

I. Researcher use program SPSS/PC computer. The statistics employed are

- Descriptive statistics to show an overview of modern pharmaceutical industry such as percent, mean, standard deviation and range.

- Correlation which analyzed relation with independent variable which is the member of pharmacist with dependent variables which are drug group and the number of registration drug.

- Mode is used to indicate strength, weakness, opportunity and threat by grouping score to 3 level positive, zero and negative for evaluation level of S, W, O, T in drug companies comparison in each factors. In addition using mode in Delphi technique to present percent of possibility and number of years.

- Factor analysis used to clarify items represent content explain factors of effect S, W, O, T

- Multiple regression was used to estimate value of drug production in 1995-2002. These values used in calculation volume of production increased in 2002 for import substitution and extend export.

II. Comparative advantage derived from calculating domestic resource cost (DRC)

Procedures for the calculation of Domestic Resource Cost : DRC

a. Domestic and foreign cost conducted from the first questionnaire input-output table is not used because the value in this table represent overall pharmaceutical industry while 18 selected drugs vary in dosage form as the researcher wants some details in production cost such as active ingredients , non active ingredients, packaging materials, direct and indirect overhead so data from manufacturers are used.

b. Direct domestic and foreign cost conducted from the first questionnaires. The domestic or foreign cost, for example raw material cost, the foreign cost although they bought from the distributors in Thailand so there are no indirect domestic and foreign cost in table 52.

c. Exchange rate conducted from report of the committee to study and suggest procedure increase effectiveness of national financial management point 178. The report stated that as on May 13, 1997 effective exchange rate is 25.85 baht per one US dollar and the real effective exchange rate (EER) is 26.10 baht per one US dollar.

d. Market price determined from average factory price in 1996 from first questionnaires because this value is the manufacturers direct sale price. If the factory price in not available, calculation will be done on wholesales price of 1996.

e. Calculate DRC by using formula

$$DRC = \frac{\text{Domestic direct cost}}{\text{(Price -Foreign direct cost)/exchange rate}}$$

Calculate domestic resource cost per real effective exchange rate

if DRC/ EER < 1 This show that drug has comparative advantage or production of this drug has opportunity cost or domestic resource cost less than 1 unit of foreign currency received.

DRC/EER > 1 shows that this drug has opportunity cost or domestic resource cost higher than 1 unit of foreign currency received.

III. Potential for export is calculated through the term of trade by using procedures as follows:

Procedure in calculation term of trade

a. Collecting wholesale price of drugs in ASEAN countries such as Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore and Vietnam from distributors in each country through drug representatives and commerce ambassadors of each country (see appendix).

b. Collecting wholesale price of drugs in Thailand by calculating average wholesale price from the price list of the companies.

c. Transportaion rate and insurance rate conducted from those regulated by the customs department which is 10 percent of total production cost for insurance rate and 5 percent for transportation fee.

d. Calculation term of trade by using formula

$$\text{Term of trade in country A} = \frac{\text{wholesale price of drug in country A}}{\text{Whole sale price of drug from Thailand}} \times 100$$

When term of trade in country A is more than 100 it is called "Favorable movement". This means country A will gain if it imports drug from Thailand.

Term of trade in country A< 100 is called "Unfavorable movement". This means A will lose profits if it imports drug from Thailand.

IV. Potential for self-sufficiency and export expansion.

Procedures of the study comprise:-

a. Collecting data

-Value of production and import of each pharmacological group from 1990-1995 from FDA.

-Value and volume (tablets or capsules) of 18 selected drug from 1996-1997 from Drug Control Division, FDA.

b. Dividing 18 selected drug by customer code to 3 groups because data from FDA does not contain export value of the following drug groups.

Group I Antibacterial is drug in customer code 3004.200-004 that consists of Antibiotic , other chemo therapeutics group belongs to FDA data. Drugs in this group are

Amoxycillin 500 mg.

Ampicillin 500 mg.

Cefalexin 250 mg.

Ketoconazole 200 mg.

Mebendazole 100 mg.

Norfloxacin 200 mg.

Group II Vitamin is customer code 3004.500-000 consisting of pharmacological group Vitamin & Antianaemia such as

- Vitamin B 1 6 12

Group III is customs code 3004.900-000 consisting of drug in pharmacological groups Alimentary, Cardiovascular, Antihypertension , Respiratory , anti-inflammatory, Analgesic such as

e Antacid

f Bromhexine 8 mg.

g Cimetidine 400 mg.

h Diclofenac 25 mg.

i Glibenclamide 5 mg.

j Ibuprofen 200 mg.

k Nifedipine 5 mg.

l Paracetamol 500 mg.

m Piroxicam 10 mg.

n Ranitidine 150 mg.

c. Estimation value of production, import and export of each group in b. by using statistical method of linear regression.

d. Calculation values of production, imports and export by using proportion according to custom's code and FDA's groups with an assumption that proportions of export is the same as proportions of production.

e. Estimation the increased volume of production by using an average price per unit in 1997 and the exchange rate 40.921 Baht per US dollar because data from FDA were those of the 1996-1997.

f. Percent of drug production increase in 2002 is based on capacity data of the first questionnaire and volume of import from Drug Control Division of FDA. These data are used to analyze.

Potential for self-sufficiency 2002 = Volume of production2002 +2(Volume import 2002)

(import substitution)

Potential for export = Volume of production + 3 (Volume of export) – Volume of export

(2002) (2002) (1997) (2002)

3 items of drug studied on self-sufficiency and export

= Volume of production + (Volume import)/2 + 3 (Volume of export) - Volume export

(2002) (2002) (1997) (2002)

If percent of real capacity can increase (2002) more than the percent volume of production 2002 increased, Pharmaceutical industry in Thailand has potential for self-sufficiency by using capacity in 1998 is year based.

If percent real capacity can increase 2002 less than percent volume of production 2002 increased, Thailand still imports that items and can't extend export to reach target.

3.2 Qualitative study

Qualitative study is conducted after the quantitative study. It consisted of 4 techniques used as follow.

3.2.1 SWOT analysis is used to analyze strength, weakness opportunity and threats of domestic pharmaceutical industry in Thailand.

3.2.2 Depth interview is used to collect opinions of private entrepreneurs about policies, problems and future trends

3.2.3 Delphi technique is used to forecast possibility future model of this industry.

3.2.4. Focus group discussion is used to brain storming private and public sectors' opinion for the development of pharmaceutical industry in Thailand.

3.2.5 Documentary data on production, import and export of the past 10 years from 1987-1997 are used in the calculation because it is the period of social and economic development plan phase 6-7 which emphasized on export promotion.

3.2.1 SWOT analysis

I. Sample size

The first group of sample consisted of 44 owners or managing directors or marketing managers selected from 169 factories by using inclusion criteria to conduct SWOT analysis. This sample consisted of 23 factories who returned 1st questionnaire. 6 factories who exported but did not return the questionnaires and 15 factories did not return the questionnaires (See appendix). The 2nd inclusion criteria were deleted because few questionnaires were returned in the scheduled period. Researcher added criteria " The company which has export or will exportation instead of the second one as follow:

Inclusion criteria:-

-Modern finished pharmaceutical producers at least 1 item in 18 selected items whatever kind of production.

-Factories that have been exported or plan to export.

-Thai's stockholder more than 50% of capital registration.

Exclusion criteria:-

- Factories that deny to involve

II. Tool

Checklists for SWOT Analysis sent to pharmaceutical manufacturers in Thailand. This data required an evaluation of present situation and issue in focus group discussion as follows:

a) Internal analysis consists of many factors e.g. organizational resource, management, marketing, research and development, personnel. Data collected for evaluation strength, weakness of manufacturers.

b) External analysis both macro level consisted of economic, social, politic, technological, law and cultured factors include foreign affairs. Analysis industrial level consisted of enter-exit the industry, competition among business, consumer requirement, supportive industry once government roles. These data required to evaluate opportunity and threat of this industry.

Note : see appendix

III. Validation of checklist for SWOT analysis

Pretest checklist of SWOT Analysis by sending this checklist by mail to an expert who is marketing manager of foreign company and the special guest lecturer in

issue SWOT Analysis in faculty of pharmacy. This expert will fill and comment this checklist.

IV. Control for error

Control for error in sampling by setting inclusion criteria. This criterion is expected to screen the relevant data from factories.

V. Collecting data for SWOT analysis

Collect data with checklist for SWOT Analysis begin on June 24, 1999 – December 31, 1999. Sending checklists by registered mail to marketing managers in manufacturers that have Thai's owners (first sample). The letter of introduction signed by co-advisor deputy professors Sinchai Kaokittichai. Until July 31, 1999 the checklists were returned from 14 companies or equal 32.55%. Researcher begins to follow up at the same time of depth interview.

VI. Data analysis for SWOT analysis

Data analysis is done by statistical method as follow:

a. Mode is used in present strength, weakness, opportunities and threats. The data is divided to 3 groups by scale to positive group, zero group and negative group. Score is used to compare level of each factor.

b. Factor analysis is used to explain group of factor in contexts.

3.2.2 Depth interview

I. Sample size

Second group of sample was drawn from the first group. This group is the experts studied by depth interviewed and Delphi technique. Besides the inclusion criteria, the researcher added critical incident techniques by enclosing forms to the first group to recommend 3 factories of large and small size manufacturers in each level. The second group our consisted of 29 manufacturers in 4 provinces as follows

- Bangkok metropolitan
- Nakorn Pathom
- Samuthprakarn
- Samuthsakorn

28 factories agreed to be interviewed (See appendix).

II. Tool

The tool for in depth interview is a question guide for interviewing the owners or managing directors of manufacturers. This form consisted of present situation, problems and obstacles, supportive agency, future plan and suggestion

Note : see appendix

III. Validation of question guide

Pretest questions guide used in interviewing were confirmed by advisor and interviewed by researcher. This question guide required more than 2 hours t6o complete. Also informants avoid replying some questions and ignored some others so researcher condense a number of questions. This adjustment help shorten the time and informants could supply ideas according to the outline e.g. present situation and impact from

government policy future turn, Recommendations to government and private sector for development this industry include possibility to reach Ministry of industry goals.

IV. Collecting data for depth interview

Collecting data by in depth interview is conducted with the owners or managing directors or representatives from August 3 – September 20, 1999. The work includes:

a. Contact the informant by telephone for the available appointment (second sample). 28 in 29 companies gave their consent

b. Send the question guide with the letter from researcher to them because they need to prepare some information.

c. In depth interview the owners, managing directors by employing face – face individual or group interview arranged by panel interviewers (researcher and assistant) and depth structured and non-directive interviews. To save time tape recording were used in recording the content of the interview.

V. Analysis data from depth interview

Evaluation qualitative data acquired by interview to ascertain modern pharmaceutical industry in Thailand which is classified into 3 groups as follows:

- Group 1 factories that could continue operation
- Group 2 factories that continue operation under certain conditions.
- Group 3 factories that have to stop operation.

3.2.3 Delphi technique

I. Tool

Checklist of Delphi technique to gather the respondents' opinion about the possibility and duration used in development and restructuring pharmaceutical industry to reach their goals. This data are summarized and presented as issues for focus group discussion. The checklist was interpreted to 7 statements as follows:

Statement 1 Characteristics of industry composed of 4 issues

Statement 2 Management composed of 5 issues

Statement 3 Competition in drug markets composed of 7 issues

Statement 4 Production composed of 7 issues

Statement 5 Institute for drug development composed of 4 issues

Statement 6 Role of government composed of 6 issues

Statement 7 Collaboration between government and private sectors composed of 5 issues

II. Validation of checklist

Pretest question guide used in Delphi technique by advisor approval and tested with 2 managers by researcher. This question guide is a condense number of questions and grouping in 7 statements namely

a. factory aspect composed of 4 questions

b. operation composed of 5 questions

c. marketing competitiveness composed of 7 questions

d. production composed of 7 questions

e. development institute composed of 4 questions

f. government action composed of 6 questions

g. collaboration of public and private sector composed of 5 questions

III. Collecting data by Delphi technique

Data collection of Delphi technique was carried out 3 times from October 1 – December 31, 1999 as follows:

a. After in depth interview, researcher used question guide to gather some ideas from the experts (second sample) to forecast future model of pharmaceutical industry by using open-ended questions about possibility (percent) and duration (years). Furthermore they can add some ideas about future model and the reasons for their suggestion.

b. Convert data into numeric number and calculate mode of each answer. Then forwarded the result to the experts to approve or change their ideas for the second time. Researcher asked them to return the 2nd checklist within October 31, 1999. Procedure was repeated for the third time as done in process b.

IV. Interpretation data of Delphi technique

Evaluation data from Delphi technique This data included in mode. The results were presented in the form of percent of possibility and duration (year) which were most chosen by the respondents.

3.2.4 Focus group discussion

I. Sample size

The third group of sample comprised representation from the manufacturers in the second group and those from the government agencies and non-government organization interviewed by the second sample. This third group brainstormed on the issue

of pharmaceutical industry development. They consisted of 14 representatives from 10 agencies as follows:

Government Sector	
Ministry of public health	
- FDA secretary general	1
- The director of drug control department	1
- Drug control department officer	3
- Government Pharmaceutical Organization	1
Ministry of Finance	
- Customs department	1
Ministry of commerce	
- Economic commercial department	1
- Export promotion department	1
Ministry of Industry	
- Industry Promotion department	1
Ministry of State University	
- Faculty of Pharmacy	1
Prime Minister Secretary office	
- Board of Investment	1
Private Sector	
- Thai Pharmaceutical Manufactures Association	1
- Industrial Pharmacist agency	1

II. Tool

a. List of issues used in focus group discussion. The ideas were interpreted to recommend on establishment of strategic plan for developing pharmaceutical industry in Thailand.

b. Question guide used to interview representation of organizations that did not participate in focus group discussion.

III. Validation of issue

Modifying issues and question in focus group discussion by presenting fundamental issue to advisee committee

IV. Collecting data

Collecting ideas from focus groups discussion on March 27, 2000 as follows:

a. The inviting letter signed by the chairman of the curriculum committee to group 3.

b. Proceeding on focus group discussion at Chainatnarenthorn meeting room building 1 FDA at 13.30-16.30 p.m. Writing, tape and video recorder record the information.

c Sending an interview request to the representatives in the agency that did not participate in focus group discussion by registered mail signed by the chairman of curriculum committee

d. Interview representative of GPO, Director of export service department and head of 6th investment promotion unit by using question guide (see appendix).

V. Interpretation data of focus group discussion

Data from focus group discussion concluded the ideas of participants and recorded by writing, observation and interviewing of the representatives who did not participate on March 27, 2000. Issues concluded were

- Problems of pharmaceutical industry at present
- Co-ordination between involved agencies
- Research and development
- Information
- Collaboration of tri parties

3.2.5 Secondary data collection

Collect secondary data from

I. Data of wholesale price of drugs in domestic market as obtained from the price lists of companies

II. Data of the number of manufacturers, value of import, production and export from resource as follows:

- Custom department, Ministry of Finance
- Drug control department FDA, Ministry of Public Health

Table 22 Methodology

Study design	Data source	Sample	Method	Tools	Objectives
Quanti-tative study	primary data	- Population studied is 176 modern pharmaceutical manufacturers which have licensed in 1998	Filling the questionnaires which are mailed and returned by mailing.	Question-naires	1. collecting general information 2.caculating comparative advantage 3.calculating term of trade 4.evaluation potential for self-sufficiency and export
	secondary data	- Drug Control Division, Food and Drug Administration, Ministry of Public Health - Custom Department, Ministry of Finance - Thai Pharmaceutical Manufacturer Association - Other organizations such as IMS, Universities in ASEAN countries			1.calculating domestic cost of production 2.calculating term of trade of 11 selected drugs studied potential for extend export to ASEAN countries.

Table 22 Methodology. (cont.)

Study design	Data source	Sample	Method	Tools	Objectives
		First group of sample are the owners, manager deputy or managers of 44 manufacturers from 176 manufacturers which achieved inclusion criteria.	SWOT Analysis	Checklist	-Analysis current operation
		Second group of sample are the owners, manager deputy or managers of 20	In depth interview	Guide question	-Evaluation problems and obstruction in drug industry
Quali-tative Study	primary data	manufacturers from 176 manufacturers which achieved inclusion criteria and incident technique.	Delphi technique	Checklist	- Forecasting future model of drug industry - Conclusion the issues for focus group discussion
		Third group of sample are representatives from public and private agencies, 1 person from each agency such as TPMA, PPA , representative from manufacturers, BOI , export promotion department, custom department, industrial promotion department, FDA, University and the GPO.	- Focus group discussion - In depth interview	Issues	Brain storming the opinions about direction of drug industry development

Table 23 Schedule of studying after defense proposal

Activities/ Month	Apr 99	May 99	Jun 99	July 99	Aug 99	Sep 99	Oct 99	Nov 99	Dec 99	Jan 00	Feb 00	Mar 00	Apr 00	May 00	June 00	July 00	Aug 00	Sep 00
1. Literature review	←													→				
2. Collecting data by questionnaire				←						→								
3. Collecting data by checklist for SWOT Analysis					←						→							
4. In depth intervie						←	→											
5.Collecting data by Delphi technique 3 times								←		→								
6. Focus group discussion												◇						
7. Collecting secondary data	←													→				
8. Data analysis											←			→				
9. Report writing														←				→
10. Advisor committee comment																	←	→
11. Defence																		◇

CHAPTER IV

RESULTS

Results from the study of the potential for self-sufficiency and export of modern pharmaceuticals in Thailand by quantitative and qualitative methods can be divided into 4 parts.

Part 1 The status of the pharmaceutical industry at present and in the future that consists of:

4.1 The current parameters are location, capital registered, form of legal organization, number of persons engaged, period of operation and standard of factories.

4.2 Operations are co-investment, type of production, formulas, capacity, current operation and problems.

4.3 The future trend of the pharmaceutical industry is a trend of development, future model and direction of development.

Part 2 Potential for self-sufficiency consists of:

4.4 The cost structure in the production of 10 selected drugs.

4.5 The comparative advantages and competitive advantages.

4.6 The capacity necessary for self-sufficiency.

4.7 Policies affected by self-sufficiency.

Part 3 The potential for export consists of:

4.8 Export and plans to export.

4.9 The cost structure of 11 selected drugs.

4.10 Comparative advantages.

4.11 Price competitive and competitive advantages.

4.12 The capacity increase for export.

4.13 Policies affected by export.

Part 4 Sensitivity analysis

4.14 The sensitivity of variables in comparative advantage

4.15 The sensitivity of variables in terms of trade

Part 1 The status of the pharmaceutical industry at present and in the future.

4.1 The current status of the modern pharmaceutical industry

4.1.1 Location

Table 24 in the appendix shows the pattern of distribution of establishments. 53 factories or 77.94% are in the Bangkok Metropolitan area. Others are in the vicinity e.g. Nonthaburi, Nakornpathom, Samuthprakarn and Pathumthani and the central region e.g. Rachaburi. Most of the factories are in Bangkok because transportation of raw materials by ship is nearby.

4.1.2 Capital registered

Data concerning registered capital of modern pharmaceutical manufacturers shows that most of them are small management entrepreneurs because 38.2% have 1-9 million baht of registered capital followed by 30.9% who have 10-49 million baht of

registered capital. 13.2% have more than 50 million baht of registered capital and only 4.4% have more than 100 million baht of registered capital (table 31 in the appendix).

4.1.3 Legal organization

The form of legal organization of the manufacturers who returned first questionnaires is as follows. The proportion of limited companies is as high as 85.07% or 57 factories, followed by limited partnerships (10.45%), public companies (1.49%), juristic partnerships (1.49%) and state enterprises with the same proportion as shown in table 26 in the appendix.

4.1.4 Persons engaged

Most manufacturers (86.8%) were medium scale employers with more than 20 persons engaged (table 25 in the appendix). The number of pharmacists engaged in the industry are 2-4. This number does not relate with the number of formulae of tablets or capsules (r=.138, .058) but is more related to the number of liquid formula (r=.260). because of the cancelation by the FDA of the proportion of the number pharmacists to the number of formulas as shown in table 27in the appendix.

4.1.5 Period of operation

Table 34 in the appendix shows that 45.59% of manufacturers have operated for more than 30 years while one factory has operated for more than 100 years. The rest of manufacturers who filled the first questionnaire have operated in each period. 14.71% of manufacturers have operated for 20-29 years and 22.06% of manufacturers have operated for 10-19 years. In 1989 pharmaceutical establishments were affected by the patent act, GMP certificate and commodity regulations in1979 so the number of manufacturers which have operated for 5-9 years is about 5%.

4.1.6 Standard of establishments

Data from the FDA about manufacturers that received a GMP certificate shows that of the factories that returned questionnaires 86.76% have received a GMP certificate. 27.94% received GMP certificate 5 dosage forms followed by 17.65 who received group 6. 1 factory received a GMP certificate group 1. 13.86% of Manufacturers did not receive a GMP certificate. All factories that filled in the questionnaire received a GMP certificate in tablet and capsule group (table 29 in the appendix).

51.47% and 35.29% of manufacturers received a GMP certificate for 1 year and 2 years respectively which corresponds with data of the FDA that most of the establishments received GMP certificates for 1 year. Another reason to explain why the number of manufacturers which did not receive GMP certificates is less than the data of the FDA is because most of the manufacturers ready to fill the in questionnaire had received GMP certificates (table 29 in the appendix).

4.2 Operations

4.2.1 Co-investment

Table 30 shows that most manufacturers (82.4%) that filled in the first questionnaire did not invest with foreign countries, while 9 factories or about 13.2% invested with foreign countries. Joint venture factories had from 1 million baht to more than 200 million baht of registered capital. Foreign countries that invest are Japan, Switzerland, The Philippines, etc.

4.2.2 Type of production

Operation information show that about 83.8% of manufacturers produce their own brand name products followed by 20.6% of manufacturers who are employed to produce Thai's own brand name products. About 11.8% of manufacturers are employed to produce generic name products according to the employers and 10.3% of manufacturers are employed to produce products by multinational companies. Data from the first questionnaire show that 1 factory produces more than 1 type of product but most of them produce their own brand name products. Sometimes they produce by order from other employers because they have residual capacity of machines, personnel and equipment. The pattern of employment by the factories will follow the formulation of employers or they register the formula for employers too.

4.2.3 Formulas

Patterns of production show that the manufacturers produce every group listed in the GMP guidelines such as liquid dosage form production 75.0%, tablet dosage form 70.59%, capsule dosage form 63.24%, cream and ointment 58.82% and injection 23.53%. Other groups are produced by 26.47% of drug factories such as eye drops, irrigation solution, eye wash etc. About 23.53% of drug factories produce injection dosage form because this requires higher technology and equipment than other dosage forms in opposition to liquid dosage form which uses common technology so most of the factories produce drugs in this dosage form. Table 33 shows that tablet has the highest number of formulas (about 228 formulas) but some formulas are not produced because registration of a formula takes time so drug companies register at the same time as they observe movement of this product in the drug market. This process makes

Thailand one of the countries which has more than 20,000 drug formulas so the FDA controls this by determining that a drug formula which has not been produced for 2 years will be withdrawn.

4.2.4 Capacity utilization

The maximum capacity of capsule manufacture from 34 drug manufacturers is 500,000-175,000,000 capsules but the real capacity is 200,000-166,250,000. The maximum capacity of tablets from 38 manufacturers is 3,000,000-3,800,000,000 but the real capacity is 600,000-3420,000,000 as seen in table 35 in the appendix. Real capacity is determined by competitiveness in the drug market with both local manufacturers and multinational companies being considered as consumers.

Maximum real capacity of tablets is higher than 3,000 million but maximum real capacity of capsules is less than 200 million. About 42.11% of manufacturers have a real capacity of tablets of between 1-50 million followed by 15.79% with a capacity of 100-150 million while 26.32% have a full capacity of tablets of between 1-50 million and the 50-100 million range is about 18.42% but 100-150 million range is about 65.79%. Full capacity of capsules between 1-50 million is about 82.94% of manufacturers followed by 50-100 million which is about 29.41% of manufacturers while real capacity of between 1-50 million is 64.71% of manufacturers followed by less than 1 million is about 23.53% of manufacturers (table 36 in the appendix).

Information about capacity was returned from 40 factories but it is used to calculate 38 factories for tablets and 34 factories for capsules. Real capacity of tablet production is 59.38% of full capacity from calculation. In the same way real capacity of capsule production is about 48.22% of full capacity. This data shows that the

modern pharmaceutical industry in Thailand can be extended as shown in table 37 in the appendix.

Calculations of percent of production increase to 100% of full capacity in this year found that production of tablets can be increased by 68.42% and capsules can be increased by 107.37% using 1998 as the year base.

Table 37 Number and percent of full and real capacity

list	Tablet	capsule
number of producers	38	34
full capacity	13,232,000,000	1,671,360,000
real capacity	7,856,564,701	805,991,980
Percent	59.38	48.22

Production increased is not related to the number of formulas but related to the whole volume of distribution (r=.275, .329 respectively).

4.2.5 The present situation of the modern pharmaceutical industry in Thailand

Analysis of the situation of the modern pharmaceutical industry in order to learn about pharmaceutical manufacturers management.

SWOT analysis can conclude as follows:

The strengths of the drug industry evaluated from internal analysis are corporate resources and personnel.

The weaknesses of the drug industry consist of operation management especially raw materials and operating cost, marketing and distribution and R&D engineering.

Opportunities of the drug business are technological entry barriers and exit barriers.

Threats to this industry consist of economic, political, international legal, rivalry among competitors, power of buyers and suppliers, availability of substitutes and government action.

Factors that do not affect the industry are ASEAN economic, political and cultural.

Each element can be integrated and explained in context by using factor analysis comprise with mode as follow:

I. The internal environment of a business is strength that can be explained in 2 contexts: (a) management consists of the ability of the management team, strategic management systems, hierarchy of objectives, planning and control systems, organization structures, the policy of the head of the company, communication network, delegation of authority and corporate image and prestige. (b) Context b consists of location of plant. Administrators evaluate both contexts as strengths.

II. Operation management is a strength explained in 2 contexts. Context (a) production management consists of efficient and effective equipment and machinery, inventory control, use of technology and adequate availability of raw materials. Cost of production and raw materials are evaluated by administrators as a weakness but the levels are not serious. Context (b) is human resources that half of the administrators think is a strength. So the operation management is a strength of the pharmaceutical industry.

III. Marketing and distribution is a strength that can be explained in 2 contexts. Context (a) marketing development consists of business image, distribution system, sales force productivity, human resources and use of IT in operation. Elements that are evaluated to be weaknesses of this context are market research. Context (b) competitiveness consists of market share while price competitiveness is

IV. Human resource management can be explained by 2 contexts. Context (a) human resource management consists of the quality of corporate staff, performance appraisal system and training program. Elements that have no effect are the favor system and cost of labor. Context (b) is turnover of personnel consisting of turnover and absenteeism that the administrators think that has no effect(table 55, 57 appendix).

A factor that is a weakness of the pharmaceutical industry is R&D and engineering. Most administrators conclude that all elements are weaknesses of the firms. These elements are R&D funding followed by R&D facilities, human resource and development of new products. The highest scale of mode of this factor is –1 showing that although R&D and engineering factors are weaknesses they are not serious (table 55,57 appendix).

Factors that are opportunities of pharmaceutical industry are

I. Technological changes are opportunities of the industry. Elements that administrators think to be opportunities are technology transfer, process R&D requirements, maturity and volatility of technology and R&D requirement to develop products. The element that has no effect is Complexity of technology. Patent law is evaluated to be a threat in their operation but is not serious(table 56, 58 appendix).

II. Entry barriers are an opportunity of the operation because of its difficulty. They can be explained by 3 contexts. The first context is former business that consists of experience effect, economy of scale, access to latest technology, government protection, product differentiation, access to raw materials, capital requirement for R&D and brand identity. The second context is marketing that consists of access to distribution channels. The last context is cost of entry that consists of switching cost.

III. Exit barriers are opportunities of operation because it is easy. These factors are fixed cost of exit, emotional barriers, asset specialization, strategic interrelationship and government and social restrictions.

Factors that are threats to the pharmaceutical industry consist of external analysis and rivalry among competitors as follow:

I. Economic indicators in Thailand that can be explained by 2 contexts. Context (a) is economic indicators and context (b) is factor endowments that consist of foreign exchange impact, wage levels, inflation and raw material supply. Elements that are not affected are GDP and manpower supply. Per capita income is an element that administrators evaluate to be opportunity (table 56, 58 appendix).

II. Political and legal factors are threats that can be explained by 3 contexts. Context (a) purchasing of the public sector (b) management of the factory and (c) standards. Elements that are evaluated to be opportunities are GMP and government support. The other elements that are threats consist of drug-purchasing regulations, control price, essential drug list, value added tax, advertising regulations, tariff and environmental law ISO 14000 respectively. International standard ISO is the only one those administrators think that has no impact on their operation. The scale of drug-

purchasing regulations of the public health center is –3 showing that 12 out of 29 administrators conclude that it is has a serious impact. (Table 56, 58 appendix).

III. ASEAN international laws are a threat to business operation. These elements consist of patent trade mark laws, other laws affecting business and trade laws (table 56, 58 appendix).

IV. Rivalry among competitors is a threat to operation. They can be explained by 3 contexts. Context (a) is operation that consists of fixed or storage cost capacity and increased brand loyalty. Context (b) is head office policy that consists of philosophy of management, goals of business, relationship to head office and growth rate of industry. Context (c) is the number of equality-balanced competitors (table 56, 58 appendix).

V. The power of buyers is a threat to operation. They can be explained by 3 contexts. First is buyers that consist of increasing production while reducing market share, availability of substitutes for the industry product, buyer's profitability from price changes, decisions of buyers contribute to quality changes. Second is the number of buyers that consist of buyers switching costs to raw material producers. Last is the importance of the quality of the products without regard to price differentiation (table 56, 58 appendix).

VI. The power of suppliers is a threat to industry. They can be explained in 2 contexts. First is raw materials that consist of a number of suppliers and the importance of the industry to the supplier group, availability of substitutes for the suppliers, total industry cost contributed by suppliers, industry threat of behavior integration, and the supplier's contribution to quality or service of the industry product. The second context

is suppliers that consist of raw material producers and an industry threat of backward integration(table 56, 58 appendix).

VII. Availability of substitutes is a threat to operation such as: user's switching cost and substitutes due to producer's profitability and aggressiveness, substitute price value and availability of class substitutes (table 56, 58 appendix).

VIII. Government action is a threat to industrial development. They can be explained by 3 contexts. Context (a) is role of government action to Thai producers that consist of industry regulation, investment promotion policy registration, regulation and process industry protection custom's duties, foreign exchange. Context (b) is government assistance provided to competitors that consist of foreign ownership capital movement among countries. Context (c) is government that means consistency of policies (table 56, 58 appendix).

Factors that have no effects to the pharmaceutical industry are as follows:

I. Social variables that can be explained by 2 contexts. Context (a) social change and (b) degree of unionization. Elements that are opportunities consist of growth of population and education level changes. The rest of elements that are evaluated to have no effect consist of the degree of unionization, ecological impacts, age distribution, consumer protection and family size change (table 56, 58 appendix).

II. ASEAN economic factors are not an influence on the drug business. They can be explained by 3 contexts such as 1 Population variables consist of Population growth GNP per capita, income and membership in regional economic blocks Context 2 (fiscal) consists of taxation of wages and salary level and Inflation. Context 3 is government policies that consist of monetary and fiscal policies and natural resource

system interest rate. They have an effect on the operation system of their operation (table 56, 58 appendix).

III ASEAN political factors do not have any effect on the drug business. They can be explained by 2 contexts. Context (a) is the public sector that consists of stability of government and foreign policies. Context (b) is strength of opposition parties and groups. Neither context has any effect. (table 56, 58 appendix).

IV. ASEAN cultural factors do not affect the drug business. They can be explained by 2 contexts. Context (a) is language and attitude. Context (b) is religious beliefs and customs (table 56, 58 appendix).

4.2.6 Problems in operation of the pharmaceutical industry

Overall factors that affect operation of modern pharmaceutical industry collected from the owners and managing directors from 28 factories are categorized according to film theory as follow:

I. Market problems consist of the domestic and foreign drug market. The domestic market has 3 channels of distribution such as:

a. Government hospitals belonging to the Ministry of Public Health, the Ministry of the Environment, the Ministry of Defense and Universities. The procurement of pharmaceutical products of these health care centers will come under the same commodity regulation of secretary of the Prime Minister 1992 that determined to use government budget to purchase essential drugs - not less than 80% for Ministry of Public health hospital and not less than 60% for other government hospitals.

b. Drug stores are channels which are most concerned with price than quality assurance.

c. Private hospitals are channels which are affected by economic crises so they begin to use the same inventory control system as government hospitals.

These policies effect the pharmaceutical industry in short and long term as follows:

- Inadequate finance for research and development. Price competition affects business and budgets for research and development. The goals of business are to maximise profits. In the short run businesses with less reserves are closed down. In the long run pharmaceutical industry development will be closed down, unless it specializes. Twenty from twenty-eight informants complain about this issue. They said that channels of distribution in the private sector are less serious than public channels.

Foreign drug markets or exports which their problems are derived from.

- Regulation in trade countries such as registration, certificated by the FDA. Their regulations are established to be non tariff barriers.

- The imitated drug. Products that have good sales in foreign drug markets will be copied by Thai people with lower standards. This behavior affects Thai manufacturers as it affects the image of pharmaceutical products from Thailand.

- Government policies such as expanding markets and public relations about pharmaceutical industry standards.

- Inadequate personal especially marketing personal to contact foreign companies.

II. Production problems affect cost of production directly or indirectly. These problems are derived from:

a. Raw materials. Most raw materials are imported because they can not be produced here or because of the low quality of produced pharmaceutical products.

b. Packing material. Some packaging materials are imported because of their standard. The problem of packaging material is one of tariff.

c. Operation Consistency of volume of production causes an increase in overtime wages and inventory control. This event derives from the strategic plan in purchasing pharmaceutical products of the Ministry of public health. This plan determines to purchase the top ten drugs summarized from each hospital in a province. Overtime wages affect the interest while inventory control affects the expiration of products. In addition while rate is a progress rate it is not advantageous to the entrepreneurs.

d. The process of production. The standards of production will be regulated by GMP regulations. These regulations do not cover public sectors such as pharmaceutical production in government hospitals without a GMP certificate.

e. Labor. Vary of personnel and lack of GMP training. Government sectors should support education and training for skilled workers.

f. Government policies such as drug registration - especially generic products that are determined to have Bioequivalence tests before registration and production (Figure 3). Bioequivalence regulations will be assure the quality of generic products but in the near future insufficiency of equipment and personnel will change this regulation from one of quality assurance to be an obstruction to Thai manufacturers.

III. Investment problems. Objectives of pharmaceutical manufacturers for investment:

a. To improve their plants according to National Standard GMP requirements. The plants which have been in operation for more than 10 years will evaluate the benefit to invest because GMP requirements will be declared to be legal in 1999 and if they must use higher budget than their revenue, some of them may close down their business.

b. Expense for Bioequivalence study to produce non-patent drugs. Cost of this study is about 300,000-400,000 baht per item so the producer will carefully consider whether to produce new generic products which may slow down the off-patent drug production. Furthermore new essential drugs are affected from competitiveness between local manufacturers and GPO because GPO scrambles the market share of essential drugs.

c. Bangkok Metropolis municipal law. Improvement of pharmaceutical plants to meet requirements of GMP for location in Bangkok Metropolitan will be obstructed by municipal law so local manufacturers might move their plants to an industrial settlement or a boundary province which uses more than 60 million baht of capital budget. Local manufacturer owners will make a decision between closing down their business or moving their plant.

d. Increase machine and equipment for extended production. At present they do not have enough marketing personnel or information about foreign markets so they cannot be sure that extended export will be cost-efficient

4.2.7 Agencies support the pharmaceutical industry.

At the present time public agencies and non-government organizations especially professional organization have important roles to support the pharmaceutical industry. Interaction processes between public and private centers must be improved by emphasizing end-users. Construction of an "Alliance system" will happen although the sharing of resources will cause some disadvantages in business. Strategic plans of "Aggregation for consumer attraction combine with deregulation" will help the industry to progress although several groups do not believe that an alliance system can be established because there is serious competition in this industry. For example Singapore has intended to be the hub of the ASEAN pharmaceutical industry. Meanwhile Thai producers can not purchase a large volume of raw materials for a low cost because they do not want the competitors to evaluate their capacity utilization. Several groups recommend an establishment center to purchase large volumes of raw material but this center must have the ethics to hide the confidential information of each member. Agencies that support the producers are as follow:

I. The Food and Drug Administration (FDA) and the Ministry of Public Health. There are many activities such as:

a. Purchasing large volumes of raw materials. The FDA has established a policy involving raw material purchasing since doctor Mongkol at Songkla first made contact with project group in China called "SBT" and the FDA is the only intermediate agency to run this activity without distribution. The FDA initiated this activity to guarantee quality assurance, preventing the producers from cheating and creating a

joint venture to purify semi-final raw materials, because synthetic raw materials in the countries with a population of less than 100 million are not cost-beneficial.

b. Collaboration in drug development with India in a project called "API". The FDA commanded the attention of entrepreneurs and they could not force the private sector to collaborate with this project. The FDA can not balance between quality and equity support because some producers seem not to be cooperating.

c. Providing information facilities according to entrepreneur request. The FDA face the problem of hidden information to avoid competitors.

d. Organizing an annual conference to promote export.

e. Their strategic plan is setting an early meeting and government to government (G to G) contacting.

f. Coordination between the private sector and universities. Some agencies still think that the FDA is working separately - for example environmental health. They recommended the FDA to emphasize quality inspection.

g. Information is developed - especially statistical data that is useful to the firms. One defect is the lack of public relations and exhibitions to the patients.

II. The Export service division, Export promotion department, Ministry of Commerce. Their activities are

a. Export. The Export promotion department delegated the export service division to support export. There is no specific policy on pharmaceutical products because they have not enough knowledge of traditional and modern medicine. They have been requested to revamp their department within 2 years.

b. Exhibitions. The Export service division has many activities to promote pharmaceutical products such as:

- Domestic exhibitions. They invite buyers to participate in exhibitions. Drug producers can participate in the group of health products.

- Foreign exhibitions. Drug producers should consider whether they can participate for example in exhibitions in Cambodia or Middle East countries. The products that are shown are herbal medicine and medical devices. The rate for occupation of a booth of 9 square meters is about 100,000 baht. The government will support some part of the expense.

Although the export service division thinks that drugs are goods that can make money for Thailand, they will support the top ten products such as construction goods, educational goods, restaurants, beauty goods and health products that can include pharmaceutical products too.

III. Board Of Investment (BOI), Secretary to the Prime Minister has some activities as

a. Financial support from BOI for research and development in all regions. BOI feels that financial support to 43 factories or 25% for improvement to meet GMP requirement is not equitable to 75 percent of factories that have been improved by themselves. BOI require financial data on moving a drug plant to a GMP location. The objective of BOI is to support investment in stimulating development in industry so any manufacturers who produce by compounding should not be supported. BOI doubt the relationship between GMP and investment promotion because some

factories have received investment promotion from BOI but have been not received a GMP certificate.

IV. The Economic Commercial department, Ministry of Commerce. They act in trade conferences that have an important effect on trade barriers both in AFTA and WTO. Technical barriers to trade agreements are derived from developed countries. Thailand is 1 of 137 member countries. The collaboration between Asian countries will be the power to fight with developed countries.

V. The Customs department. They have two activities to support industry. One is tariff and another is customer service by exception of tariffs that use bonded warehouses, drawback tariffs according to section 19 and compensation of tariff. Most producers use compensation of tariff because it has an easier procedure than drawback tariff. The Customs department make it easier by increasing the number of bank services from 1 to 10.

Another customs service measure is the permission to quarantine in drawback tariff and using EDI systems. The strategic plan is solving the problems and minimum control.

VI. United Nation of Drug Organization (UNIDO) is a technological service center for the pharmaceutical industry. UNIDO is an NGO that supports quality control. The former concept was technology transfer but now it increases its activities about quality assurance in drug, food and cosmetic products. It certifies pharmaceutical products that are exported and it has the potential to run bioequivalence studies.

4.3 The future trend of the pharmaceutical industry.

4.3.1 The development trend of the pharmaceutical industry in Thailand.

The future trends of local manufacturers according to the interviews are divided into two approaches such as operation approach, consisting of production, marketing and capital approach.

Operation approach

I. Increase R&D in five aspects.

a. Specialization such as drug delivery systems to, for example, a modified dosage form to increase drug compliance, reduce frequency of intake, sustain released, suppository, enteric coated or new drug delivery system. Pharmacological groups that are in the industry are Gastrointestinal tract, cardiovascular, Non-steroidal anti-inflammatory analgesic and respiratory tract.

b. Formulation both of new formulations and copy research.

c. Active ingredients that are developed by high potential manufacturers such as Ranitidine, Aluminium hydroxide. These factories should be supported by a government agency because they adhere to quality so sometimes ignore their factories, drug development may be slow. Development includes favoring agents, herbal medicine and extractions from herbal medicines.

d. Marketing is studied by establishment organization to research pharmacoepidemiology and trends of disease.

e. Environmental issues, such as development to decrease dangerous pollution or least impact to the environment.

II. Extend the domestic and foreign market by

a. Increasing the domestic market by producing products which are largely consumed by Thai people - both modern drugs, herbal drugs, health products and vitamins, but not producing raw materials. The problems for developing herbal medicines are the exact dose and side effects. Otherwise some factories extend to the medical device market. Channels of distribution which can be extended are drug stores because of the consumer behavior of self-medication which has a higher tendency and marketing competitiveness because of advertising or that is uncontrolled by regulation pricing and ASEAN drug market will be OTC drugs.

b. Expand to the foreign drug market such as increasing exports to Indochina, Mayanmar, Laos, Cambodia, Malaysia and Indonesia, Middle East countries such as Yemen and Latin America.

III. Increase productivity by:

a. Extension of production according to GMP guidelines group of dosage form such as eye preparations, injections and antibiotic and pharmacological medicines. The goal of this innovation is to extend domestic market share to help their business to survive, begin to export, and respect user demand. Groups such as antibiotic antacid and dosage form capsule.

b. Employing high potential manufacturers to produce items which use complicated technology, high fixed costs such as injection and hormone drugs.

c. Increasing generic formula production by consideration of potent drugs.

d. Increasing the volume of each item production according to size of market.

e. Increasing real capacity of machines and equipment to full capacity.

f. Employing or repacking according to the ability of the producers.

Investment approach that has some effect on operational aspects. More than ninety percent of local manufacturers do not want joint ventures with stakeholders. Some informants said that joint ventures would mean that manufacturers would miss technology transfer. Patterns of investment in the future are:

I. Joint ventures with Thai manufacturers. This event will occur in condition of economic crisis or a firm relationship between owners. Most local manufacturers do not select this option because of similar products and unconformable management.

II. Joint ventures with foreign companies. The purpose is technology transfer. Some local manufacturers want to co-operate to produce raw materials that can be price competitive with Chinese and Indian producers, for example Monsanto is a raw material producer that closed down its business in Thailand because of high cost of production.

Joint ventures will be considered with first countries because China's companies are different from USA companies, second some countries want to share half of the total profit which is not fair on Thai manufacturers. The last one is technology transfer when compared with the benefit that foreigners receive.

4.3.2 The future model of the pharmaceutical industry.

Data collected by the Delphi technique found models of the industry in the current year, 5 years time, 10 years time, 20 years time, more than 20 years time and long term are

I. Current model of pharmaceutical industry.

a. Some factories meet ISO requirements. The mode value of realization is the highest realization and 100% of experts put it at 100%. 21 Experts in 25 think that it is happening at the present time or in the near future. 4 experts predicted the timing of realization to be 5 years hence.

b. Sufficiency of pharmacists and scientists in both number and quality. Mode value of likelihood of realization is 100%. Two experts think that realization is only 50 percent. Predictions of timing of realization is distributed from 0-20 years hence. Seventy two percent of experts who replied said that it is occuring at the present time but 5 experts give predictons of the timing being 5 years hence. Two experts think that it's timing will be 10 years hence and the same amount put it at 20 years hence.

c. Convenient and rapid quality control system. One expert said 0% but 2 experts said 50% and the overall forecast for likelihood of realization is high. The mode value is 100 percent. The predicted time of realization is distributed from the present time to infinity. The mode value of timing is at the present time but 2 experts think that it will occur in 5 years hence and one expert said 10 years hence. One of the twenty-five experts gave the predicted timing at infinity because he thinks that some factories can not develop.

d. Production of international marketing personnel. Ninety six percent of the experts replied that the likelihood of realization is 100%. Only one expert said 50%. 96% of experts feel that it has already been realized (zero year) and one expert said that it's timing is 20 years hence.

e. Increase of R&D expense. The predicted likelihood of realization is 100%. Three experts said 50 percent. Sixty eight percent of experts suggested that there is the

possibility of occurrence in the near future. Four experts said that the predicted timing is 5 years hence, 3 experts think that 10years hence and only one expert said 20 years hence.

f. Product image is accepted by the domestic drug market. The mode value for likelihood of realization is 100 percent. Two experts put it at 50 percent. Eighty percent of experts said that it is already happening but four experts predict it is in 5 years hence. One person predicted the timing of realization is 20 years hence if this statement refers to all factories.

g. Product image is accepted in foreign drug market. The experts conclude that foreign drug markets are the neighboring market such as ASEAN countries. The predicted likelihood of this statement is 100%. Two experts who replied gave the proposition a 50 percent chance of realization, the timing of realization predicted is in recent years but 3 experts felt that it will be realized in five years hence while 2 give it as 10 years hence.

h. Increase in productivity for 50 percent import substitution

Ninety two percent of experts think that the statement has a 100 percent chance of realization. Two experts put it at a 50 percent chance if import includes patent drugs and high technological products while some multinational factories are moving to neighborhood countries. Eighty percent of experts think it will be realized in the near future. 5 experts predicted timing of 5 to 20 years hence, two put it at 5 years, two said 10 years and only one gave the timing as 20 years hence.

i. Cooperation of the private sector and academia in technology transfer and development

The mode value for likelihood of realization 100%. Eighty four percent of experts said that it has already happened. Of the four other experts, 2 said 5 years and 2 said 10 years hence.

j. Collaboration of public and private sector in expanding the foreign market.

The mode value for likelihood of realization is in 100 percent. One expert give it a 50% chance and only one expert said 0 percent. This expert forecast the timing to be infinity. Eighty percent said it had been realized and 4 experts said its timing is 5 years hence.

k. Public and private sector cooperate to overcome export barriers.

The mode value for likelihood of realization is 100 percent. Two experts gave it a 50 percent chance. The predicted timing of realization is the near future. Of five experts, four think 5 years and one thinks 10 years hence.

II. The future model of the pharmaceutical industry in 5 years.

a. All factors received GMP certificate. The mode value of likelihood of realization is high, at 100 percent. 92% of Experts think that all factories will receive GMP certificate and 4% of experts put it at 0 and 50%. 96% of Experts give the predicted value of period or realization 5 years hence but 4% of experts give the predicted timing 10 years hence.

b. Quality management systems meet the requirements of ISO and GMP. Mode value of likelihood of realization is at 100%. All experts are unanimous that it is the highest realization. The predicted timing of realization being distributed from present to 10 years hence. 80% of experts think that the timing will be 5 years hence

but two experts predict the timing being 10 years hence. Three in twenty-five Experts agree that realization is at the present time.

c. Specialization. The distribution of likelihood of realization is from 0-100 percent. The predicted timing of realization is from 5 years to the distant future. Two of the experts said 50 percent and only one gave it unrealised. Eighty eight percent of experts think that it is the highest realization but 19 experts predict timing being 5 years hence. Five experts said that it is 10 years hence but only one expert did not agree that all factories will be specialists and it will be realized at infinity.

d. Support in plant movement or machine adjustment. The mode value for likelihood of realization is high, 100% and 12% of the expert ranges between 0 and 50 percent. 84% of Experts also predicted that it is likely to become a reality in 5 years hence, if the government wants to conscientiously promote it. One expert thinks that the predicted timing is 10 years and only one expert put it in 20 years hence. Two experts said that predicted timing is a long time in the present situation.

e. Thai brand names are accepted in developing countries. The predicted likelihood of realization is 100%. Four experts gave the prediction a 50% chance of realization. The distribution of timing is from now to more than 20 years. The mode value is in 5 years hence. One expert feels that Thai brand names are already accepted in developing countries. Of the 3 experts, 2 gave in 10 years hence and only one said more than 20 years hence.

f. International trade is promoted to be counter trade. There is a very wide spread of opinions. Three experts said 50 percent, and one expert said 100 percent but the overall forecast for likelihood of realization is 0 percent. The timing of realization

predicted is between 5 years and infinity. The mode value is 5 years hence. Of the six experts, one said 10 years, 20 years and more than 20 years hence, but three experts feel that it will not occur.

g. Thailand is the leader of ASEAN countries in drug exports by increasing export values in 2003 to be three times the export value in 1997.

A predicted likelihood of realization is 100 percent. Five experts feel that this statement has a 50% chance of realization. Timing forecast is wide spread from 0 and 20 years hence. One expert feels it has already been realized (zero years), four said 10 years and one said 20 year hence.

h. Funding to support and motivate exporters

Exporters' opinions are distributed from 0 percent to 100 percent. The mode value is 100% depending on government policies. One expert feels that it will be unrealized because of the economic crisis, three persons replied gave it a 50% chance. The predicted timing is widely spread from 10 to more than 20 years hence. The mode value of timing is 5 years hence. Of five experts that replied; two give it ten years hence and one gives it twenty years, but only one gives it more than 20 years hence.

i. Government to promote investment with foreigners for technology transfer and confidence

The distribution for likelihood of occurrence is from 0-100 percent but the mode value is 100 percent. Three experts give it a 50% chance and only one thinks it is unrealized. The predicted timing is in 5 years hence but one expert feels it has already happened. Five experts predicted its timing in 10 years hence and only one person thinks more than twenty yeas hence.

j. Tax restructuring and import-export duties improvement.

The mode value for likelihood of realization is 100%. Only one expert thinks 50% because the government is concerned about revenue reduction. Ninety two percent of experts forecast times of realization being 5 years hence. One expert thinks it will be realized in the near future while another expert gives it 20 years hence.

k. Cooperation to exchange benefit beyond legal investment promotion.

The mode value for likelihood of realization is 100%. Two experts give it 0% and only one said 50%. The predicted timing in realization being 5 years hence. One expert said ten years and one said 20 years hence. Two experts feel its timing is infinity.

III. The future model of the pharmaceutical industry in 10 years.

a. Thailand is the hub of some finished drug production that is accepted by developing countries.

The distribution for likelihood of realization is from a 0-100% chance. Mode value of occurrence is 100%. Two experts said 50 percent but one expert thinks it is unreal. The predicted timing for likelihood of realization is 10 years hence. Two experts feel that it has been already realized but 2 experts said its timing is 5 years hence. Only one said 20 years hence because the Malaysian government declares to be the center of pharmaceutical production of ASEAN countries.

b. Changing the out-of-date machinery to increase productivity.

The mode value of likelihood of realization is 100 percent. Two experts think 0 and 50 percent, one said 0 percent and another said 50 percent. Predicted timing is 10 years hence. One expert feels that it has been realized in recent years and one expert gives it in 5 years and another 20 years hence.

IV. The future model of the pharmaceutical industry in 20 years.

a. Thailand is the leader of ASEAN countries in chemical exports by increasing export values in 2003 to be three times the export values in 1997.

The mode value for the replies regarding the likelihood of this happening was low, at 0 percent. Two of the experts said 50% and only one expert gave it 100 percent chance. The predicted timing is in more than 20 years time. Three experts predict timing 20 years hence and two of them predict timing as infinity.

b. Thailand is the base of drug and medicinal herb extraction production.

Ninety four percent of experts give it 100 percent chance. Two experts said 50 percent because neighboring countries, for example Malaysia and Vietnam, are developing their pharmaceutical industry. The predicted timing of realization is 10 to 20 years hence.

c. To use domestic raw materials to produce value added pharmaceutical products.

Mode value for likelihood of realization is 100 percent but four experts think 50 percent because there are no clinical trial reports to support efficacy of treatment and only one expert feels that it is unreal. The predicted timing for realization is 20 years hence. Three experts give its timing ten years hence. One person replied gave its timing more than 20 years and only one put it in infinity.

d. An Institute for the training of production technology and quality control

The distribution for likelihood of realization is in the range from 0 to 100%. The mode value of realization has a 100% chance. Three experts put it in 50% chance but

only one thinks that it is unrealized because of the response and pattern to establish institutes. Predicted timing for occurrence is ten to twenty years hence.

e. Information center in marketing and technology of ASEAN countries.

Ninety six percent of experts give it a 100 percent chance, but one expert thinks it is unrealized because there are many competitors. The predicted timing for realization is 10 to 20 years hence.

f. Government supports using the latest technology and equipment in production and quality control.

Eighty percents of experts give the likelihood of realization in 100 percent, four persons who replied give it a 50% chance while one person thinks it is unrealized. The predicted timing of realization is 20 years hence. Two persons said 5 years, six experts give the timing 10 years hence. Only one expert feels that it will be a long time because of the economic crisis.

g. The finished drug industry has investment promotion by providing maximum profits in all regions.

Mode value for likelihood of realization is 0 percent, two experts give it a 50% chance, the predicted timing of occurrence is 20 years hence if the economy picks up. Two experts forecast timing in 10 years hence, one thinks more than 20 years and only one feels that it will be a long time.

h. The Government strategy for promotion of the development of non-patent drugs in Thailand and still used in developing countries.

Eighty eight percent of experts give it a 50% chance. Two experts think 100%, and one expert feels 0 percent, because the government never supports this activity.

The predicted timing for occurrence is 5 years and more than 20 years hence and the mode value is in 20 years hence.

i. The Government is the leader in R&D.

Twenty-four experts agree that the likelihood of realization is 100 percent and only one said 50%. The predicted timing of realization is widely spread. The mode value of timing is in 20 years hence. One expert thinks that it already exists, two experts give it 5 years hence and 2 experts forecast timing 10 years hence. Only one expert feels that the predicted timing of realization is infinity.

V. The future model of the pharmaceutical industry in more than 20 years.

a. The domestic market is a free trade market. Ninety two percent of experts think that this statement is unreal. Two experts said 50 percent. The predicted timing of occurrence is in 20 years hence, but two persons said 5 years and only one expert said 10 years.

b. A quality assurance institute that collaborates with foreign institutes.

The distribution for likelihood of restriction is wide spread. The overall forecast of realization is 50%. Two experts think it is unrealized. Five experts gave it a better than 100 percent chance. The predicted timing of realization is ten to twenty years hence.

VI. The future model of the pharmaceutical industry in future (more than 50 years).

a. Thailand is the hub of some chemical production that is accepted by developing countries.

The distribution for likelihood of realization is from 0 to 100 percent. Mode value 84% is a 0 percent of chance. Only one expert thinks 50 percent but three persons think

100 percent if we begin to produce semi-finished raw materials or with investment by foreigners.

Predicted timing is from 10 years hence to infinity, but mode is infinity because of the economics of scale and the size of the market.

b. The production of commercial raw materials to substitute imports.

The distribution for the likelihood of realization ranges from 0 to 100 percent. The mode value is 0 percent while two experts think that it may be realized and only one gives it 50%. The predicted timing is infinity. One expert feels that if the government attempts to develop, its timing is in 10 years hence. One persons who replied give its timing in 20 and more than 20 years hence, but only one expert thinks that it already exits for some non-active ingredients for example sugar and lactose.

- Group 5 Institute for development

c. The collaboration of the public and private sectors to search for raw material sources that have a high quality and a low cost, by coordinating the purchasing of large volumes of raw material.

The mode value for likelihood of realization is 100 percent but three experts think 0 percent because of the serious and inadvisable competitiveness. The predicted timing of occurrence is a long time because the experts think this statement will occur in the next generation of administration teams. Three experts forecast timing of occurrence of not less than 20 years hence.

4.3.3 Direction of development of the pharmaceutical industry.

I. A tri- party coordination

The Tri party must adjust their interaction by focusing on end users. They have developed but their potential is not high enough to support exports and deal with the free agreements of both the AFTS and the WTO.

Academics should cooperate to produce high quality personnel and continuous education and training. Although Faculties of Pharmacy in Thailand are accepted by foreign academics, they are blocked by government project regulations. Therefore they have developed slower than if they had been established by an agency. The objective of manufacturers is to maximize profits based on time utilization. The public sector has insufficient manpower to carry out this requirement, so construction has failed to appear. The Government sector should accept the potential of academics and decentralization. Although presently there are different curriculums that affect the quality of pharmacists, in the future there will be coordination among the eleven faculties of pharmacy.

Academic presenters recommend organizations which are accepted by all sectors which can then seek capital from the budgets of all sectors, or capital from both home and abroad, or attract private sector cooperation.

Private sectors want to see separation among public sectors in control. Standard quality reduces the confidence of local manufacturers. Although the FDA has been coordinating between local manufacturers and faculties of pharmacy for some time, the private sector thinks that the FDA work separately from other ministries such as the Safety Environment, etc. and teamwork from public sectors.

The GPO requires teamwork to study raw material markets and the demand for future development according to private leanings.

II. Information.

The development of the pharmaceutical industry in Thailand consists of an effective management team and concise information. This information consists of the advantages, the disadvantages, and the cost-benefit evaluations used by the owners in effective decision making. Technological data alone is not enough, the administrators should have marketing data too.

Information should be summarized for convenience and better understanding. The summarizing of data stimulates administrators to study their detail. Summarization is conducted by information providers, especially the public sector, because they can collect data from the private sector and initiate various projects. Furthermore they can evaluate the cost-benefit of each project which helps local manufacturers to break the ice.

Information should be collated to reduced overlap. Information is provided individually, so some data overlaps, for example the faculty of pharmacy and the FDA provide information which is not coordinated. This information can not used by local manufacturers.

Information provided by the public sector is not effective because there are no public relations. For example statistical data of imports and production are distributed by the FDA, but the FDA never informs visitors. Another example is the export service unit of the export promotion department which functions to support export, but they do

not have a specific policy in finished pharmaceutical products because of the clarification of data.

III. Research and development.

GMP and the ISO are international quality assurances although they are one factor besides formulation or storage. Maintenance of GMP or ISO is an ethic of local manufacturers, so the penalty provisions of the law are more serious such as departure from the drug business. The private sector thinks that quality inspections can have some errors, sometimes in both the products of GMP certified manufacturers and non GMP certified ones. However, GMP certificates influence exports to foreign countries.

There is some question about bioequivalence study requirements because pharmaceutical products are the only goods that require bioequivalence study, by comparison with the original product, although products from local manufacturers received the GMP certificate. The FDA explain the importance of bioequivalence tests, especially the companies with original products, because original products have had pre and post marketing surveillance for a long time. There are many studies about toxicology both acute and chronic in original products.

Research and development are difficult to conduct because serious competition results in low profit margins which are not enough to fund research projects. This situation is one factor which decreases competitiveness against imported products. Of the local manufacturers which can compete many become researcher dependent for their decisions.

A center or manager should be established if the government is to promote research and development. Its officials will select a group of local manufacturers which are ready to be leaders. This group would have 3 functions

a. An information provider for overall data of the industry.

b. Quality development such as personnel, processing, and technology.

c. Coordinator among the public sector, private sector and academics.

Another function is to define interest groups in the public and private sector. These interest groups will coordinate to start research and development projects, such as market research in consumer demand weaknesses, and an operation plan to increase production pharmacists by the public sector. This center would summarize weaknesses by flow charts then organize a response.

This under production suggestion guide for the pharmaceutical industry in Thailand has no authority and is effective only in Thailand.

The research and development of the GPO carries out, for example, clinical trials of herbal medicines e.g. the quality control of raw materials which affects export promotion and quality assurance. The GPO tries to be an adviser in the food industry, but the pharmaceutical industry may not be accepted because of inadequate personnel and a conflict of interests. A suitable solution would be to establish the pharmaceutical institute as a non-profit sector. It would have significant powers. Its function would include personnel development, however local manufacturers may regard it as too expensive.

Part 2 Potential for self-sufficiency is consist of

4.4 Cost structure in production of 10 selected drugs.

Information of 10 selected drugs studied for studied self-sufficiency. Dosage form of these drugs are the same as original products except Norfloxacin 200 mg. And Piroxicam 10 mg. That are produced both tablet and capsule although in drug market other items may be produced in both tablet and capsule but these manufacturers did not returned the questionnaires (table 45). All 10 items have packaging both loose packed and strip of four or ten tablets or capsules. Most of the strip are 10 tablets or capsules. The manufacturers will not agree to give production cost of items that are produced by few manufacturers, just off-patent drug and high competitiveness e.g. Nifedipine 5 mg. And Cephalexin 250 mg.

Table 45 Dosage form and packing of 10 selected drugs studied potential for self-sufficiency

Name	Dosage form	Packaging	Packing	Number of producers	Number of producers gave cost of production
1. Amoxycillin 500 mg.	Capsule	Strip pack	10x10	2(2)	-
	Capsule	Strip pack	50x10	2(1)	-
	Capsule	Loose pack	100	1	-
	Capsule	Loose pack	500	21(10)	9
2. Cephalexin 250 mg.	Capsule	Strip pack	10x10	1	1
	Capsule	Loose pack	100	3(3)	1
	Capsule	Loose pack	500	1	1
3. Diclofenac 25 mg.	Capsule	Strip pack	10x10	2(2)	-

Table 45 Dosage form and packing of 10 selected drugs studied potential for self-sufficiency.(cont.)

Name	Dosage form	Packaging	Packing	Number of producers	Number of producers gave cost of production
	Capsule	Strip pack	50x10	2(2)	-
	Capsule	Strip pack	100x10	4(4)	-
	Tablet	Loose pack	100	1(1)	-
	Tablet	Loose pack	500	2(2)	-
	Tablet	Loose pack	1000	12(5)	9
4. Glibenclamide 5 mg.	Tablet	Strip pack	10x10	1	-
	Tablet	Strip pack	50x10	3(2)	2
	Tablet	Loose pack	100	1	-
	Tablet	Loose pack	250	1	-
	Tablet	Loose pack	500	3(1)	3
	Tablet	Loose pack	1000	4(2)	3
5. Ketoconazole 200 mg.	Tablet	Strip pack	1x10	2(1)	-
	Tablet	Strip pack	10x10	9(3)	3
	Tablet	Strip pack	25x10	8(7)	2
	Tablet	Strip pack	50x10	3(2)	1
	Tablet	Loose pack	100	3(3)	1
	Tablet	Loose pack	250	1(1)	-
	Tablet	Loose pack	500	2	-
	Tablet	Loose pack	1000	1	-
6. Nifedipine 5 mg. cap.	Capsule	Loose pack	50	1	-
7. Norfloxacin 200 mg.	Tablet	Strip pack	20x8	1(1)	-

Table 45 Dosage form and packing of 10 selected drugs studied potential for self-sufficiency.(cont.)

Name	Dosage form	Packaging	Packing	Number of producers	Number of producers gave cost of production
	Tablet	Strip pack	25x8	1(1)	-
	Tablet	Strip pack	10x10	3(1)	1
	Tablet	Strip pack	50x10	3(2)	2
	Tablet	Loose pack	100	1(1)	1
	Tablet	Loose pack	200	1	-
	Tablet	Loose pack	250	2(1)	-
	Tablet	Loose pack	500	4(2)	4
	Tablet	Loose pack	1000	3	2
	Capsule	Strip pack	1x4	1	-
	Capsule	Strip pack	5x4	1	1
	Capsule	Loose pack	100	2(1)	2
	Capsule	Loose pack	500	2(1)	1
8. Piroxicam 10 mg.	Capsule	Strip pack	5x2	1	-
	Capsule	Strip pack	1x10	2(2)	-
	Capsule	Strip pack	10x10	2(2)	1
	Capsule	Loose pack	500	8(4)	5
	Capsule	Loose pack	1000	10(4)	5
	Tablet	Strip pack	1x10	1(1)	-
	Tablet	Strip pack	100x10	1	-
	Tablet	Loose pack	500	1	-
	Tablet	Loose pack	1000	3(2)	-

Table 45 Dosage form and packing of 10 selected drugs studied potential for self-sufficiency.(cont.)

Name	Dosage form	Packaging	Packing	Number of producers	Number of producers gave cost of production
9. Propanolol 10 mg.	Tablet	Loose pack	1000	3(3)	2
	Tablet	Loose pack	500	2(2)	-
	Tablet	Strip pack	100x10	1(1)	-
	Tablet	Strip pack	50x10	1(1)	-
10. Ranitidine 150 mg.	Tablet	Strip pack	10x10	3(3)	1
	Tablet	Strip pack	2x10	1(1)	-

Structure of production cost of tablet or capsule in Thailand's pharmaceutical industry consist of active ingredients, non-active ingredients, packing in the form of bottle(glass, plastic) or strip, capsule and box, labor cost, overhead cost which included direct overhead e.g. electricity, water and indirect overhead e.g. operation cost.

Each item has different proportions of cost structure depend on active ingredient, which each active ingredients will be different depend on packaging. The item with active ingredients cost in the highest proportion are antibacterial group. For example Cefalexin 250 mg. in packing of 500 capsules about 87.68% of total cost is active ingredient. Other product, Amoxycillin 250 mg. in packing of 500 capsules has active ingredient cost about 85.92% of total production cost. In the contrary Propanolol 10 mg. packing 1,000 tablets has lowest proportion of active ingredient about 6.01% of total production cost. Items that packed in bottle have packaging cost less than packed

in strip e.g. Amoxycillin 500 mg. capsule packing 500 capsule has packaging cost about 2.48% of product cost while strip packed has packaging cost about 15.72%.

Overhead cost can not be clarified to direct or indirect overhead cost by some manufacturers but this proportion depend on each factories. Direct overhead cost is about 0.79% in Amoxycillin 500 mg. to maximum about 25.47% in Propanolol 10 mg.. Indirect overhead cost is minimum 0.31% in Vitamin B1-6-12 to maximum 16.81% in Diclofenac 25 mg..All items have direct overhead cost higher proportion than indirect overhead cost.

Dosage form is affected proportion of production cost especially packaging cost. Packaging cost of tablet is less proportion than capsule for example Norfloxacin 200 mg. packing 500 tablet has packaging cost about 7.58% while packing 500 capsules has about 20.42%. The same as Norfloxacin 200 mg. tablet packed in strip has packaging cost 7.58% but Norfloxacin 200 mg. capsule packed in strip has packaging cost 20.42%. Piroxicam 10 mg. packing 1,000 tablet have packaging cost 3.68% that less than dosage form capsule about 27.65%(table46).

Table 46 Cost structure of 10 selected drugs

Name	Packing	Dosage form	Active ingredient (%)	Non-active ingredient (%)	Packaging material (%)	Labor (%)	Overhead (%) Direct	Overhead (%) Indirect
Amoxycillin 500 mg.	500	capsule	85.92	5.47	2.48	1.76	3.17	1.21
	50x10	capsule	78.63	0.02	15.72	4.15	0.79	0.69

Table 46 Cost structure of 10 selected drugs.(cont.)

Name	Packing	Dosage form	Active ingredient (%)	Non-active ingredient (%)	Packaging material (%)	Labor (%)	Overhead (%)	
							Direct	Indirect
Cefalexin 250 mg.	100	capsule	83.07	3.89	2.39	3.23	7.42	-
	500	capsule	87.68	6.70	0.59	0.30	2.46	2.27
	10x10	capsule	80.32	4.02	12.05	2.01	0.80	0.80
Diclofenac 25 mg.	500	tablet	17.38	30.94	7.35	26.91	16.20	1.23
	1000	tablet	33.84	17.01	6.22	19.10	15.05	8.77
	50x10	tablet	10.92	16.81	30.25	8.40	16.81	16.81
	100x10	tablet	5.86	1.59	41.99	27.48	15.38	7.69
Glibenclamide 5 mg.	500	tablet	37.25	15.94	8.78	11.82	21.81	4.39
	1000	tablet	36.12	11.23	5.73	24.51	14.40	7.95
	50x10	tablet	13.67	12.57	11.51	26.41	32.00	3.85
Ketoconazole 200 mg.	100	tablet	83.33	4.17	5.00	1.94	5.56	-
	10x10	tablet	80.80	3.32	7.69	4.03	2.79	1.37
	25x10	tablet	77.82	0.70	4.54	5.54	7.61	3.80
Norfloxacin 200 mg.	100	tablet	53.12	9.34	13.74	11.12	12.36	0.32
	500	tablet	62.44	6.64	7.58	8.84	9.75	4.74
	1000	tablet	81.37	7.50	2.36	3.19	2.36	3.22
	10x10	tablet	75.72	3.42	8.98	8.82	1.62	1.45
	50x10	tablet	41.17	8.13	24.46	8.78	10.98	6.48
	5x4	tablet	37.39	0.19	43.41	7.00	12.00	-

Table 46 Cost structure of 10 selected drugs.(cont.)

Name	Packing	Dosage form	Active ingredient (%)	Non-active ingredient (%)	Packaging material (%)	Labor (%)	Overhead (%) Direct	Overhead (%) Indirect
Piroxicam 10 mg.	500	capsule	14.16	21.27	17.13	17.34	22.55	7.55
	1000	capsule	26.26	9.56	27.65	21.45	9.57	5.52
Propanolol 10 mg.	1000	tablet	6.01	5.50	12.93	36.24	3[illegible].47	3.85
Ranitidine 150 mg.	100	tablet	78.30	7.08	1.28	1.05	5.21	7.08

Note : Data of cost structure of Nifedipine 5 mg. is not available.

Table 62 show domestic cost of antibacterial are higher than other items because of the cost of active ingredients are expensive and they must be imported. Drugs packed in strips have domestic cost higher than packed in loose packed. Drugs in large packed have high domestic cost than small packed.

Dosage form affect domestic cost. Drugs in capsule have higher domestic cost than drugs in tablet when they are in the same packaging. For example Norfloxacin 200 mg. capsule packing in 100 capsules bottle has domestic cost 37.67% compare to 21.54% cost of Norfloxacin 200 mg. Tablets in 10 striped form, while the cost of 4 tablets per strip rises to 62.61%.

Piroxicam 10 mg. is one of the sample of dosage form differentiation. This item that is packed in the same amount 1,000 unit has difference domestic cost. Capsule dosage form has domestic cost 71.27% of total cost and tablet dosage form has

domestic cost 27.37% of total cost. The reason is gelatin capsule can be produced in Thailand so domestic cost is increase as production cost. (table 62).

Table 62 Percentage of domestic cost of production by packaging.

Name	Packing	Packaging	Dosage form	Domestic cost	
				Min –Max	Average
Amoxycillin 500 mg.	500	Loose pack	capsule	4.41-18.37	11.39
	50x10	Strip pack	capsule	-	21.37
Ampicillin 500 mg.	500	Loose pack	capsule	6.97-25.27	15.88
Antacid	1000	Loose pack	tablet	25.00-81.47	45.95
	50x10	Strip pack	Tablet	15.97-67.78	48.24
Bromhexine 8 mg.	1000	Loose pack	Tablet	37.44-88.22	65.27
Cefalexin 250 mg.	100	Loose pack	Capsule		13.04
	500	Loose pack	Capsule		10.54
	10x10	Strip pack	Capsule		19.68
Cimetidine 400 mg.	500	Loose pack	Tablet	18.26-46.33	33.91
	1000	Loose pack	Tablet	24.53-67.15	45.90
	10x10	Strip pack	Tablet		58.29
	50x10	Strip pack	Tablet		47.86
Diclofenac 25 mg.	500	Loose pack	Tablet		51.69
	1000	Loose pack	Tablet	31.73-82.58	54.62
	50x10	Strip pack	tablet		72.27
	100x10	Strip pack	tablet		94.14
Glibenclamide 5 mg.	500	Loose pack	Tablet	36.75-63.02	49.48
	1000	Loose pack	tablet	47.37-80.64	60.26
	50x10	Strip pack	tablet	65.38-87.72	77.33

Table 62 Percentage of domestic cost of production by packaging.(cont.)

Name	Packing	Packaging	Dosage form	Domestic cost	
				Min –Max	Average
Ibuprofen 200 mg.	500	Loose pack	Tablet	21.57-57.75	34.18
Name	Packing	Packaging	Dosage form	Domestic cost	
				Min –Max	Average
	1000	Loose pack	tablet	23.34-54.62	38.44
	50x10	Strip pack	tablet	47.85-79.31	68.83
Ketoconazole 200 mg.	100	Loose pack	tablet		13.89
	10x10	Strip pack	tablet		17.93
	25x10	Strip pack	tablet	11.62-31.44	21.57
Mebendazole 100 mg.	250	Loose pack	Tablet		42.07
	1000	Loose pack	tablet		14.18
Norfloxacin 200 mg.	100	Loose pack	Tablet	27.40-47.41	37.67
	500	Loose pack	Tablet	10.23-47.42	32.53
	1000	Loose pack	tablet	11.39-14.66	13.02
	10x10	Strip pack	tablet		21.54
	50x10	Strip pack	tablet	40.79-63.71	52.25
	5x4	Strip pack	tablet		
Paracetamol 500 mg.	100	Loose pack	Tablet		42.64
	1000	Loose pack	tablet		42.37
	100x10	Strip pack	tablet		55.47
	50x10	Strip pack	tablet		73.61
Piroxicam 10 mg.	500	Loose pack	Capsule	59.36-87.20	77.74
	1000	Loose pack	capsule	41.67-87.09	71.27
	10x10	Strip pack	capsule		59.86
Propanolol 10 mg.	1000	Loose pack	Tablet		42.64

Table 62 Percentage of domestic cost of production by packaging.(cont.)

Name	Packing	Packaging	Dosage form	Domestic cost	
				Min –Max	Average
Ranitidine 150 mg.	100	Loose pack	tablet		21.70
Vitamin B1-6-12	500	Loose pack	Tablet	5.20-35.17	24.20
	1000	Loose pack	tablet	9.24-42.31	25.16

4.5 Comparative advantage and competitive advantage

The production cost used to calculate DRC are conducted in 2 conditions. First average production cost is consist of average domestic cost and average foreign cost , and the factory price is in average too. Second, maximum and minimum production cost are maximum and minimum of total cost of production because maximum production cost may not be maximum domestic cost or maximum foreign cost. Factory price for maximum total cost of production is maximum factory price of each drug.

Calculation DRC by using average cost of production found that 18 items selected drugs have comparative advantage. Norfloxacin 200 mg. Packing loose pack 1000 tablet has DRC/EER0.05 mean that this item has most comparative advantage or least opportunity cost when compare with other items. Follow by Ketoconazole 200 mg. Strip packed 25x10 tablet that has DRC/EER 0.07 and Norfloxacin 200 mg. Strip packed 10x10 tablet (table 48).

Calculation DRC/EER by using minimum total cost of production found that Piroxicam 10 mg.loose packed 500 capsule has highest DRC/EER 0.86. Norfloxacin 200 mg.loose packed 1000 tablet has the least DRC/EER at 0.01. This drug also has least DRC/EER when use average cost of production too (table 49).

Calculation by using maximum total cost of production found that DRC/EER of Ketoconazole 200 mg.strip packed 25x10 tablet decrease from 0.07 to 0.03 and Norrfloxacin 200 mg. Loose packed 500 tablet decrease 0.16 to 0.03 (table 50).

4.6 Capacity increased for self-sufficiency

Data of full and real capacity found that in 1998 real capacity of tablet production is 59.38 percent of full capacity, and real capacity of capsule production is 48.22 of full capacity. So if the manufacturers extend their production to full capacity, they can increase production of tablet 68.42% and capsule 107.37% based on real capacity of tablet and capsule in 1998 respectively.

The volume of production increased for self-sufficiency or import-substitution according to goal of industrial restructuring plan is 50% of imported in 2003. Most of drugs selected to study self-sufficiency can be increased both in tablet and capsule dosage form except Ketoconazole 200 mg. must be increased production 110.41% (table 63) and Norfloxacin 200 mg. produced in tablet must be increase to produce 78.70% respectively that over increased capacity in 1998. Diclofenac 25 mg., Piroxicam 10 mg., Propanolol 10 mg. and Ranitidine 150 mg. should not increase production in 2003 because the volume of production of these drugs in 1998 were more than the volume calculated from linear regression. Because volume of production, import and export of each item can not be searched. So estimation of volume of these activities will used statistical method linear regression by dividing all items into 3 categories according to pharmacological groups and calculation volume of production, import and export in each pharmacological groups. Then calculation each item by using proportion averaged from 1996-1997 as shown in table 71-74.

Table 48 Domestic resource cost at average cost of 10 selected drugs studied potential for self-sufficiency.

Name	Packing	Domestic direct cost	Foreign direct cost	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate(EER) 1996	Domestic resource cost (DRC) (baht/dollar)	DRC/EER
Amoxycillin 500 mg. cap..	500	83.08	646.55	1069.67	25.85	26.10	5.08	0.19
Cefalexin 250 mg. cap.. *	10X10	49.00	200.00	300.00	25.85	26.10	12.67	0.49
Cefalexin 250 mg. cap.. *	100	28.17	187.87	194.50	25.85	26.10	109.83	4.21
Cefalexin 250 mg. cap.. *	500	107.00	908.00	1200.00	25.85	26.10	9.47	0.36
Diclofenac 25 mg. tab.	1000	73.21	60.83	338.33	25.85	26.10	6.82	0.26
Glibenclamide 5 mg. tab.	50X10	116.00	34.13	445.00	25.85	26.10	7.30	0.28
Glibenclamide 5 mg. tab.	500	32.51	33.19	313.09	25.85	26.10	3.00	0.12
Glibenclamide 5 mg. tab.	1000	80.76	53.25	310.00	25.85	26.10	8.13	0.31
Ketoconazole 200 mg. tab.	10X10	44.32	196.49	461.37	25.85	26.10	4.33	0.17
Ketoconazole 200 mg. tab.	100	50.00	310.00	612.50	25.85	26.10	4.27	0.16

Table 48 Domestic resource cost at average cost of 10 selected drugs studied potential for self-sufficiency.(cont.)

Name	Packing	Domestic direct cost	Foreign direct cost	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate(EER) 1996	Domestic resource cost (DRC) (baht/dollar)	DRC/EER
Ketoconazole 200 mg. Tab.	25X10	91.88	102.31	1447.50	25.85	26.10	1.77	0.07
Ketoconazole 200 mg. Tab.	50X10	244.30	883.55	3150.00	25.85	26.10	2.79	0.11
Ketoconazole 200 mg. Tab.	100	50.00	310.00	612.50	25.85	26.10	4.27	0.16
Norfloxacin 200 mg. Tab.*	10X10	13.41	48.86	250.00	25.85	26.10	1.72	0.07
Norfloxacin 200 mg. Tab.*	50X10	165.26	162.50	485.00	25.85	26.10	13.25	0.51
Norfloxacin 200 mg. Tab.*	5X4	9.57	5.71	37.38	25.85	26.10	7.81	0.30
Norfloxacin 200 mg. Tab.*	100	13.53	34.92	204.30	25.85	26.10	2.06	0.08
Norfloxacin 200 mg. Tab.*	500	105.76	208.91	869.09	25.85	26.10	4.14	0.16
Norfloxacin 200 mg. Tab.*	1000	53.50	399.50	1400	25.85	26.10	1.38	0.05
Piroxicam 10 mg. Cap.*	10X10	22.00	14.75	100.00	25.85	26.10	6.67	0.26
Piroxicam 10 mg. Cap.*	500	93.04	29.51	238.00	25.85	26.10	11.54	0.44

Table 48 Domestic resource cost at average cost of 10 selected drugs studied potential for self-sufficiency.(cont.)

Name	Packing	Domestic direct cost	Foreign direct cost	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate(EER) 1996	Domestic resource cost (DRC) (baht/dollar)	DRC/EER
Piroxicam 10 mg. cap.*	1000	112.84	73.71	966.67	25.85	26.10	3.27	0.13
Propanolol 10 mg. tab.	1000	67.33	7.43	572.00	25.85	26.10	3.08	0.12
Ranitidine 150 mg. tab.*	10X10	153.16	552.73	2100.00	25.85	26.10	2.56	0.10

* = item that has one cost of production

Table 63 Percentage of production increased for import-substitution.

Name	Volume of production 1998 (tablet/capsule)	Volume of production for 50% import-substitution 2003	
		Increased volume of production	percent
Amoxycillin 500 mg. cap.	111,007,147	88,861,530	80.05
Cefalexin 250 mg. cap.	5,027,398	4,366,073	86.85
Diclofenac 25 mg. tab.	119,810,997	-11,872,036	-9.91
Glibenclamide 5 mg. tab.	245,284,398	3,691,838	1.51
Ketoconazole 200 mg. tab.	25,845,208	28,535,876	110.41
Nifedipine 5 mg. cap.	18,232,780	4,110,596	12.63
Norfloxacin 200 mg.	19,916,623	15,674,274	78.70
Piroxicam 10 mg. cap.	167,694,879	-15,080,331	-8.99
Propanolol 10 mg. tab.	120,258,010	-9,443,365	-7.85
Ranitidine 150 mg. tab.	21,683,889	-870,968	-1.82

Note: exchange rate 1997 is 31.4817 baht per US dollar

Exchange rate 1998 is 41.585 baht/US dollar

Source Bank of Thailand

4.7 Policies affected self-sufficiency

Domestic policies that affect operation of pharmaceutical industry consist of

4.7.1 Policy that regulate public hospitals to purchase essential drugs in the controlled price. Another point is determining to buy essential drugs from the GPO first, if they have been produced by the GPO. Public hospitals can also purchase from other companies if GPO does not produced but their prices should not higher than the controlled prices. Although only the controlled price is withdrawn for the corruption

plan and regulation must support quality of products for example good health at low cost policy can be used in economic crisis period but is not suitable in long run.

Otherwise GPO think of many benefits in joint venture with private manufacturers or foreigners. The GPO has invested with Philippines companies to produce raw materials that have been received promotion from BOI. They have some promotion obstruction about economic of scale so they can not compete with imported raw materials. GPO want to joint with Thai's manufacturers to produce raw materials especially non-active ingredients but they need to solve the problem of economic of scale by asking local manufacturers aggregate to buy this raw materials or joint with foreigners to expand exporting. In addition the GPO joint the private local manufacturers to produce herbal medicine because of marketing competence and some produce in production.

4.7.3 Good health at low cost policy is the system to increase the effectiveness of selection, procurement, distribution and the use of pharmaceutical products for effective drug, quality drug, low cost and rational drug use by effective purchasing system. The operation plan is provincial purchase beyond reference price (secretary of Ministry of Public Health, 1999:6). Effectiveness of purchasing is determined by scaling raw material source. Five score for raw material source in USA, West Europe, Australia; four score for raw material source in East Europe or Asia company which are not correspond with practice. There are many grade of raw materials that produced by Asian countries have high quality so specification of raw materials should be determined by standard not by countries. This policy causes dumping and price war to be in public hospitals list and they could by another items.

Beside price competitiveness, reduced cost of production by using lower cost of raw materials and distribution in drug stores and private clinics is one method of industry to survive.

4.7.4 Price control by internal trade department, Ministry of commerce. Nine firm owners said that drugs are health products that controlled by quality standard and effectiveness. Low profit will affect research and development. Fixing the price should come from government attenuation and internal trade department request drug company to maintain drug price while cost of production has trend to raise.

4.7.5 Consumer protection policy. Production in hospitals such as liquid dosage form and parenteral solution can save government budget but conduct the inequality of GMP regulation. FDA should look onto quality while the hospitals should clarify their functions.

4.7.6 Management policies if private sector. Private manufacturers should deviate from price competition to consumer satisfaction by construction imaging quality and standard to consumers. The number of manufacturers may be large to be developed and conduct price competitiveness. The fact that all factories must develop to received GMP certificate while some factories did not developed themselves. If pharmaceutical agencies have fully supported these factories, they should accept that this process is used to screen the undeveloped producers. The rest of manufacturers are ready to develop for competition with foreign manufacturers in free trade agreement market. FDA should limit 5 years to these factories for closing down or changing their business. Price policy. Private manufacturers should deviate from price competition to consumer sericerity by construction imaging quality and standard to consumers.

Part 3 Potential for export

4.8 Export and future export plan.

At present about 42.65% of Thai's pharmaceutical industry about 42.65% have exported. Joint venture companies form 8.82% and the rest 4.41% are joint venture companies who do not export because their foreign counterparts are expanding their production market to Thailand. In future the pattern of expansion may be changed according to drug development of ASEAN trade agreement.

About 36.77% of Thai drug factories do not export because they want to expand their business to domestic drug market and some companies lack marketing personnel. (table 38 appendix).

Eight from thirty-five factories or about 32.86% export to 3 foreign countries of factories accounting for 20.00% export to 5 foreign countries,1 foreign country 6 factories(17.15%), 6 foreign countries 5 factories(14.28%), 4 foreign countries 4 factories(11 43%), 7 foreign countries 2 factories(5.71%), 2 foreign countries 2 factories(5.71%) and 8 countries 1 factory (2.86%) respectively. ASEAN countries that are export market from 9 countries (table 39 appendix).

Table 40 in the appendix show that ASEAN countries are the target of export market. About 71.43% of manufacturers export to Laos followed by Myanmar 57.14%, Cambodia 51.43%, Malaysia 51.43%, Singapore 34.29%, Vietnam 28.57%, Philippines 20.0% and Indonesia 11.43% respectively. Other regions are Hong Kong 17.14%, China 14.29%, Sri Lanka 11.43%, Europe 8.57% and South America 5.71% respectively (table 42). The number of factories exporting to each country is very few when compared with the total number of export factories. The ASEAN countries which

Thailand hasn't exported is Brunei due to price competition and trade inconsistency. This requires the government support.

Table 41 in appendix shows details of export from the first questionnaires by exported countries. Dosage forms which are exported to ASEAN countries are tablet, capsule, liquid, injection and lozenge. These dosage forms are produced with high technology when compared with dosage form exported to other regions. Drugs in tablet dosage form are exported by many pharmacological groups. Myanmar has more exported dosage form than other ASEAN countries. This shows that Myanmar is a more attractive market for Thai's manufacturers than other countries. Pharmacological groups of drugs exported to ASEAN countries are varied such as Cardio-vascular group, hypertensive drug e.g. Atenolol, Enarapril, Antibacterial, Antihyperlipidemia, anthelmintics, analgesic e.g. Aspirin, Paracetamol, steroid and other drug that used high production technology such as injection and parenteral solution while drugs exported to Europe are balm, herbal medicine and plaster.

About 30% of the manufacturers who returned the first questionnaires have a future plan to export to foreign countries. This consists of 32.345% if Thai's factories and 7.35% of joint venture. This data shows that some joint venture companies are in process of planning. About 29.41% of Thai's factories do not have a plan to export because size of plant, period of operation. Joint venture companies about 1.48% or 1 factory does not want to export because it is considered to move to other ASEAN countries. Manufacturers that have plan to export are ones that have exported and ones that never export but desired to extend their markets(table 42 in appendix).

The ASEAN countries that Thai's factories are interested are Philippines and Indonesia accounted for 40.74% and 33.33% respectively. Brunei interests by 18.52% of Thai's manufacturers although they have not exported to this country yet. ASEAN markets are more interesting than other countries because of a convenience in transportation, communication and a slower drug development than that of Thailand's. The reasons to expand export to foreign countries vary depending on size and marketing competency of manufacturers in Thailand. Some factories are in process of selecting items for export. The countries that Thai manufacturers do not extend their export to are those that have strict registration and asset ownership. They considers only price. Other reasons are the lack of market personnel and financial support. Thai manufacturers are interested to extend their export to the countries which they can increase their volume and items, having large group of consumers and opportunity advantage in transportation. Dosage forms and pharmacological groups are the same as drugs that have been exported such as liquid dosage form injection and new items few Thai manufacturers have produced(table 43 in appendix).

Dosage forms that Thai manufacturers plan to extend export are those which are the same as previous export. The point is they want to increase a number of foreign countries to export to and also to increase the pharmacological group as shown in table 44 in appendix.

4.9 Cost structure of 11 selected drugs

Information of 11 selected drug studied for potential for export. Dosage form of 11 selected drugs are the same as original products except Cimetidine 400 mg., Ibuprofen 200 mg., Norfloxacin 200 mg. and Vitamin B1-6-12 those are produced both

in tablet and in capsule. Some manufacturers that produce 11 selected drugs have exported some of those drugs but may not cover all these 11 items. The manufacturers agree to give production cost of items that have been exported for a long time and have many formulas e.g. Paracetamol.

Table 64 Dosage form of 11 selected drugs studied export and number of producers and exporters

Name	Dosage form	Packaging	Packing	Number Of producers	Number of producers that gave cost
1. Amoxycillin 500 mg.	Capsule	Strip pack	10x10	2(2)	-
	Capsule	Strip pack	50x10	2(1)	-
	Capsule	Loose pack	100	1	-
	Capsule	Loose pack	500	21(10)	9
2. Ampicillin 500 mg.	Capsule	Strip pack	10x10	2(2)	-
	Capsule	Loose pack	500	20(10)	11
3. Antacid	Tablet	Strip pack	10x10	2(1)	-
	Tablet	Loose pack	20	1(1)	-
	Tablet	Strip pack	50x10	9(5)	4
	Tablet	Strip pack	100x10	1	-
	Tablet	Loose pack	500	10(5)	-
	Tablet	Loose pack	1000	11(6)	9
4. Bromhexine 8 mg.	Tablet	Strip pack	10x10	2	-
	Tablet	Strip pack	50x10	2(2)	-
	Tablet	Loose pack	500	1	-
	Tablet	Loose pack	1000	13(5)	9

Table 64 Dosage form of 11 selected drugs studied export and number of producers and exporters. (cont.)

Name	Dosage form	Packaging	Packing	Number Of producers	Number of producers that gave cost
5. Cimetidine 400 mg.	Tablet	Strip pack	10x10	2(1)	-
	Tablet	Strip pack	50x10	7	-
	Tablet	Loose pack	40	1	-
	Tablet	Loose pack	500	16(7)	6
	Tablet	Loose pack	1000	6(3)	-
	Capsule	Strip pack	2x12	1(1)	-
	Capsule	Loose pack	500	2(2)	2
6. Diclofenac 25 mg.	Tablet	Strip pack	10x10	2(2)	-
	Tablet	Strip pack	50x10	2(2)	-
	Tablet	Strip pack	100x10	4(4)	-
	Tablet	Loose pack	100	1(1)	-
	Tablet	Loose pack	500	2(2)	-
	Tablet	Loose pack	1000	12(5)	9
7. Ibuprofen 200 mg.	Tablet	Strip pack	50x10	4(3)	-
(Film coated &sugar coated)	Tablet	Strip pack	100x10	1	-
	Tablet	Loose pack	100	1(1)	-
	Tablet	Loose pack	500	8(4)	7
	Tablet	Loose pack	1000	16(6)	9
	Capsule	Loose pack	1000	1	-

Table 64 Dosage form of 11 selected drugs studied export and number of producers and exporters. (cont.)

Name	Dosage form	Packaging	Packing	Number Of producers	Number of producers that gave cost
8. Mebendazole 100 mg.	Tablet	Strip pack	1x6	2	-
	Tablet	Strip pack	1x8	1(1)	-
	Tablet	Strip pack	100x6	1	-
	Tablet	Loose pack	100	1	-
	Tablet	Loose pack	250	1(1)	1
	Tablet	Loose pack	500	1	-
	Tablet	Loose pack	1000	2(1)	1
9. Norfloxacin 200 mg.	Tablet	Strip pack	20x8	1(1)	-
	Tablet	Strip pack	25x8	1(1)	-
	Tablet	Strip pack	10x10	3(1)	1
	Tablet	Strip pack	50x10	3(2)	2
	Tablet	Loose pack	100	1(1)	1
	Tablet	Loose pack	200	1	-
	Tablet	Loose pack	250	2(1)	-
	Tablet	Loose pack	500	4(2)	4
	Tablet	Loose pack	1000	3	2
	Capsule	Strip pack	1x4	1	-
	Capsule	Strip pack	5x4	1	1
	Capsule	Loose pack	100	2(1)	2
	Capsule	Loose pack	500	2(1)	1

Table 64 Dosage form of 11 selected drugs studied export and number of producers and exporters. (cont.)

Name	Dosage form	Packaging	Packing	Number Of producers	Number of producers that gave cost
10. Paracetamol 500 mg.	Tablet	Strip pack	10x10	2(1)	
	Tablet	Strip pack	50x10	3(3)	3
	Tablet	Strip pack	100x10	3(1)	1
	Tablet	Loose pack	10	1(1)	
	Tablet	Loose pack	60	1	
	Tablet	Loose pack	100	13(7)	1
	Tablet	Loose pack	500	6(2)	
	Tablet	Loose pack	1000	37(16)	23
11. Vitamin B1-6-12	Tablet	Strip pack	10x10	1	-
	Tablet	Strip pack	30x10	1	-
	Tablet	Loose pack	100	3(1)	-
	Tablet	Strip pack	25x10	1(1)	-
	Tablet	Loose pack	500	6(2)	9
	Tablet	Loose pack	1000	12(2)	4
	Capsule	Loose pack	1000	1	-

Note : (number) is number of manufacturers that have exported.

Items in antibacterial group have highest active ingredient cost proportion. For example Amoxycillin 500 mg. packing 500 capsules has active ingredient cost about 85.92% of total production cost. Item that has least active ingredient cost is Ibuprofen 200 mg. paacking 50x10 (table 65).

Labor cost do not correspond with active ingredient , packaging or type of packing such as Antacid packing looose packed 1,000 tablet and strip packed 50x10 tablet have labor cost of 15.45 and 12/14 prcent of total production cost respectively.

Indirect overhead cost is minimum 0.31% in Vitamin B1-6-12 to maximum 16.81% in Diclofenac 25 mg.. All items have higher proportion of direct overhead cost than indirect overhead cost.

Table 65 Cost structure of 11 selected drugs.

Name	Packing	Dosage form	Active ingredient (%)	Non-active ingredient (%)	Packaging material (%)	Labor (%)	Overhead Cost (Direct)	Overhead Cost (Indirect)
Amoxycillin 500 mg.	500	Capsule	85.92	5.47	2.48	1.76	3.17	1.21
	50x10	Capsule	78.63	0.02	15.72	4.15	0.79	0.69
Ampicillin 500 mg.	500	capsule	82.76	5.82	3.39	1.91	4.36	1.56
Antacid	1000	tablet	46.23	12.51	8.66	15.45	10.45	6.71
	50x10	tablet	47.02	8.60	18.28	12.14	7.97	6.00
Bromhexine 8 mg.	1000	tablet	32.33	11.77	10.45	20.44	14.22	10.79
Cimetidine 400 mg.	500	tablet	60.80	10.98	4.12	8.13	10.52	5.45
	1000	tablet	59.24	4.74	13.83	6.04	9.53	6.62
	10x10	tablet	38.11	3.60	20.20	30.20	0.87	7.02
	50x10	tablet	49.31	2.82	15.28	5.62	26.96	-
	500	tablet	63.46	13.84	7.17	10.23	10.07	5.23

Table 65 Cost structure of 11 selected drugs. (cont.)

Name	Packing	Dosage form	Active ingredient	Non-active ingredient	Packaging material	Labor	Overhead Cost	
			(%)	(%)	(%)	(%)	(Direct)	(Indirect)
Ibuprofen 200	500	tablet	63.46	13.84	7.17	10.23	10.07	5.23
mg.	1000	tablet	53.85	11.57	4.62	12.81	12.20	4.95
	50x10	tablet	28.37	8.52	28.11	17.96	9.00	8.05
Mebendazole 100	250	tablet	57.93	6.42	2.64	9.93	15.33	7.69
mg.	1000	tablet	80.73	5.08	2.73	2.73	3.82	4.91
Norfloxacin 200	100	tablet	53.12	9.34	13.74	11.12	12.36	0.32
mg.	500	tablet	62.44	6.64	7.58	8.84	9.75	4.74
	1000	tablet	81.37	7.50	2.36	3.19	2.36	3.22
	10x10	tablet	75.72	3.42	8.98	8.82	1.62	1.45
	50x10	tablet	41.17	8.13	24.46	8.78	10.98	6.48
	5x4	tablet	37.39	0.19	43.41	7.00	12.00	-
Paracetamol 500	100	tablet	57.36	12.18	22.84	5.08	1.52	1.02
mg.	1000	tablet	53.70	8.83	9.90	9.96	10.95	6.66
	100x10	tablet	39.66	5.55	34.28	10.02	5.48	5.01
	50x10	tablet	30.76	6.28	17.53	15.79	22.32	7.32
Vitamin B1-6-12	500	tablet	71.16	5.50	4.19	6.84	12.00	0.31
	1000		72.07	7.12	3.78	6.05	6.51	4.47

Results of the study of domestic cost of 11 selected drugs showed that the domestic cost of antibacterial are lower than the cost of other items because imported active ingredients are more expensive. Drugs packed in strips have higher domestic cost than the ones of loose packed. Drugs with large packed have higher domestic cost.

Although active ingredients of all items are imported but this condition does not relate with the proportion between domestic and foreign cost, for example Bromhexine 8 mg. has domestic cost 47.39 baht while the foreign cost is 25.21 baht per one packing. This is also true with Diclofenac 25 mg. and Glibenclamide 5 mg.(table 66).

Table 66 Percentage of domestic cost of production by packaging.

Name	Packing	Packaging	Dosage form	Domestic cost	
				Min.-max	Average
Amoxycillin 500 mg.	500	Loosed pack	capsule	4.41-18.37	11.39
	50x10	Strip pack	capsule	-	21.37
Ampicillin 500 mg.	500	Loosed pack	capsule	6.97-25.27	15.88
Antacid	1000	Loosed pack	tablet	25.00-81.47	45.95
	50x10	Strip pack	tablet	15.97-67.78	48.24
Bromhexine 8 mg.	1000	Loosed pack	tablet	37.44-88.22	65.27
Cimetidine 400 mg.	500	Loosed pack	tablet	18.26-46.33	33.91
	1000	Loosed pack	tablet	24.53-67.15	45.90
	10x10	Strip pack	tablet		58.29
	50x10	Strip pack	tablet		47.86
Diclofenac 25 mg.	500	Loosed pack	tablet		51.69
	1000	Loosed pack	tablet	31.73-82.58	54.62
	50x10	Strip pack	tablet		72.27
	100x10	Strip pack	tablet		94.14

Table 66 Percentage of domestic cost of production by packaging. (cont.)

Name	Packing	Packaging	Dosage form	Domestic cost	
				Min.-max	Average
Ibuprofen 200 mg.	500	Loosed pack	tablet	21.57-57.75	34.18
	1000	Loosed pack	tablet	23.34-54.62	38.44
	50x10	Strip pack	tablet	47.85-79.31	68.83
Mebendazole 100 mg.	250	Loosed pack	tablet		42.07
	1000	Loosed pack	tablet		14.18
Norfloxacin 200 mg.	100	Loosed pack	tablet	27.40-47.41	37.67
	500	Loosed pack	tablet	10.23-47.42	32.53
	1000	Loosed pack	tablet	11.39-14.66	13.02
	10x10	Strip pack	tablet		21.54
	50x10	Strip pack	tablet	40.79-63.71	52.25
	5x4	Strip pack	tablet		
Paracetamol 500 mg.	100	Loosed pack	tablet		42.64
	1000	Loosed pack	tablet		42.37
	100x10	Strip pack	tablet		55.47
	50x10	Strip pack	tablet		73.61
Vitamin B1-6-12	500	Loosed pack	tablet	5.20-35.17	24.20
	1000	Loosed pack	tablet	9.24-42.31	25.16

4.10 Comparative advantage

Calculation DRC/EER by using average cost of production showed that all items have comparative advantage. Norfloxacin 200 mg. Packing loose pack 1000 tablet has DRC/EER0.05 which means that this item has most comparative advantage. Drug that has the least comparative advantage is Paracetamol 500 mg. Strip packed 50x10 tablet

that has DRC/EER equal to 0.69. DRC/EER does not depend on form or packing for example Paracetamol 500 mg. Loose paked 100 tablet has DRC/EER 0.041 which is less than DRC/EER of the ones in the loosed packed of 1000 tablets (0.59). The strip packed 100x10 tablet has DRC/EER 0.17 which is less than those of the loosed pack (table 67).

Table 67 Domestic resource cost at average cost of production of 11 selected drugs.

Name	Packing	Domestic direct cost	Foreign direct cost	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate (EER) 1996	Domestic resource cost (DRC) (Baht/ Dollar)	DRC/EER
Amoxycillin 500 mg. cap.	500	83.08	646.55	1069.67	25.85	26.10	5.08	0.19
Ampicillin 500 mg. cap.	500	111.79	592.26	1063.05	25.85	26.10	6.14	0.24
Antacid tab.	50X10	40.94	43.94	117.50	25.85	26.10	14.39	0.55
Antacid tab.	1000	61.67	72.55	199.78	25.85	26.10	12.53	0.48
Bromhexine 8 mg. Tab.	1000	47.39	25.21	179.44	25.85	26.10	7.94	0.30
Cimetidine 400 mg. tab.	500	84.66	165.01	1080.00	25.85	26.10	2.39	0.09
Diclofenac 25 mg. tab.	1000	73.21	60.83	338.33	25.85	26.10	6.82	0.26
Ibuprofen 200 mg. tab.	500	50.58	97.42	250.00	25.85	26.10	8.57	0.33
Ibuprofen 200 mg. tab.	1000	80.33	128.62	336.67	25.85	26.10	9.98	0.38
Mebendazole 100 mg. tab.*	250	84.74	116.67	513.97	25.85	26.10	5.51	0.21
Mebendazole 100 mg. tab.*	1000	26.00	157.32	300.00	25.85	26.10	4.71	0.18
Norfloxacin 200 mg. tab.*	10X10	13.41	48.86	250.00	25.85	26.10	1.72	0.07

Table 67 Domestic resource cost at average cost of production of 11 selected drugs.(cont.)

Name	Packing	Domestic direct cost	Foreign direct cost	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate (EER) 1996	Domestic resource cost (DRC) (Baht/ Dollar)	DRC/EER
Norfloxacin 200 mg. tab.	50X10	165.26	162.50	485.00	25.85	26.10	13.25	0.51
Norfloxacin 200 mg. tab.	5X4	9.57	5.71	37.38	25.85	26.10	7.81	0.30
Norfloxacin 200 mg. tab.	100	13.53	34.92	204.30	25.85	26.10	2.06	0.08
Norfloxacin 200 mg. tab.	500	105.76	208.91	869.09	25.85	26.10	4.14	0.16
Norfloxacin 200 mg. tab.	1000	53.50	399.50	1400	25.85	26.10	1.38	0.05
Paracetamol 500 mg. tab.*	100	4.20	5.65	15.78	25.85	26.10	10.72	0.41
Paracetamol 500 mg. tab.	50X10	115.03	34.83	200.00	25.85	26.10	18.00	0.69
Paracetamol 500 mg. tab.	100X10	66.44	53.33	450.00	25.85	26.10	4.33	0.17
Paracetamol 500 mg. tab.	1000	56.91	71.28	166.86	25.85	26.10	15.39	0.59
Vitamin B1-6-12 tab.	500	37.89	67.63	251.08	25.85	26.10	5.34	0.20

Table 67 Domestic resource cost at average cost of production of 11 selected drugs.(cont.)

Name	Packing	Domestic direct cost	Foreign direct cost	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate (EER) 1996	Domestic resource cost (DRC) (Baht/ Dollar)	DRC/EER
Vitamin B1-6-12 tab.	1000	51.60	106.05	345.00	25.85	26.10	5.58	0.21

* = items that has one cost of production

Table 68 Term of trade of 11 selected drugs studies potential of export at average wholesale price

Name	Packing	Malaysia	Myanmar	Singapore	Vietnam	Philippines	Laos
Amoxycillin 500 mg.	100'S FP	328.96	2,725.00	53.96	66.83	169.76	28.00***
	500'S	371.23	3,075.14	60.89	75.42	465.64	76.82***
	1000'S	590.67	4,892.89	96.89	120.00	740.89	122.22***
Ampicillin 500 mg.	100'S	250.31	3,461.95	89.94	25.47	487.111	0.52(China)***
	500'S	236.20	3,266.77	84.87	24.04	459.64	15.43(China)***
Antacid	500'S	375.00	5,786.11	263.89	1,125.00	975.00	102.78***
	1000'S	385.71	5,951.43	271.43	1,157.14	1002.86	105.71***
	50X10'S FP	270.00	4,166.00	190.00	810.00	702.00	74.00***
Vitamin B1-6-12	500'S	650.91	32,458.18	52.73	74.55	2454.55	60.00***
	1000'S	730.61	36,432.65	59.18	83.67	2755.10	67.35***
Bromhexine 8 mg	500'S	516.18	5,688.24	60.29	32.35	970.59	226.47
	1000'S	1,002.86	11,051.43	117.14	62.86	1885.71	440.00

Table 68 Term of trade of 11 selected drugs studies potential of export at average wholesale price.(cont.)

Name	Packing	Malaysia	Myanmar	Singapore	Vietnam	Philippines	Laos
	100X10'S FP	344.12	3,792.16	40.20	21.57	647.06	88.24*
Cimetidine 400 mg.	500'S	1,277.91	1,912.05	73.90	135.33	793.98	30.03**
	1000'S	1,623.47	2,429.08	93.88	106.52	1008.67	52.55**
	100X10'S FP	1,178.52	1,763.33	68.15	146.74	732.22	38.15**
Diclofenac 25 mg.	500'S	710.14	12,763.77	65.22	9,855.07	1236.23	42.03**
	1000'S	449.54	8079.82	41.28	6238.53	782.57	26.61**
	100X10'S	532.61	9572.83	48.91	7391.30	927.17	31.52**
Ibuprofen 200 mg.	500'S	357.81	15806.25	354.69	86.56	993.75	140.63*
	1000'S	381.67	16860.00	378.33	92.33	1060.00	150.00*
	100X10'S	263.22	11627.59	260.92	63.68	731.03	103.45*

Table 68 Term of trade of 11 selected drugs studies potential of export at average wholesale price.(cont.)

Mebendazole 100 mg.	500'S	1062.82	31660.90	NA	15.38	NA	133.33*
	1X6'S	660.56	19677.69	NA	9.56	NA	82.87*
Name	Packing	Malaysia	Myanmar	Singapore	Vietnam	Philippines	Laos
Norfloxacin 200 mg.	500'S	2012.60	10074.02	4586.61	NA	3387.40	NA
	1X10'S	291.12	1457.18	663.44	NA	390.74	NA
Paracetamol 500 mg.	100'S	150.00	142570.83	1133.33	17.78	7512.50	57.08
	500'S	128.57	122203.57	971.43	20.74	6439.29	48.93
	1000'S	163.64	155531.82	1236.36	16.30	8195.45	62.27
	100X10'S	73.47	69830.61	555.10	36.30	3679.59	27.96

* Thai company ** India'company *** Laos company

Calculation DRC/EER by using minimum total cost of production found that Bromhexine 8 mg. Loose packed 1000 tablet has highest DRC/EER (0.77), followed by Antacid strip packed 50x10 tablet(0.67) respectively. Ibuprofen 200 mg. Loose packed 500 and 1000 tablet have DRC/EER equal 0.65. The least DRC/EER is 0.01 that is Norfloxacin 200 mg.loose packed 1000 tablet. Drugs that has more DRC/EER than Norfloxacin 200 mg. is Cimetidine 400 mg. 0.05 table 49 appendix).

Calculation by sing maximum total cost of production found that items which lose comparative advantage are Paracetamol 500 mg.strip packed 50x10 tablet and loose packed 1000 tablet that DRC/EER are increased to 1.17 and 2.60 respectively. DRC/EER of Ibuprofen 200 mg. Loose packed 500 tablet increase from 0.33 to 0.96 when calculated by using maximum total production cost while DRC/EER of Ketoconazole 200 mg. strip packed 25x10 tablet decreases from 0.07 to 0.03 and Norrfloxacin 200 mg. Loose packed 500 tablet decreases 0.16 to 0.03 (table 68)

4.11 Price competitive and competitive advantage

I. Term of Trade at average price by countries

Calculation term of trade by using average wholesale price of 11 selected drugs showed that Thai manufacturers can not compete in price for most items of Laos and Vietnam. Some items that Laos imports from China and India are cheaper than those imported from Thailand. however Thai manufacturers can compete with Malaysia, Philippines and Myanmar drug market every item respectively. Items of drugs that have highest term of trade in Malaysia are Cimetidine 400 mg. In Myanmar, it is Paracetamol 500 mg., Mebendazole 100 mg. and Ibuprofen 200 mg.. Drugs that have term of trade

more than 100 in Singapore are Antacid ,Ibuprofen 200 mg., Norfloxacin 200 mg. and Paracetamol 500 mg. but Bromhexine 8 mg. only packing 1000 tablet that term of trade is more than 100. Drug that have term of trade more than 100 in Vietnam are Antacid, Cimetidine 400 mg., Diclofenac 25 mg. Amoxycilin 500 mg. can not be competed only packing 1000 capsule. All items can be competed in Philippines except Mebendazole 100 mg. because of the data is unavailable but all items have term of trade less than in Myanmar. Items that have time of trade higher than in Malaysia are Ampicillin 500 mg., Antacid, Vitamin B-6-12 , Bromhexine 8 mg., Diclofenac 25 mg., Ibuprofen 200 mg. , Norfloxacin 200 mg. and Paracetamol 500 mg.

Item that have term of trade less than that of Malaysia are Cimetidine 400 mg.. As for Amoxycillin 500 mg, only strip packed has the term of trade lower than that of Malaysia. Few items can be competed in Laos such as Amoxycillin 500 mg. packing 1000 capsule that produced in Laos, Bromhexine 8 mg. packing loose packed 500, 1000 tablet that are imported. Ibuprofen 200 mg. , Mebendazole 100 mg. packing loose packed 500 tablet that imported from Thailand. Items that can not absolutely compete absolutely are Ampicillin 500 mg. imported from China and produced in Laos. Vitamin B1-6-12 produced in Laos, Cimetidine 400 mg., Diclofenac 25 mg. imported from India and Paracetamol 500 mg. (table 56 appendix).

II. Term of trade by items at minimum and maximum wholesale price.

Term of trade of Amoxycillin 500 mg. are more than 100 in Malaysia, Myanmar, Singapore, Philippines and Laos drug market. Packing loose packed 100 capsule can not be competed in Vietnam with Amoxycillin produced by domestic factories(term of trade 55.42). At maximum wholesale price in Thailand , Amoxycillin can be still

competed in Malaysia(261.61), Myanmar (2,167.13) and Philippines (328.15) as shown in table 72 appendix.

Term of trade of Ampicillin 500 mg. at minimum wholesale price can be competed with drug markets in Malaysia, Myanmar and Philippines but it can not do so in Singapore, Vietnam and Laos.

In Vietnam Ampicillin 500 mg. which is imported from Austria and which is produced by domestic factories are cheaper than the drug from Thailand. As for Laos, Ampicillin 500 mg. which is imported from China and Vietnam and Ampicillin which is produced locally are cheaper than the one imported from Thailand. At maximum price, Ampicillin from Thailand can still compete in Malaysia, Myanmar and Philippines drug market (table 73 appendix).

Antacid has vary packing both loose and strip packed that also different from minimum wholesale price. Loose packed and strip packed Antacid have term of trade more than 100 in 6 ASEAN countries drug market. Term of trade is highest in Myanmar 12252.94 follow by Vietnam (2541.18). This item imported from Thailand. Consideration at minimum wholesale price , term of trade of Antacid loose packed is decrease to 76.09 and strip packed is decrease to 46.05. Term of trade in the rest countries are still higher than 100. Strip packed Antacid at maximum wholesale price is highest in Myanmar 5951.43 and least in Laos 100.00. at minimum wholesale price strip packed Antacid term of trade is less than 100 in Laos. This item are imported from Thailand and produced by Laos manufacturers (table 74 appendix).

Term of trade of Bromhexine 8 mg. at minimum wholesale price are higher than 100 in Myanmar 911051.43), Philippines (1885.71), Malaysia (102.86) and Singapore

(117.14) respectively. Term of trade of this drug in Laos is higher than 100, both are drugs which are imported from Thailand and produced in Laos but the term of trade of drug produced in Laos is 440.00 which is higher than the one imported from Thailand 257.14. Term of trade of this drug in Vietnam is 6262.86. Maximum wholesale price of Bromhexine imported from Thailand can be still competed in Malaysia, Myanmar and Philippines drug market. This drug can be competed in Laos drug market only with the one that is produced in Laos but cannot compete with drug imported from Thailand (table 75 appendix).

Cimetidine 400 mg. has varied wholesale prices and pattern of sale for example this one with loose packed 100 tablets are sold as one unit so researcher present all 3 packing in table 76. Term of trade in Singapore is higher than 100 for Cimetidine with loose packed 100 tablets.

Packing that can compete are loose packed 500 tablets and strip packed only at the minimum wholesale price. In Vietnam this drug with 3 packing cannot compete with one that is imported from Canada. This drug that Laos imported from Thailand and India have term of trade less than 100 at minimum and maximum price (table 76 appendix).

Diclofenac 25 mg. packing loose packed can competed in 6 ASEAN countries at minimum wholesale price. At maximum wholesale price this drug can competed in Singapore and Laos that imported from India. Strip packed can not compete in Singapore and Laos at minimum wholesale price with drug that imported from India (table 77 appendix).

Ibuprofen 200 mg. has term of trade more than 100 in 6 countries at minimum wholesale price. At maximum wholesale price this drug can not compete in Vietnam and Laos. Loose packed of this drug at 500, 1000 tablets at maximum price can be compete with drug that Laos imported from Thailand (table 78 appendix).

Term of trade of Mebendazole 100 mg. in Vietnam is less than 100 at both minimum and maximum wholesale price. In Laos this drug can compete at minimum price with this one that has imported from Thailand (table 79 appendix).

Norfloxacin 200 mg. can be calculated its term of trade in 4 countries Malaysia, Myanmar, Singapore and Philippines because I the rest countries the data is non available. This one from Thailand can compete in 4 countries at both maximum and minimum wholesale price. Loose packed of this drug has highest term of trade 7191.36 in Singapore drug market. While strip packed is highest in Myanmar = 1457.18 (table 80 appendix).

Paracetamol 500 mg. distributed in drug market has 3 patterns. One is packing 100 tablets. It is sole each pack because its comfortable. Second is packing 1000 tablets for retailing and third is strip packed that is very popular. At minimum wholesale price packing 100 and 1000 tablets can not compete with packing 1000 tablets in Vietnam and Laos. For strip packed it can not compete with Paracetamol in Malaysia beside of these 2 countries. Paracetamol that Vietnam import from France and Australia can not compete with Paracetamol all 3 packing from Thailand. Paracetamol distributed in Laos can not compete with Paracetamol packing loose pack imported from Thailand and Vietnam at maximum wholesale price (table 81 appendix).

Vitamin B1-6-12 can not compete in Singapore drug market (term of trade=69.05), Vietnam drug market especially drug that produced by Vietnamese's factory (97.62). Laos drug market that produced in Laos (78.57). Term of trade of this drug is 100 at minimum price when compete with drug that Laos imported from Vietnam. Term of trade of Vitamin B1 6 12 is highest in Myanmar (42504.76) follow by Philippines (1061.90) and Malaysia (852.38) respectively (as shown in table 82 appendix).

4.12 **Capacity increased for export**

Calculation volume of production increased for export extension in 2003 found that Vitamin B1 6 12 can not be increased enough for export (89.22%)follow by Norfloxacin 200 mg. (81.00%), Mebendazole 500 mg.(80.06%) and 100 mg.(79.97%). These drugs are all tablet dosage form that can be increased maximum 68.42%. Capsule dosage form that are exported as Amoxycillin must be increased volume of production 80.49% that equal Ampicillin 500 mg. as seen in table 69.

Table 69 Percentage of production increased for export in 2003

Name	Volume of production 1999 (tablet/capsule)	Volume of production for export	
		Volume of production increase(tablet/capsule)	Percentage
Amoxycillin 500 mg. cap.	111,007,147	89,353,269	80.49
Ampicillin 500 mg. cap.	54,169,224	43,601,399	80.49

Table 69 Percentage of production increased for export in 2003. (cont.)

Name	Volume of production 1999 (tablet/capsule)	Volume of production for export	
		Volume of production increase(tablet/capsul	Percentage
Antacid tab.	1,544,276,558	-62,028,318	-4.017
Bromhexine 8 mg. tab.	194,429,978	-7,809,029	-4.016
Cimetidine 400 mg. tab.	1,410,427,264	-56,652,049	-4.017
Diclofenac 25 mg. tab.	119,810,997	-4,812,623	-4.017
Ibuprofen 200 mg. tab.	144,087,544	-5,786,562	-4.016
Mebendazole 100 mg. tab.	30334286	24257985	79.97
Mebendazole 500 mg. tab.	6,127,440	4,905,370	80.06
Norfloxacin 200 mg.	19,916,623	16,131,607	81.00
Paracetamol 500 mg. tab.	2,341,739,216	-94,058,967	-4.017
Vitamin B1-6-12 tab.	364,285,645	308,268,336	89.22

3 items of drugs that studied both self-sufficiency and extend export are Amoxycillin 500 mg., Diclofenac 25 mg. and Norfloxacin 200 mg. that will be increased 81.88, 25.39 and 81.00% respectively (table 70).

Table 70 Increase production of drugs studied self-sufficiency and export.

Name	Volume of production 1998 (tablet/capsule)	Production for self-sufficiency and export	
		Volume of production increased(tablet/capsule)	Percent
Amoxycillin 500 mg. cap.	111,007,147	90,889,237	81.88
Diclofenac 25 mg. tab.	83,756,515	21,268,869	25.39
Norfloxacin 200 mg.	19,916,623	16,131,607	81.00

Note : exchange rate 1997 is 31.4817 baht per US dollar

exchange rate 1998 is 41.585 baht per US dollar

Source: Bank of Thailand

4.13 Policies affecting export

There is a question whether it is too late to develop drug production industry. Our neighboring countries have accelerated the development of pharmaceutical products so they can be self-reliance soon. Some agencies think that manufacturers do not export because they produce copy or counterfeit drug to supply domestic demand only. Problems in export to ASEAN countries are:

4.13.1 Trade barriers policies such as regulations, technical trade barriers in foreign countries, requirement of certificate from FDA etc.

4.13.2 Control policy on imitated drugs and substandard products. Products that have high volume of distribution in foreign markets will be copied by Thai manufacturers but with substandard quality. This destroys the product image of Thailand. However every sector points that this industry is ready to export although

there are some obstruction such as quality of products, imitated drugs or the country's being a drug transportation pass. These affect the ASEAN countries' confidence for drug quality from Thailand.

4.13.3 Export promotion policies of public sector such as marketing, public relation about GMP of Thai's manufacturers. FDA has developed export promotion such as opening an express way for special cases, labeling certificate according to trade countries although not accepted by domestic regulation. This condition is for export only. Besides, there is a development of GMP certificate, using WHO guideline to be international standard within 1 year. There is a problem about some of the production. FDA's point of view is local manufacturers have high potential but they are not convened. The government sector has to launch a concrete promotion such as an announcement about high quality of local manufacturers and distinguish factories which receive GMP certificate from those which do not.

Since BOI view that pharmaceutical industry at present is formulation, with no research and development so it does not give promotion. It give privilege to every region that produce raw material or semi-finished raw material or conducts development research on this industry. All these regions will receive promotion and maximum profits especially the privilege for equipment used.

4.13.4 Management policies of private manufacturers. Private sectors are ready to export but they must develop some activities if they want to compete with neighboring industry. They lack evaluation of cost-benefit and potential for export so there are in sufficient marketing personnel. Export promotion department needs to know requirement of manufacturers. If manufacturers want to export they can consult with

the export service division. The export promotion department has been a leader for export because Thai manufacturers lack knowledge of export. At present, Thai manufacturers are ready so the export promotion department will change its operational plan.

The problems originated from characteristic of business which was mostly developed from family business that affect the present structure of management although circumstance is rapidly changed but this ideology still prevail. The advantage of former structure is strengthen administrators who have recession thinking while disadvantage are non-acceptance idea of import substitution and extend export. The result is crowded manufacturers in domestic market and ended with severely competitiveness and slow development.

Another disadvantage is that conservative administrators pay attention only to domestic market so they do not get new information and sometimes their information are distorted to find off their competitors. This condition results in negotiation. Although public sector has developed, private sector remains idle. Weakness of private sector is a lack of foreign information, a lack of perspective in development projects and benefits of regulation.

Private sector has been already had an expansion capacity but they have not accepted new approach. As for the public sector, they should provide the local enterprise useful information. Advantages of this industry are ranked from high to low namely, production, export, personnel, quality marketing and raw material production. BOI do not promote development because it thinks that Thai producers are not ready to compete with foreign producers.

Product differentiation is one option to develop but motivation of local manufacturers must consider maximized profit according to theory of the firm.

4.5. Academic policies. Academic institutions should be leaders especially faculties of pharmacy.

4.6. Export promotion policy. It is unlikely for pharmaceutical product to receive support from export promotion department because it has to take care of tap 14-15 important goods while pharmaceutical products are not still categorized in this group.

4.7. Free trade area policies. Impacts from free trade agreements such as AFTA and WTO. Although there is policy of harmonization but some countries use non-tariff barriers to make Thai exporters disadvantage. Public sector cannot subsidize due to free trade agreement. All sectors must realize this problem and collaboration with each other to solve the problems. For example if Thai manufacturers cannot compete with finished products imported from India, we will negotiate on buying only raw materials from India. Win-win situation will be used to reduce trade barriers. India is not a member of AFTA but it is a member of BIMS-TEC. Every sector has to accelerate their effort to solve the problem before Singapore come back to be leader.

Economic commercial department is a direct agency to represent local manufacturers in negotiation with foreign countries. Export promotion department is an intermediate agency to pass some problems to Economic Commercial department.

Raw material tariff is reduced to 1% on August 10, 1999. Tariff rate from 0% to 1% is not a significant impact (0%-5% is accepted as non significance). Government

may worry about their revenue but the tax from local manufacturers revenue that derives from reduction of raw materials tariff will be compensated. If the government does not satisfy, they can calculate from small scale or look at Singapore as the example of success in tariff reduction.

In the future free trade agreement will affect quality of imported raw materials . GPO can not take the role in inspecting and assurance raw materials quality. FDA must take this role if they want to develop pharmaceutical industry in Thailand.

Part 4 Sensitivity analysis

4.14. Sensitivity of variable in comparative advantage

Sensitivity analysis of comparative advantage (DRC/EER) consist of 5 variables. They are

.- Domestic cost of production

.- Foreign cost of production

- Factory price

- Manage Exchange rate

- Effective Exchange Rate

Sensitivity is analyzed by changing the studied variables while fixing other variables. Exchange rate and effective exchange rate are changed together as exchange rate in Thailand is still managed rate. So variable studied ins ratio between exchange rate with effective exchange rate. The result is presented as number of ratio between these 2 rates. If the ratio is more than 1, the government should intervene to devaluate Baht currency. On the contrary if the ratio is less than 1, the government should

intervene to appreciate Baht currency. Sensitivity analysis is changing variables until value of DRC/EER equals 1.00 (critical point) as seen in table 71 appendix.

I. Production of Amoxycillin 500 mg. capsules packing 500.

Movement of variables showed that domestic production cost change in the same way as DRC/EER. DRC/EER increased when domestic cost of production increased. Domestic cost of production that makes DRC/EER increased to 1 is 425.00 Baht or 411.56% increased. Foreign cost of production change in the same way as DRC/EER. Foreign cost of production increased of 987.00 Baht or 52.66% will increase DRC/EER to 1.00. Factory price decrease of 729.00 Baht or 31.85% will increase DRC/EER to 1.

The important variable is ratio of ER/EER. Ratio between ER and EER changes the same way as DRC/EER. ER/EER increases to 5.1 or 413.16% will increase ER/EER to 1. This value show that if ER is less than EER production of Amoxycillin 500 mg., it has comparative advantage. If the government does not interview and allow Baht currency to depreciate more than 5 times of real exchange rate, production of Amoxycillin 500 mg. will begin to loose comparative advantage (table 83 appendix).

Table 71 Changing of variables that make DRC/EER meet critical point.

Name	Packing	Changing / packing			
		domestic cost of production	foreign cost of production	factory price	ER/EER
Amoxycillin 500 mg.	500	425.00	987.00	729.00	5.1
Ampicillin 500 mg.	500	472.00	946.00	709.00	4.00

Table 71 Changing of variables that make DRC/EER meet critical point. (cont.)

Name	Packing	Changing / packing			
		domestic cost of production	foreign cost of production	factory price	ER/EER
Antacid	1000	135.00	145.50	134.00	2.18
	50x10	93.00	96.00	84.50	2.27
Bromhexine 8 mg.	1000	155.00	132.50	72.50	3.25
Cefalexin 250 mg.	100	315.00	472.00	216.00	11.10
	10x10	101.00	251.50	248.50	2.05
Cimetidine 400 mg.	500	328.00	406.00	249.00	3.85
Diclofenac 25 mg.	1000	280.00	265.50	133.50	3.8
Glibenclamide 5 mg.	500	250.00	280.75	98.00	7.6
	1000	258.00	230.00	133.50	3.18
	50x10	417.00	335.00	149.00	3.6
Ibuprofen 200 mg.	500	153.00	199.50	147.50	3.02
	1000	210.00	257.00	208.50	2.6
Ketoconazole 200	100	305.00	563.00	359.50	6.05
mg.	10x10	267.00	417.50	240.50	6.00
	25x10	1350.00	1356.00	194.00	14.6
	50x10	2270.00	2907.00	1127.00	9.3
Mebendazole 100	250	134.00	166.00	201.00	1.58
mg.	1000	143.00	274.10	183.25	5.5
Norfloxacin 200 mg.	100	170.00	190.80	48.40	12.5
	500	665.00	764.00	314.00	6.25
	1000	805.00	1147.00	452.50	15
	5x4	32.00	27.90	15.25	3.3
	10x10	203.00	236.70	62.50	15

Table 71 Changing of variables that make DRC/EER meet critical point. (cont.)

Name	Packing	Changing / packing			
		domestic cost of production	foreign cost of production	factory price	ER/EER
	50x10	290.00	285.00	326.00	1.74
Paracetamol 500 mg.	100	10.20	11.60	9.83	2.42
	1000	113.00	127.00	128.00	1.98
	50x10	181.00	101.00	149.00	1.56
	100x10	67.00	54.00	119.50	1
Piroxicam 10 mg.	500	210.00	145.50	122.00	2.25
	1000	342.00	302.00	186.00	3.03
	10x10	25.55	18.20	36.60	1.15
Propanolol 10 mg.	1000	570.00	505.00	74.50	8.4
Ranitidine 150 mg.	10x10	1550.00	1948.00	705.00	10.1
Vitamin B1-6-12	500	185.00	213.50	105.40	4.85
	1000	240.00	293.50	157.50	4.65

II. Production of Ampicillin 500 mg. capsule packing 500 capsules.

Domestic cost of production changes in the same direction with DRC/EER. Domestic cost of production increases to 300.71%. So as 1 Foreign cost of production which changes in the same direction as DRC/EER and can increase 59.73%. Factory price decrease to 33.31% or to 709.00 Baht. If ratio between ER and EER increase more than 4, the production of Ampicillin 500 mg. will loose its comparative advantage (table 83 appendix).

III. Production of Antacid tablet packing loose packed 500 tablets and strip packed 50x10 tablets

Domestic cost of production of loose packed Antacid can increase to 135.00 Baht or 118.91% which will increase DRC/EER to 1. Foreign cost of production increase to 145.50 Baht or 100.55% which will increase DRC/EER to 1. Factory price decrease to 134.00 Baht or 35.20% will increase more than 2.18 in loose packed, and 2.27 in strip packed will increase DRC/EER to 1 (table 83 appendix).

IV. Production of Bromhexine 8 mg. tablet packing 1,000 tablets.

Domestic cost of production, foreign cost of production and ratio between ER and EER change in the same way as DRC/EER. If domestic cost of production can increase to 155.00% or foreign cost of production to 132.50%, or ER/ER increase 3.25 times, production of Bromhexine 8 mg. will begin to loose comparative advantage. Factory price decrease to 72.50 Baht, DRC/EER increase to 1 (table 83 in the appendix).

V. Production Cefalexin 250 mg. capsule packing loose packed 100, 500 capsule and strip packed 10x10 capsules.

Production of Cefalexin 250 mg. in 1996 had high comparative advantage because factory price was so high that domestic cost could increase to 1018.21% or increase from 28.17 Baht to 315.00 Baht. Foreign cost could increase from 187.87 Baht to 472.00 Baht or 151.24%. Factory price could decrease from 500.00 Baht to 216.00 Baht. Ratio between ER and EER could increase 1016.87% or 11.10 times. Packing loose packed 500 capsules and strip packed had less comparative advantage than items mentioned above. Domestic cost could increase 175.70% and 106.12% respectively. Foreign cost could increase 20.48 and 25.75%. factory price could decrease 15.50 and 17.17% while packing loose packed 100 capsules could decrease

56.80%. Ratio between ER/EER could increase 174.69 and 106.27% as shown in table 83 in the appendix.

VI. Production Cimetidine 400 mg. tablet packing loose packed 500 tablets.

Domestic cost can increase 287.43% or increase to 328.00 Baht while foreign cost can increase 146.05% and ratio between ER/EER can increase 287..38% but factory price can decrease to 249.00 Baht from 490.00 Baht (table 83 appendix).

VII. Production Diclofenac 25 mg. tablet packing loose packed.

Domestic cost can increase from 73.21 Baht to 280.00 Baht while foreign cost can increase 336.46%. Factory price can decrease to 133.50 Baht. Baht currency can devaluate to 3.8 times when compared with real exchange currency (table 83 appendix).

VIII. Production Glibenclamide 5 mg. tablet packing loose packed 500,1000 tablets and strip packed 50x10 tablets.

Production Glibenclamide 5 mg. packing loose packed 500 tablet has the highest comparative advantage followed by packing strip packed and the last one is packing loose packed 1,000 tablets. Domestic cost can decrease 668.99, 259.48, 219.47% respectively. Foreign cost can increase 68.70, 66.89, 56.94% respectively.

Baht currency can devaluate until when compared with real exchange rate is 7.6, 3.6, and 3.18 times respectively (table 83 appendix).

IX. Production of Ibuprofen 200 mg. tablet packing loosed packed 500, 1000 tablets.

Domestic cost can increase to 202.49% for production of packing loose packed 500 tablets and 161.42% for production packing loose packed 1,000 tablets.

Production of Ibuprofen 200 mg. packing loose packed 500 and 1,000 tablets. Foreign cost can increase 104.78 and 99.81 respectively. Factory price can decrease to 41..00, 38.07% respectively. DRC/EER will increase to 1 when ratio between ER and EER is increase to 3.02 and 2.6 for packing 500 and 1,000 tablets respectively (table 83 appendix).

X. Production of Ketoconazole 200 mg. tablet packing loose packed 100 tablets.

Production of Ketoconazole 200 mg. packing strip packed 10x10 tablets have the highest sensitivity because domestic cost can increase to 502.44% while packing 100's, 25x10 and 50x10 can increase to 510.00, 1369.31 and 829.19% respectively.

Foreign cost of production for packing 25x10's has lowest sensitivity because it can increase 1225.38% while packing 100 tablets, 10x10 and 50x10 tablets can increase 81.61, 112.48 and 229.01 respectively, as contrast to factory price that can decrease in packing 100, 10x10, 25x10, 50x10 to 41.31, 47.87, 86.60 and 64.22 respectively. Ratio between exchange rate and effective exchange rate can increase to 508.74, 503.71, 1369.04 and 835.76% for packing 100, 10x10, 25x10 and 50x10 respectively (table 83 appendix).

XI. Production Mebendazole 100 mg. tablets packing loose packed 250, 1000 tablets.

Domestic cost, foreign cost and exchange rate change the same way as DRC/EER that reverse to comparative advantage because if DRC/EER is more than 1. It shows that production of this item lost opportunity cost more than other items. Production Mebendazole100 mg. packing 500 and 1000 tablets can increase domestic

cost 58.13 and 450% respectively to make DRC/EER=1. Foreign cost can increase 42.28 and 74.23% for packing 500 and 1000 tablets. Factory price can decrease 19.60 and 38.92% respectively. Ratio begin to loose comparative advantage is 1.58 and 5.5 for packing 500 and 1000 tablets (table 83 appendix).

XII. Production Norfloxacin 200 mg. packing loose packed 100, 500, 1000 tablets and strip packed 5x4, 10x10, 50x10 tablets.

Production Norfloxacin 200 mg. packing loose packed 100, 500 and 1,000 tablets have comparative advantage until domestic cost increase 1156.47, 528.78 and 1404.67%. Foreign cost increase to 446.39, 265.71 and 187.11%. Factory price is decrease 76.31, 63.87 and 62.29. Ratio between ER and EER increase to 12.5, 6.25 and 15 respectively. DRC/EER of packing strip packed 5x4, 10x10, 50x10 increase to critical point when domestic cost is increase 234.38, 1413.80 and 75.48 respectively. Foreign cost increase 388.62,388.45 and 75.38%. Factory price is decrease 59.20,75.12 and 27.56%. Ratio between ER and EER increase to be 3.3, 15 and 1.74 respectively (table 83 appendix).

XIII. Production Paracetamol 500 mg. tablet packing loose packed 100 and 1000 tablet, strip packed 50x10, 100x10 tablets

Production Paracetamol 500 mg. tablet packing loose packed 100 and 1000 tablets have DRC/EER less than 1 and will increase to 1 if domestic cost increase 142.86 and 98.56%. Foreign cost increase 105.31 and 78.18%. Factory price is decrease 37.77 and 30.21%. Ratio between ER and EER increase 143.50 and 99.3% respectively. Paracetamol 500 mg. packing strip packed 100x10 is more sensitive than packing 50x10 because domestic cost can increase 189.98 and 1.26%. Factory price

can decrease 30.70 and 0.23%. Ratio between ER and EER can increase 56.97 and 0.62% respectively (table 83 appendix).

XIV. Production Piroxicam 10 mg. capsule packing loose packed 500 and 10000 capsule and strip packed 10x10 capsules.

Production Piroxicam 10 mg. capsule packing loose packed 500 and 1,000 capsules have less sensitivity than strip packed. Domestic cost can increase 125.71, 203.08 and 15.91. Foreign cost can increase 393.05, 309.71 and 23.39. Factory price can decrease 48.74, 55.10 and 8.50. Ratio between ER and EER can increase 126.39, 204.88 and 15.71 respectively (table 83 appendix).

XV. Production Propanolol 10 mg. tablet packing 1000 tablets.

Variables that change in the same way s DRC/EER are domestic cost, foreign cost and ER/EER ratio that can increase 746.58, 6696.77 and 745.20 respectively while factory price decrease 89.98% will increase DRC/EER to 1 (table 83 appendix).

XVI. Production Ranitidine 150 mg. tablet packing10x10 tablets.

DRC/EER will increase to 1 when domestic cost increases to 912.01% or foreign cost increases to 252.43% or factory price decreases to 66.43% and Baht currency devalue to be 10.1 time to real exchange rate or increase 916.25% (table 83 appendix).

XVII. Production Vitamin B1 6 12 tablet packing 500, 1000 tablets.

DRC/EER of Vitamin B 1 6 12 will increase to critical point if domestic cost increases to 388.26 and 365.12%. Foreign cost increases to 215.69 and 176.76%.

Factory price decreases 58.02 and 54.34%. Baht currency devaluate to 4.86 and 4.65 times of real exchange rate (table 83 appendix).

4.15 Sensitivity Analysis of term of trade

Variables studied sensitivity are 4 values such as

a. Wholesale price of 11 selected drugs in foreign countries that are changed from 2 conditions. First is pricing and second is the changing exchange rate in that country.

b. Wholesale price of 11 selected drugs in Thailand.

c. Insurance premium

d. Transportation fee

(table 84 in appendix)

I. Sensitivity analysis of term of trade in Laos

Changing wholesale price of 11 selected drugs in Laos showed that items that have unfavorable movement are Amoxycillin 500 mg. capsule produced in Laos. Antacid produced in Laos, Bromhexine 8 mg. tablet produced in Laos, Diclofenac 25 mg. tablet produced in Laos, Ibuprofen 200 mg imported from Thailand, Mebendazole 100 mg. impored from Thailand, Paracetamol 500 mg. packing 100 and 1000 tablets produced in Laos. If the wholesale price is increased term of trade is increased to 100. Items with high sensitivity is Antacid packing 10x10 because wholesale price in Laos is increase 6.76% will increase term of trade to 100 follow by Mebendazole 100 mg. packing 6x12(7.67%), Paracetamol 500 mg. packing 100 tablets (9.64%), Amoxycillin 500 mg. strip packed 10x10(22.64%), Diclofenac 25 mg. strip packed 10x10 imported from India(38.67%), Bromhexine 8 mg. strip packed

10x10(70.13%), Ibuprofen 200 mg. loose packed 500's(70.61%), Diclofenac 25 mg. strip packed 10x10 produced in Laos(70.73%) and Paracetamol 500 mg. loose packed(89.93%). Other items that term of trade are more than 100 sensitivity of them mean that wholesale price of drugs imported from Thailand are advantage until wholesale price in Laos decrease to percent that calculated. For example Ampicillin 500 mg. that Laos imported from Vietnam can be decrease wholesale price 193.375% that exporters from Thailand can still compete. Other items are Cimetidine 400 mg. strip packed 10x10 imported from India(151.21%), Mebendazole 500 mg. produced in Laos(23.76%), Paracetamol 500 mg. packing 10x50 imported from Vietnam (170.59%), Vitamin B1 6 12 packing 120x10 imported from Vietnam (23.21%), produced in Laos(4.55%). These results show that Vitamin B 1 6 12 that produced in Laos has highest sensitivity (table 85 appendix).

Table 84 Sensitivity of term of trade by countries.

Name	trade market	foreign wholesale price	Thailand wholesale price	transportation fee(%)	insurance premium(%)
Amoxycillin 500 mg.	Laos	2.1275	2.3913	38.65	43.64
	Malaysia	2.1275	11.5540	60820	61320
	Myanmar	2.1275	56.9200	342840	343309
	Philippines	2.1275	14.4950	79110	79610
	Singapore	2.1275	0.9460	-	-
	Vietnam	2.1275	0.7983-2.6217	35.95-52.97	40.95-57.98
Ampicillin 500 mg.	Laos	2.8750	0.8522	-	-
	Malaysia	2.8750	3.4590	4912	5412
	Myanmar	2.8750	95.7300	429350	429850

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Amoxycillin 500 mg.	Laos	2.1275	2.3913	38.65	43.64
	Malaysia	2.1275	11.5540	60820	61320
	Myanmar	2.1275	56.9200	342840	343309
	Philippines	2.1275	14.4950	79110	79610
	Singapore	2.1275	0.9460	-	-
	Vietnam	2.1275	0.7983-2.6217	35.95-52.97	40.95-57.98
Ampicillin 500 mg.	Laos	2.8750	0.8522	-	-
	Malaysia	2.8750	3.4590	4912	5412
	Myanmar	2.8750	95.7300	429350	429850

Table 84 Sensitivity of term of trade by countries. (cont.)

Name	trade market	foreign wholesale price	Thailand wholesale price	transportation fee(%)	insurance premium(%)
	Philippines	2.8750	13.4740	50980	51480
	Singapore	2.8750	1.2416	-	-
	Vietnam	2.875	0.7043-2.2540	-	-
Antacid	Laos	0.3450	0.3217	13.33	18.33
	Malaysia	0.3450	1.1761	34085	.34585
	Myanmar	0.3450	20.6980	782400	782900
	Philippines	.3450	3.0515	105970	106470
	Singapore	0.3450	0.8277	20730	21230
	Vietnam	0.4255	3.5216	984.60	989.60
Bromhexine 8 mg.	Laos	.4600	1.3391	275.00	280.00
	Malaysia	.4600	3.0561	76865	77365
	Myanmar	0.4600	33.6350	956000	956500
	Philippines	.4600	5.7375	153950	154450
	Singapore	0.4600	0.3547	-	-
	Vietnam	.4600	0.1878	-	-
Cimetidine 400 mg.	Laos	2.5875	0.8956	-	-
	Malaysia	2.5875	27.6720	130445	130940
	Myanmar	2.5875	41.3950	200570	201070
	Philippines	2.5875	17.1880	768500	77350
	Singapore	2.5875	2.1678	-80.00	-580.00
	Vietnam	2.5875	1.5965	-	-
Diclofenac 25 mg.	Laos	0.1840-0.8050	0.2608-2.3912	77.50-282.85	82.50-287.85

Table 84 Sensitivity of term of trade by countries. (cont.)

Name	trade market	foreign wholesale price	Thailand wholesale price	transportation fee(%)	insurance premium(%)
	Malaysia	0.1840	4.2635	295430	295940
	Myanmar	0.1840	160.41	11518000	11519000
	Philippines	0.1840	7.4160	522000	522500
	Singapore	0.1840	.3941	17330	17830
	Vietnam	0.8050	0.5869	-	-
Ibuprofen 200 mg.	Laos	0.2645	0.7826	281.30	280.00
	Malaysia	0.2645	1.9890	88450	88950
	Myanmar	0.2645	20.6980	1023900	1024400
	Philippines	0.2645	5.5335	265670	266170
	Singapore	.8050	1.9708	21376	21876
	Vietnam	0.2645	0.4695	124.78	129.78
Mebendazole 100 mg.	Laos	1.9205	1.8087	14.55	19.55
	Malaysia	1.9205	14.4130	88250	88750
	Myanmar	1.9205	429.50	2946500	2947000
	Philippines	-	-	-	-
	Singapore	-	-	-	-
	Vietnam	1.9205	.2113	-	-
Mebendazole 500 mg.	Laos	14.95	10.5040	-	-
	Malaysia	-	-	-	-
	Myanmar	14.95	181.10	149210	149710
	Philippines	1.9205	14.6090	89600	90100
	Singapore	-	-	-	-

Table 84 Sensitivity of term of trade by countries. (cont.)

Name	trade market	foreign wholesale price	Thailand wholesale price	transportation fee(%)	insurance premium(%)
	Vietnam	14.95	1.1739-1.2913	-	-
Norfloxacin 200 mg.	Laos	-	-	-	-
	Malaysia	3.68	44.45	148750	149250
	Myanmar	-	-	-	-
	Philippines	3.68	37.4140	123450	.123950
	Singapore	-	-	-	-
	Vietnam	-	-	-	-
Paraacetamol 500 mg.	Laos	0.1265-0.4600	0.1217-1.1913	17.27-1031.70	22.27-1036.67
	Malaysia	.1265	0.3113	21546	22046
	Myanmar	0.1265	34.4960	3595500	3596000
	Philippines	.1265	1.5621	152310	152810
	Singapore	.1380	2.3650	215650	216150
	Vietnam	0.1380	.0939-1.1739	396.23	401.25
Vitamin B1-6-12	Laos	0.3450-0.5175	0.2869-0.3652	-	
	Malaysia	.3450	3.1132	108340	108840
	Myanmar	0.3450	155.24	5939500	-
	Philippines	.3450	11.7390	439000	439500
	Singapore	.3450	1.5766	49440	49940
	Vietnam	.3450	0.521-3.8740	25.00-1375.00	30.00-1380.00

Wholesale price from Thailand change in the opposite direction of the term of trade. Items that can increase the wholesale price are Amoxycilln 500 mg. packing 10x10(29.26%), Antacid (7.23%), Bromhexine(234.78%), Diclofenac 25 mg. (63%), Ibuprofen (240.26%), Mebendazole (8.31%), Paracetamol 500 mg. packing 1000 tablets (10.64%) respectively. On the other hand items that have the term of trade less than 100 means that the wholesale price from Thailand must decrease to make the term of trade increase to 100. These items are Ampicillin 65.91, Cimetidine 60.20, Mebendazole (19.20), Paracetamol 63.05, Vitamin B 1 6 12 18.84 respectively (Table 86 appendix).

Insurance premium and transportation fee change in the opposite way with the term of trade. The results from calculation of Amoxycillin 500 mg. are if insurance premium can be increased to 38.65% and transportation fee to 43.64% the term of trade will decrease to 100. Insurance premium of Antacid can be increased 13.33% and transportation fee 18.33% respectively. Bromhexine 8 mg. can increase insurance premium 275.00% and transportation fee 280.00%. Paracetamol 500 mg. has the least sensitivity as can be calculated because insurance premium can be increased to 1031.70% and transportation fee can be increased to 2053.40%. Ampicillin, Cimetidine, Mebendazole, Paracetamol, Vitamin b1 6 12 have too low sensitivity to be calculated (table 87 appendix).

II. Sensitivity analysis of term of trade in Vietnam

Price competition in Vietnam drug market is similar to that of Laos drug market because some items can compete while other items can not compete. For example analysis of sensitivity some item's wholesale price must be decreased while

some item's wholesale price must be increased. The critical point is the value of variable that is used in calculation and make the term of trade equal 100. Items that can compete in Vietnam drug market are Ampicillin 500 mg. that is imported from Austria, France and Australia. Wholesale price of these drugs can decrease 21.20, 29.44 and 21.20 percent respectively. Thai exporters begin to lose competitiveness. Antacid that is exported from Thailand can increase wholesale price to 89.49% therefore new Thai exporter still compete in Vietnam drug market. Ibuprofen 200 mg. produced in Vietnam can decrease wholesale price 51.02%. Thai exporters can compete only Paracetamol 500 mg. imported from France and Australia that wholesale price in Vietnam can be reduced to 77.28 and 89.78 percent respectively. Items that Thai exporters can compete if wholesale price in Vietnam increase are Amoxycillin 500 mg. produced in Vietnam. It will be increased wholesale price to 131.75% that increase term of trade to 100. Ampicillin 500 mg. imported from Austria is highest sensitivity because wholesale price increased 10.92% will increase the term of trade to 100. Mebendazole 500 mg. product of Janssen produced in India has lowest sensitivity because its wholesale price can decrease to 1007.41% so Thai exporters can still compete in Vietnam drug market.

Sensitivity study by changing wholesale price from Thailand found that item that has highest sensitivity is Ampicillin 500 mg. imported from Austria because this product from Thailand can be increased 9.84%. The item that has lowest sensitivity is Vitamin B 1 6 12 imported from France because the wholesale price of this product from Thailand can be increased to 1191.33% (table 89 appendix).

Sensitivity studied by changing insurance premium rate and transportation fee found that insurance premium rate can be increase from 5% to 40.95%. Thai exporters still compete with Amoxycillin 500 mg. imported from Austria. Vitamin B 1 6 12 import from France has lowest sensitivity because insurance premium rate increase 25%. The same as premium insurance rate, transportation fee can be increased to 13700% therefore the term of trade is reduced to 100. Vitamin B 1 6 12 produced in Vietnam still be competed by Thai exporters until transportation fee is increase 30.00% (table 90 appendix).

III. Sensitivity Analysis of term of trade in Singapore

Items that must be increased wholesale price in order to increase term of trade are Amoxycillin 500 mg.. Thai exporters can compete if it is increased to 95.56% of wholesale price and increase term of trade to 100.

Ampicillin 500 mg. must be increased to 101.35%, Bromhexine 8 mg. 12.76%. Cimetidine 400 mg. has highest sensitivity because it is increased only 3.79% which will increase term of trade to 100. Items that decrease wholesale price will decrease term of trade to 100 are Antacid which can reduce 63.76%, Diclofenac 59.41%, Ibuprofen 200 mg. 64.48%, Paracetamol 94.93%, and Vitamin B1 6 12 80.97% respectively (table 91 appendix).

Wholesale price of drugs from Thailand changes in the opposite way with the term of trade so items that have the term of trade more than 100, can increase wholesale price to the critical point. These drugs are Antacid which can increase wholesale price 175.90%. Diclofenac 25 mg, Ibuprofen 200 mg., Paracetamol 500 mg. and Vitamin B 1 6 12 .can increase 146.31, 181.54, 1870.83 and 425.53% respectively. Items that

reduced wholesale price to compete in Singapore drug market are Amoxycillin 500 mg.(48.86%), Ampicillin 500 mg.(50.34%), Bromhexine 8 mg.(11.33%), Cimetidine 400 mg.(3.65%) respectively (table 92 appendix).

Sensitivity of insurance premium rate and transportation fee are very low. Cimetidine 40 mg. has highest sensitivity that insurance premium reduce 84.00% or transportation fee reduce 42.00%. This makes the term of trade increase to 100. Items that have too low sensitivity to calculate are Amoxycillin 500 mg., Ampicillin 500 mg. and Bromhexine 8 mg. Mebendazole can not be calculated because its data are not available (table 93 appendix).

IV. Sensitivity analysis of term of trade in Malaysia

All items have more than 100 for the term of trade except Mebendazole 500 mg. of which data are not available. Sensitivity of term of trade derived from reduction of wholesale price of drugs in Malaysia. Ampicillin 500 mg. has highest sensitivity because its price can be changed only 27.73% followed by Paracetamol 14.67%, Antacid 14.49%. Diclofenac 25 mg.has lowest sensitivity because it can reduce wholesale price to 96.25% (table 94 appendix).

Wholesale price from Thailand change in the opposite way with the term of trade. All items exported from Thailand have the term of trade more than critical point which mean that if the term of trade reduces to 100 wholesale price of Thai's exports can increase. For example Ampicillin 500 mg. has highest sensitivity because it can increase wholesale price only to 38.36%. Other items have low sensitivity because they can increase from 183.00-2564.69%. These items are Paracetamol 500 mg. and Diclofenac 25 mg. (table 95 appendix).

Insurance premium and transportation fee change in the opposite way with the term of trade so reduction term of trade in Malaysia drug market to critical point will increase both rates. Sensitivity analysis found that insurance premium has low sensitivity. Diclofenac 25 mg. is the lowest sensitive item because it can increase insurance premium from 10% to 2954.30% or an increase of 58,986.00%, transportation fee increase from 5% to 2,959.40% or an increase of 29,494.00%. Ampicillin 500 mg. is highest sensitive item because insurance premium can increase to an 49.12% or an increase of 882.49% and transportation fee increase to 54.12% or an increase 441.20% (table 96 appendix).

V. Sensitivity analysis of term of trade in Philippines

Term of trade of all items in Philippines drug market are similar to that of Malaysia because all items show favorable movement in Philippines. All items must be reduced wholesale price in Philippines in order to decrease term of trade to 100. For example Ampicillin 500 mg. has highest sensitivity. Its wholesale price reduces to 81.45% which makes the term of trade decrease to 100. Diclofenac 25 mg. is lowest sensitive item because its wholesale price can decrease to 97.84%. Percentage of wholesale price reduction of each item is closely from 81.45-97.84% (table 97 appendix).

Variable that affects the term of trade in opposite with the wholesale price in Philippines is the wholesale price from Thailand. Sensitivity analysis found that wholesale price of all items from Thailand will increase in the range of 438.96 to 4535.00% which means that sensitivity of wholesale price from Thailand is low.

Diclofenac 25 mg. is lowest sensitive item because it can increase wholesale price 4535.00% followed by Vitamin B 1 6 12 (3813.00%), Ibuprofen 200 mg.(2305.87%), Bromhexine 8 mg.(1334.38%), Paracetamol 500 mg.(1320.09%) and Norfloxacin 200 mg.(1069.19%) respectively (table 98 appendix).

Raising of insurance premium and transportation fee will decrease term of trade. The 2 variables are low sensitivity. Insurance premium increases 10,096.00-104,300.00% and transportation fee increases 5048.00-52150.00%. Diclofenac 25 mg. is lowest sensitive items and Ampicillin 500 mg. is highest sensitive item as shown in table 99 appendix.

VI. Sensitivity analysis of term of trade in Myanmar

All items imported by Myanmar have term of trade more than 100 so reduction term of trade to 100 must decrease wholesale price in Myanmar. Percentage of reduction is in the range of 92.82-99.68%. Mebendazole 500 mg. is highest sensitive item because it can decrease wholesale price 92.82% followed by Cimetidine (94.56), Amoxycillin(96.75), Ampicillin(97.39), Antacid(98.55), Bromhexine(98.81), Ibuprofen(98.89), Mebendazole 100 mg.(99.61), Paracetamol(99.68) and Diclofenac (99.90) respectively(table 100 appendix).

Increase wholesale price of Thailand will decrease term of trade to 100. Sensitivity analysis found that Mebendazole 500 mg. is highest sensitive item that increase 1293.08% while term of trade decrease to 100follow by Cimetidine (1739.78), Amoxycillin(2976.76), Ampicillin(3729.20), Antacid(6799.33), Bromhexine(8308.75), Ibuprofen(8899.13), Mebendazole 100 mg.(252618.56), Paracetamol(31260.00). Diclofenac is lowest sensitive item that can increase 100,156.25% (table 101 appendix).

Insurance premium and transportation fee have low sensitivity. Insurance premium change in the range from 29,742.00%-2,303,500.00% and transportation fee increase in the range of 14,871.00-1,151,800.00%.

Mebendazole 500 mg. is highest sensitive item and Diclofenac 25 mg. is lowest sensitive item (table 102 appendix).

CHAPTER V

DISCUSSION

The results of the study both in quantitative and qualitative methods show a consistency with data derived from drug manufacturers and from the National Statistical office, office of the Prime Minister, which in 1997 conducted an Industrial census No.2 concerning manufacturing industry. The data is to be used for policy setting and plans for the development of manufacturing industry in Thailand. It is also in consistent with the data from the Food and Drug Administration, Ministry of Public Health whose duties include gathering data on drugs. Comparing data distributing with population to ensure that the data gathered represent total population.

The results can be classified into 4 groups they are:

5.1 Production Cost

5.2 Self – sufficiency Potential and Export

5.3 Expansion sufficiency

5.4 Guidelines for Development

5.5 Comparison of Foreign policies on Pharmaceutical industry.

5.1 Production cost

Production cost consists of structure of production cost, domestic cost and domestic resource cost.

5.1.1 Structure of Production Cost

The calculation of the percentage of structure of production cost shows differences in each drug. The percentage cost of active ingredients ranges from 5.86 to 87.68, non – active ingredients cost ranges from 0.59 to 43.41, labor cost ranges from 0.30 to 30.20, direct overhead cost ranges from 0.79 to 35.47 while indirect overhead cost ranges from 0.31 to 16.81. In some drug factories there is no clear – cut information on direct and indirect overhead cost thus deterred the data to some extent. From the calculation, percentage cost of active Ingredients in antibacterial drugs is higher than that of other products, while percentage cost of packaging materials is high for drugs contained in a pack.

A study by Kwanjai Rattanarodjanasakul in 1986 showed that manufacturing cost consists of 81% of raw materials, 7% of packaging materials, 6% of labor cost, 1% of water, electricity and other sources of energy, and 5% of maintenance and depreciation cost. When comparing these figures with structural production cost being studied in this research, it is obvious that the study covers those studied earlier. However, averaging these components may not reveal any other details except for the grouping of doses forms and packaging types (see table 92 in the appendix)

In comparing with Kwanjai's study, it is noted that the present cost of raw materials is lower than in 1986. This may be because of the increasing number of raw material producers around the world that leads to price competition and reduction.

According to the 1997 Industrial census, the structure of drug production consists of 54.3% of raw materials and other component cost, 14.68% of

manufacturing cost, 193*99% of operating (indirect) cost, and 11.03% of other costs. It must be pointed out that the average cost of raw materials shown in the census is lower than that of this study.

This is due to the fact that in their calculation, the National Statistical office had included the cost of herbal products in the cost of raw materials, therefore, lessen the average cost. In examining the cost of drug production item by item, it is found that difference in cost of production is between dosage form and packaging. However, in cost average the difference is between packaging cost of capsule and tablet dosage form made into a pack. This difference may be the result of using unequal number of data in averaging cost since only 2 items of capsular drug have been used in comparing with 15 items of drug tablets. The result is the diversity of percentages of packaging cost.

A study of profit proportion in various drug distributions channels in comparison with a report from a sub- working-group on procurement and distribution of drugs in Thailand in 1994. With an assumption of equal cost of production, shows that local manufacturers gain less profit than imported drugs or original drugs of the same packing. The calculation is based on profit percentages of factory price, original drug wholesale price, the Ministry of Public Health control price, the Government Pharmaceutical Organization selling price, and wholesale price of local manufactures.

It has been specified that the structure of drug imported price composes of 35% of production cost, 35% of profit including import tariff, and 30% of sales promotion and other expenditure. This means that the value-added of drugs counts for up to 65 in 100 from manufacturing cost or 185.71 percent. However, it should be

noted that in some cases such as in Propanolol 30 mg., the value-added price of drug from the original manufacturer exceeded the calculated price due to the expiration of patent protection. Furthermore, the profit percentage of drugs sold by the G.P.O. is higher than that of local manufacturers. The least profit percentage is of drugs sold to various organizations within the Ministry of Public Health using control price. This poses the problems of whether the G.P.O. should use quality control strategy as a competitive tool to compete with local manufacturers in the future, and whether increasing in the percentage of profit given to manufactures in Thailand will encourage growth in research and development. (table 93 in the appendix) these value-added prices indicate that the competitive of drugs from various sources of manufacturing is not only determined by comparative advantage but also competitive advantage.

5.1.2 Domestic and Foreign Cost

There is no record on the study of domestic cost as separated from foreign cost. However, it is presumed that foreign cost cover total cost of raw materials used in drug production since manufacturers in Thailand prefer imported materials to locally produced materials due to the lower price. Furthermore, some of the non-active ingredients such as corn starch have to be imported because Thailand is still unable to produce these ingredients suitable to be used in drug production. It is evident that domestic cost averages differ from 10.54% to 94.14% depending on drug items and types of packaging. The domestic cost of capsule dosage form especially those contained in a strip packed is usually higher than the others because the cost of packaging material and labor cost are mostly domestic cost. At present Thailand can produce empty capsules using local raw materials thus make it a domestic cost.

5.1.3 Domestic Resource Cost (DRC)

At present, there is no report on the finding of the itemized of domestic resources cost used in the production of finished drugs. This cost is an indicator of comparative advantage. A study of comparative advantage using RCA as an indicator indicates that Thailand possesses comparative advantage in total drug manufacturing. The increase in value of this indicator may be the result of the increasing skill of labors. However, using DRC as a measure of comparative advantage made it possible to observe changes in the component of production cost in relation to changes in comparative advantage. This is especially true for direct effect factors such as domestic cost and foreign cost. This indicator shows the proportion of domestic resource cost being using effectively by taking in foreign currencies. It also indicates the movement of the proportion cost of production. Though it seems that the lower the cost of domestic resource in drug production, the lower the DRC which is favorable, but in reality, there is a clear-cut movement if stable DRC is desired. It means that decreasing in domestic cost will be resulting in increasing foreign cost therefore increasing the DRC. In such case it is necessary to increase selling price to keep balance if the stability of DRC is still required since DRC will be affected by price increase.

Thus it is suitable to use DRC in calculating comparative advantage in each item of drug especially it perform by drug manufacturers. By using accurate data in detail i.e. calculating domestic cost apart from foreign resource cost, separating each unit cost increasing details on hidden domestic and foreign indirect cost such as tax, tariff, import fee and 40 on will enable us to see in more details of each drug item being

calculated. Using average cost of production and factory price as basics for calculating comparative advantage of the 18 drugs may not be totally reliable if the data used is from different sources. This mean that a factory may give only production cost of a certain drug without giving information on factory price. As a consequence, factory price may not correlate with the cost of production. Taking Cefalexin 250 Mg. Capsules contained in a bottle of 100 capsules as an example, the factory had quoted only production cost thus factory price was quoted instead from a report on drug production prepared by Drug control division, the Food and Drug Administration.

It can be pointed out from comparative advantage that opportunity cost is less than income gained even though foreign cost is of higher proportion. In other words, in pharmaceutical industry, importing raw materials from abroad does not pose any problem in promoting domestic drug manufacture when using opportunity Cost and comparative advantage as basis for consideration. Being a high value-added commodity is an advantage for drug.

For the lowest cost of production comparative advantage is gained on every item but for the high cost of production drugs such as Paracetarnol 500 mg. contained in a bottle of 1,000 tablet or contained in a pack of 50 x 10 tables, the advantage is diminishing as the result of using factory price as an average where total cost of production is of the highest. Therefore, if DRC calculation is based on factory price from the factory having the highest total cost of production, the DRE will change. As for a pack of Paracetamol 50 x 10 tablets, the DRC is equal to 17.00 and DRC/EER is equal to 0.65 while a bottle of 1,000 Paracetamol tablet the DRC is equal to 12.39 and DRC/EER is equal to 0.47 this means that at the 1996 selling price the 2 types still

gain comparative advantage. This study comes to the conclusion that the government should promote the production of finished drugs in Pharmaceutical industry since it will bring benefits to the country not only in terms of the economic aspect of increasing national revenue and reducing national expenditure, but also in the security aspect of being self-reliance. Also the access to drugs of reasonable prices will certainly bring good health to the public.

Aside from the study of DRC of selected drugs manufacturing which indicate that pharmaceutical industry is worth promoting, there is another supportive reason why the industry should be promoted. In Thailand most of pharmaceutical factories regardless of size are owned by the Thai nationalities. These factories produce drugs of there own brand identities and other brand names as they are contracted by Thai manufactures and distribution (see table 33 in the appendix) this shows that Thai manufactures have potential in producing drugs as well as marketing the commodities.

Interest should be placed on Horse factories employed to produce drugs under Thai brand names Some of these factories may have potentials in producing drugs which required high technology and expertise. This group of factories is usually specialized in research and development, while the other group is capable of drug production but less in market development. There fore it this later group of factories get assistance in marketing promotion, they will be able to expand the market locally and abroad.

5.2 Self – sufficient Potential and Export

5.2.1 Competitive Advantage

According to DRC calculation, it can be concluded that pharmaceutical industry is a comparative advantage industry or industry with low opportunity cost. However, this indicator is only a fundamental figure indicating that drug is a commodity Thailand should produce for self-sufficient instead of import. Thus, it is necessary to conduct market researches in foreign countries. This can be through another indicator called Term of Trade. Since drug commodity differs in doses form, it is assumed that these three aspects are equal in a specified drug in the market thus unit price can be calculated by comparing price per tablet. Up to the present time, there is no report on the application of Term of trade in determining competency of drug manufactures in price competition. So this may not be the best indicator in evaluating whether the price of drug commodity from Thailand can compete with those in the foreign countries being studied. Furthermore, lack of data in details such as of drug distributors in Singapore made the analysis unclear to a certain extent.

Out of six ASEAN countries being studied in the Term of trade there are three of them whose data is not yet obtained. They are Indonesia, Cambodia and Brunei. The study shows that Thailand can compete with Malaysia, Myanmar and the Philippines in every item of data obtained. However, the term of trade only inculcates the ability to compete in a market where price 5 used as the only criterion. But a profound study in each country reveals that most of the drugs sale in the market are imported from original manufacturers. The drugs may be produced from a mother country or other country where joint-venture factories are situated. For example, drugs of Janssen company are produced in India. The prices of these drugs are high because

they are from the original companies regardless of the expiration of paten protection period. The reason to import these drugs are as followed

a. Pharmaceutical factories in these countries are of the same character as of the Thai factories in that they produce copies of original drugs. The production may be inadequate to meet the consumer demand so they have to import from other countries. The decision to import drugs is based on the country's colonial background. For example, Myanmar is in flavor of importing drugs from European countries.

b. Values of drug consuming is similar to Thai values in that it is preferable to use imported drugs regardlers of high prices. In addition, drug application system may not be so strict in some countries such as drug purchasing in Myanmar does not require physician prescription. In other cases the country has a strict system but physicians are in the habit of prescribing imported drugs. This may be the result of drug promotion as in the analysis of transnational drug companies by Vinsent Navaro.

Even though drugs from Thailand can compete in price with original drug companies, efforts to build outstanding identities such as quality, brand loyalty and favorable images are recommended. Thai drugs from original drugs. These specialties may be in the forms of sustain-released drugs or convenient application drugs. This will enable Thai drugs to compete with both locally produced drugs as well as imported drugs in foreign markets where price competition is concerned.

As for Singapore, Vietnam, and Laos, only a small number of drugs can compete in the markets this drugs can be classified into 2 groups they are:

a. Imported drug from European countries or Australia. If Thailand is to compete with drugs in this group, aside from price competition, it is necessary to build outstanding identities as mentioned earlier.

b. Drugs locally produced. These drugs face problems similar to Thai drugs such as small scale of production, low technology with high cost of production. If there is no trade barrier imposed on this group, it is possible for Thai drugs to compete in the market.

There are two groups of drugs that Thailand is still unable to compete in price competition. These are : a. Locally produced drugs such as drugs produced in Vietnam and Laos. Marketing research an this group of drugs in details will enable Thailand to compete in the markets b. Imported drug from Asian countries such as from India, china, and Vietnam. These countries export their products to Laos. India and China are major competitions in drugs markets of many countries including those of original drug producing countries. The main reason is because these two countries have potentials to produce lower price of raw materials than in European countries and the U.S., thus lowered the prices of finished drugs and enabling them to compete in overseas market. Haring Terms of Trade of less than 100 goes not significantly mean that Thailand can not compete in drug markets in Singapore, Vietnam and Laos. However, it needs to increase competitive strategies especially marketing research in the competition. Confidence in there produces can be obtained by ways of creating recognition image, outstanding packages, taste and quality that are equal to original products, as well as brand names and logos loyalty. Strict penalty should be enforced to behaviors damaging image of Thai commodities such as drug counterfeit, drug

imitation and negligence of standard quality of drug. As for the Philippines markets, Thai entrepreneurs should now take the opportunity to compete with other foreign companies since Philippines is in the process of reforming drug consumption system in order to reduce drug expenses and high selling prices. Drug competition pattern is about to shift from competition with original companies to competition with lower-offered price companies.

The study of comparative advantage is a primary evaluation of drug competition in domestic markets and overseas markets. However, in drug manufacture, is necessary to take a holistic approach, which means that commodity advantage only does not guarantee the success of drug distribution and competition in the markets. Decision to produce drugs for self-sufficiency or in substitution of drug import should not be based an the lower price of domestic drugs alone. When evaluating present situation of drug industry, it is found that the problems do not lie solely on the cost of production but also on market competition. Other problems are concurring with those of the theory of the Firm. Even though drug manufactures operate under the motive to gain highest profit possible, it should take into consideration the ethics of pharmaceutical profession. This means that in archiving highest sales volume, competition must be on drug quality and standard, and drug formula development which, in turn, affected marketing problems both domestic and overseas markets.

This is concurrence with Micky c. smith's simulating module. The module is adapted from a competitive simulation module by Michael E. Porter and the so call "government policy" e.g. regulations on drug procurement of government organizations or price control. Furthermore, in applying competitive advantage theory

to the "diamond diagram" simulating module of Michael E. Porter. It is clear that there are problems on aggressive competitions among domestic factories, production factors that create dual-standard drugs to reduce production cost. Over demand from drug end-users which forces suppliers to import drugs from abroad even though it can be locally produced, including the lack of side-products industry and inefficient coordination of government organization resulting in import problems.

If the government and those in convenient ignore these problems only drugs from abroad whose price is set up according to brand name loyalty and domestic drugs of very low price regardless of quality are available in the markets. Also if the administer of bioequivalence test is forced by the government without well preparation, it will prolong the availability of foreign import drugs in domestic market. While reducing the opportunity to compete overseas of locally produced drugs due to poor quality of drugs or higher price in the case of developed drugs

In order to successfully strength pharmaceutical industry's ability to compete with foreign imported drugs in domestic as well as foreign markets, and under the constraints of economic crisis in which the government has limit budget for supporting the industries. But it is compel to provide the people with good quality drugs, by taking into consideration. The Michael E. Porter's competitive advantage theory together with present status of Thai manufacturers, the government needs to change its roles in strengthening competitive advantage of Thai manufacturers. There are 4 determinants in the changing roles of the government. They are

Determinants I Rivalry of domestic Competition

The increasing number of drug factories helps stimulate competition and accelerate development. However, it is important that the government effectively play its role in overseeing that the competition leads to the development of human resource, technology, marketing information and specialization. These can be obtained through the use of factory own resource or in conjunction with other factories. Surely, they need supports from government organizations such as the Ministry of University Affairs should facilitate training and sharing uses of machine and personnel.

Setting up a pharmaceutical institution may help accelerate development in this direction.

Also, the Food and Drug Control Administration should exert close supervision on drug price competition together with quality control inspection. This may require assistance from the Department of Medical sciences and the faculty of Pharmacy from various universities to conduct quality control inspection on drug production. This is to ensure that drug factories strictly follow standards of production in producing drugs into the markets. Another important tool in development is a convenient access to information on drugs for consumers since customer's preference is an important mechanism for the selection of commodities. Another important thing is the development of free trade competition with no rules and regulations to bar drug producers from equal opportunity for development. This will also stimulate development in the government section as well as evaluation of cost and return on the country's limit resource to the most beneficial use.

Determinant II Supportive industry

The development of industries relating to or supporting of drug manufacturing industry such as raw materials, packaging materials, machinery and equipment will stimulate the increasing in factors of production which are transferable. These factors included studies and researches of relating subjects such as the development of herbs as raw materials in pharmaceutical production, the production of non-active ingredients such as corn starch, syrup, para-rubber for bottle stoppers and etc. including researches an new patterns of drugs for drug efficacy.

This development will enhance pharmaceutical industry and other industries as well. Clearly, the prominent role of the government is that of the Ministry of University Affairs in conducting more researches and studies which are up-to-date and timely. This can be done by the government alone or with cooperation form private sector. The important thing to be develop along side with researches is the access to information which is open to all and can be retrieved conveniently by manufactures of various fields of industry.

Determinant III Demand

Demand for drug consumption has been increased both in domestic and foreign markets. The government can help promoting demand for drug commodity by expanding markets for manufacturers. The government role in market expansion is through reducing monopoly in some channels of distribution, encouraging end-users to consume or of the Thai products, imposing measurements to reduce the import of drugs that can be locally produced. As for foreign markets, the government can play an important role in giving information on standards of drugs manufacturing in Thailand so be well known and recognized by overseas consumers. This can be done

by organizing trade exhibitions to introduce Thai pharmaceutical manufacturers into foreign markets. The main problems Thai manufacturers encountered in participating trade exhibition in the past was the efforts to meet the break-even point. Thus the government should be aware that drug is different from other commodities in that it is a health product. Exporting drugs has to follow steps in drug formula registration and requires a quality analysis according to pharmaceutical formula of each country, which varies from country to country. Also the exhibition of pharmaceutical products needs different kind of preparation. If the government is to set a policy an export promotion, it is necessary to make a though study drugs. Since drug information are vary term of compilation and classification it is difficult to make the most out of them.

Determinants IV Factors Endowment

Factors endowment affect the cost of production. The government play an important role in assisting manufacturers to gain comparative advantages in the cost of production by using raw material tariff rate as its mechanism. It must be agree upon that, at present, Thailand is capable of producing neither active or non-active ingredients even though it has sufficient resources but lack of development to a certain level suitable for pharmaceutical usage. This may be because of no clear direction on development available to the people concerned. According to an interview with a number of executives, 90% of them indicated the need to have a long-term policy on the direction of development in order that they can set their plans accordingly. Since the fluctuation of needs of active ingredients bring uncertainty to the investment, the government should pay attention to non-active ingredients. By cooperation among government organizations with the center of interest is placed on the development of

pharmaceutical production for competition, each individual organization can play its role in development accordingly. Because most of the factories are small-scale factories, monetary grants from the government will enabling and stimulating the factories in development.

5.2.3 Export Potential

Thai drug manufacturers have the desire for self-development in export expansion. However, not every factory has the ability to export nor to get support from the government. Small-scale factories should set their targets on expanding drug production to a full capacity in every drug category to feed domestic markets before exporting. Factories with less than 10 years of operation should set their targets on expanding domestic markets using every channel available before considering market expansion to overseas countries. The absence of capsule and tablet types of drug production in some factories leads to the belief that they are incapable of exporting. Also in factories that are engaged in producing drugs for other manufacturers, As for joint-ventures between Thai and foreign factories, there are 3 factories that do not export their commodities, the reasons for not exporting vary in each factory. A factory owned by a Thai entrepreneur was forced to became of the recent economic crisis. Since the joint-venture still produce the same type of drugs and is in the early stage of the venture, the company has not yet decided to expand its market to foreign countries. However, it is in the process of developing and planning for universal doses forms for future export. In some factories whose products are largely sold in domestic markets, plans have been made to move their production bases to countries where cost of

production and regulations governing the import of drugs are strictly enforced, thus no export plan is considered.

5.2.4 Export Promotion

Tactics for supporting export potential can be determined by a study on the number of drug manufacturers who export their products to overseas markets. These exported products may not necessary be on the list of selected drugs of this study. The reason is that whether the exported drugs is on the said list or not it is evident that the manufacturers have export potentials. For example, there are 21 factories that produce Amoxycillin 500 mg contained in a bottle of 500 capsules, but only 10 factories export their products abroad. Thus market expansion should be done by these 10 factories even though they have never been exported Amoxycillin before. The government should supply these factories with relating information and marketing. As for the 11 remaining factories with no export experience, the tactic is to build confidence in export.

Priority in export promotion should be given to our neighboring drug markets. Since Thailand has been exported our products to 8 in 9 ASEAN countries in 1999 with the exception of Brunei. It is unfortunate that Brunei considers pricing as a major criterion in drug procurement white Thai exporters are not prepare to lower the quality of drugs in exchange of low pricing which will enable them to compete in Brunei markets. According to our survey by questionnaires, 4 factories have exported then

products to Indonesia, while 7 factories have done so in the Philippines in contrast to the UN. Study in 1991 which reported that no export have been made to Indonesia and the Philippines. Thus it is evident that there is export development in Thai factories. However, it the export is to be expanded to Brunei, cooperation between private sector and government sector is needed. Overseas markets other than the ASEAN markets namely Hong Kong, China, Sri Lanka, Europe, The Middle East, Japan, South America and Macao should also be promoted since export of less-sophisticated drugs have already been developed.

Differences in exported drug groups determine export promotion strategies. Thailand has been exporting various groups of drugs to all ASEAN countries both in the forms of capsules and tablets. Some drug groups are subjects scrupulous examination by the imported countries to determine drug efficacy. This is especially true in those of the cardiovascular group. It is noted that in developed countries such as Japan and European countries, Thailand has not been able to compete in the export of drugs in capsule and tablet forms. (see table 43) In Japan, only antibacterial drugs such as Amoxycillin and Ampicillin produced by Thai-Japan joint-venture can be exported back to Japan's market. In European, only those groups of drugs, which are not produced in the country such as adhesive plaster are exported.

5.2.5 Export Expansion

Plans for export expansion are the results of the increasing number of form 1-9 countries where drugs are about to or being exported to especially all of the ASEAN countries, and the saturated level of consumption in domestic markets. Furthermore, manufacturers of less than 10 years of operation but highly efficient in marketing who

have vision in the possibility of drug expansion in both domestic and foreign markets initiate the plans. This is in concurrence with Mahfuzur Rahman's thinking in that developing countries tend to substitute production to import. In reality, industrial development is based equally on import as well as export consideration. (A.H.M. Mahfuzur Rahman, 1973) Countries getting most interest from drug manufacturers in market expansion are Myanmar (table 43), Laos, Cambodia and Malaysia successively. This concurred with the study by Thai Farm (Bank) Research Center, which reported that in the future Myanmar would be the principal drug markets for hormone group drugs with approximately 65% rate of expansion, while Laos will be the major market for penicillin. Countries that receive less attention from drug manufacturers in export expansion are China, European countries, Japan, South America and the U.S.A. since they are recognized as the most advanced countries in pharmaceutical production especially in active ingredients. Application and import of drugs in these countries are treated with strict measurement. They also share 73% of production sharing in the world. (Robert Balance). Thus drugs exported to these countries must be differentiate from those that can be produced locally in that country for example herbal products. The least interesting country in ASEAN for export expansion is Brunei due to high price competition as mentioned earlier.

In considering doses forms and drug lists the manufactures plan to promote in export expansion, it is obvious that in ASEAN country the drugs are in a variety dosage forms e.g. tablet, capsule and a injection. These drugs have already been exported but will be increased in the number of new drug formula such as in vaccine, vitamins, and antimalarial drug groups. As for the type of the drug, the increment will

be non-prescription drug, over the country drugs, and herbal drug group. The increase in herbal drug group is due to the fact that raw materials used in herbal drug production can be acquired locally. Also in this region popularity in consuming herbal drugs is equal to that of modern drugs.

In expanding their products to markets in developed countries, the manufacturers plan to export products like balm, tonic powder, and plaster since the productions of the said drugs are nil in those countries. The selection of ASEAN markets for export expansion of drugs in the groups of capsule, tablet, and injection types which are different from those intended to export to the markets in Europe, China, and Japan is because ASEAN markets have confidence in pharmaceutical production technology employed by Thai manufacturers. Also the average rate of growth for 1997-2001 in ASEAN markets is 12.3% higher than the other group of markets. (1MS, 1997) Even among ASEAN markets there are differences in practices such as for countries with high standard drug control measures and systematic drug application like Malaysia, Singapore, and the Philippines, it is evident that drugs exported are in cardiovascular group such as anti-hypertension, Cardio-vascular while generic drugs such as antibiotics, pain-released drug, gastrointestinal tract, respiratory system, vitamins are export to the rest of ASEAN countries. As for drug manufacturers, the main reason for export expansion to ASEAN countries is because of transportation advantages. But, in the selection of drug list to be exported, ASEAN markets are selected because manufacturers believe that the cultural habit of drug consumption is similar to that of the Thai people. Thus, supporting information or foreign market researches provided by the government will help drug manufacturers in

the expansion and production in the right direction, much better than what the manufacturers can get by their own observations and field trip studies.

5.3 Sufficiency in Export Expansion

Production capacity of tablet type drugs is 20 times higher than that of capsule type drugs due to the lower case of production of the former, and the higher price of machinery and equipment used in the production of the latter. Also the production is another reason why most of drug manufacturers decide to produce tablet type drugs. In 1998, actual production capacity ranges from 11.11-90.00 percent for tablet type drugs and from 10.00-95.00 percent for capsule type drugs. It means that the full capacity of 8 hours per day of the factory production capacity was not met. This is because of market competition and choices of machinery and equipment. The increase in production depends on time management ability of production manager. The result of this study differed from that of Kwanjai's study in 1984. In her study, Kwanjai indicated that actual production capacity of drug factories is 16% for general production and 65% for drugs of the highest sales volume. However, her calculation was based on selected drugs without taking into consideration the dosage forms of capsule or tablet type of drugs. In reality equipment and machinery employed in producing tablet type are separately used from that of capsule type.

Also in her study, machinery used for production of tablet type drugs of different formula is not separated which means that one machine is used in the production of tablets of different drug formulas. In each production the volume of

drugs produced is subjected to sales volume and drug inventory alternatively. Drug production is of a one-year plan and can be adjusted according to situational and environmental changes. Kwanjai's study also differs from the study conducted by Thai Farmers Research Center which reports that 29% of drug factories operate without any plan of production. Since each drug has different product cycle, stability and quality control standards, production plan of each drug should be prepared separately. According to a report by the Industrial Finance Cooperation of Thailand in 1996 concerning production capacity, the increasing number of modern pharmaceutical manufactures results in oversupply for overall production capacity. Production capacity used is of 57% to 62% of overall capacity. A failure to operate in full capacity causes higher cost of production per unit this figure is similar to that of C.Sepelvada and E.Menesses whose report in 1970 reveals that drug factories in Asia average under 50-60% of their production capacity.

The calculation of DRC and terms of trade reveals that Thai pharmaceutical industry with supports from the government will be able to compete in pricing competition with certain overseas markets. As a consequence, the question arises whether the factories will be able to increase their production capacities to meet the increasing demand if the government set up policies on self-sufficiency-using finished drugs as substitution to imported drugs and on import expansion. Since the increase in production capacity by increasing machinery and equipment means the increasing of production cost which, in turn, affect the DRC and Terms of trade. Changes in DRC and terms of trade may result in the failure of drug factories to compete in foreign markets. Thus it is appropriate to project production increasing based on targets

identified in the Pharmaceutical Industry Structural Reform by the Ministry of Industry. From the projection, production in substitute of import should be 50% while export should be expanded to triple the amount of 1997. The data on the amount of drug production, import and export is only estimation. They are different both in the classification of drug groups and units of storage which effect the figures from the grouping stage to each item.

The estimation of data on production, export, and import are achieved through statistical estimation of which the data vary according to changes in the government policies which effect the year based for calculation. Furthermore, the fluctuation in baht value affects the volume of production. Calculation of volume of production is based on the assumption that during 1997-2002 the patterns of medical treatment and drug application many not differ significantly. This makes it possible to see the trend of production in each drug item. For example, Ranitidine must be produced more than Cimetidine or Ibuprofen must to produced equally to Diclofenac. This increasing amount of production depends on the government policy and export markets as have been planned.

From the percentage of the increase amount of drug production to be substitute for import drug as specified in the set objectives which is 50%, the increasing amount of drugs in each item, which exceed the actual percentage of production capacity in 1998 are Ketoconazole 200 mg, Norfloxacin 200 mg. and Nifedipine 5 mg. since the production of Nifedipine 5 mg. of capsule type must be increased from the year 1998 up to 12.63% in the year 2002, however technology used in producing the soft, gelatin capsule is considerable different from ordinary capsule production. Furthermore, there

is only one factory in Thailand that produces Nifedipine 5 mg. In this special type of capsule, the factory belongs to a foreigner and produces only drugs as ordered by other factories. It is note worthy that at present Nifedipine is the only drug contained in this soft capsule. The investment on purchasing new production machine in order to compete with the existing machine may bring about the problem of the machine not being used in full capacity thus higher cost of production than that of the existing factory. Besides, experiments must be done for technology to be used in the production of soft capsule to determine the required stability level. Such experiment will take same time before the factory is ready for production. Thus, it is recommended that marketing research be administered to ensure the need for this type of capsule before investing.

As for the increase production of Norfloxacin 200 mg. and Ketoconazole 200 mg. which exceed the factory production capacity, there are 3 alternatives for the production of these two drugs which now available in both capsule and tablet pattern.

a. Switch to the capsule form. Some preparation can be produced in both capsules and in tablets forms , for example, Cimetidine 400 mg., Ibuprofen 200 mg., Norfloxacin 200 mg., and Piroxicum 10 mg.. In principle, the production of drug in capsule or tablet form, local manufacturers are likely to imitate the original drugs of which the patterns are decided by the preference of the consumers. Take the U.S. as an example, consumers prefer drugs in tablet pattern to capsule pattern. Thus most drugs are produced in tablet form. There are 3 factors to take into consideration whether to produce drugs in capsule or tablet form. a. In making a tablet, the improper flow of liquid make it difficult to compress the drug. b. Compression into tablet is rather

difficult in some drugs. c. Drug of high dosage application is preferably contained in a capsule. Usually, technology employed in tablet compression is less complicate with cheaper cost of production. However, in some factories drugs are mostly produced in capsule pattern, even though they usually are in tablets. This is determined by market mechanism. Also variety in drug patterns correspond to the demands in the market. As for the different patterns of packaging in some drugs such as Antacid tablets are contained in a bottle and in a pack as well due to different sources of distribution. For example, drugs distributed in a hospital are usually by counting the tablets while drugs purchased in a drug store are usually in a pack for the convenience of carrying and storing. Besides, stability in some drugs make it necessary to be in a pack.

b. Proper management of time or cycle of production will increase the amount of production without the increasing will increase the amount of production without the increasing of time. This depends on the ability of the production manager in supervising the use of machinery to a full capacity in the time of production.

c. Working over-time, or increasing the production by increasing the working time of the machine if by doing so the break-even can be met since machinery is regarded as a fixed cost of production. Thus a full use of machinery instead of buying a new machine will reduce the marginal cost form the economic of scale.

5.4 Guidelines for Development

The development of Industrial competitions requires a full knowledge of operating status of drug factory, direction in Industry development and strategic development. From the SWOT analysis and the information received from Delphi

technique and interview, answers can be provided for the 3 requirements mentioning above.

5.4.1 Present Operating Status of the Factory

From the analysis, internal business management and marketing are 2 major components in pharmaceutical business. Also there are certain factors regarded by top management as weak points. Thus the researcher employed the statistical method of factor analysis to help explain in separate dimensions. However, the sub-factors of internal business management namely cost of raw materials and operation cost are classified into production management dimension. These two sub-factors are of the weakness of this dimension.

As a consequence, the internal business management may be regarded as a weakness in pharmaceutical industry. The same also apply to market evaluation in which 2 out of 8 factors are evaluate by top management as weaknesses in pharmaceutical industry. They are marketing research and price competition. But these two factors can explain each dimension of marketing

However, there are other factors in these components including the levels of point rating as evaluated by top management are not in the critical level, thus for the whole picture, these factors are still regarded as strengths of the industry. This may impose some conflicts especially when comparing with the report of the ministry of industry in 1997, the differences are in the weaknesses of the industry such as research and product development, efficiency of labors, information system in the business, production cost, human resource development and marketing management. The study reveals that market management, It system and labor efficiency are strengths of the

industry. The reason may be because in the past 1-2 years, efforts were made to correct these weaknesses. However, there are weaknesses that are the same as this study and still exist. They are cost of raw materials, price competition, research expenditure and the number of personnel in research and development.

As for opportunities and threats, when composing with a study by the working group on Industrial Restructuring, Ministry of Industry, in 1998, it finds that the opportunities are international free trade and the depreciation of bath volume. In contrast to top management attitudes in this survey, who thought that they are threats to the industry. The reason for this may be from the time Free Trade Agreement has been enforced, when the Thai managers realized that trade barriers have been imposed by many of the member countries with unfavorable results to Thailand. Respecting the Agreement, Thailand does not impose trade barriers to any country in retaliation. Also the weakening of Thai baht affected the higher price of imported raw materials and unable Thailand to compete in foreign markets. Furthermore, drug commodity is different from other commodities in such practices as formula registration, quality control standards, and pattern of the exhibition emphasizing national GMP standards as universally recognized.

5.4.2 Development Strategy

There are some limitations to development strategy since government policy affected private sector directly while government organizations oversee that the policy has been practiced. So if the government plans are to be of benefits to private sector, it is the responsibility of the private sector to provide adequate data and information as well as the anticipating effects of the policy so that the government can use in policy

formulation. Can the contrary, looking from the government points of view, certain policies such as price control, reference standard price, and pharmaceutical procurement, and etc. are government mechanism for consumers protection from being taken advantages of since drug uses is partially controlled by physician, pharmacist or other medical personnel. Also government policy is, in some case, intended to be used a trade barrier on original drug which can be produced locally. The fact is that the profit percentage of drugs sold to government health care service centers is lower than profit percentage of drugs sold by using reference standard prices or sold to the Government Pharmaceutical Office. Besides, supports from the government also have some limitations. Thai industry can be classified into 23 categories, each category is divided into groups. There are 188 groups all together. Finished drug is a sub-group of Pharmaceutical chemical production used for ailment treatment and herbal commodity. It has been grouped to a 5.9% value-added group rank no.6 in the industry category comparing with the 21.4% value-added of food production industry. Also textile, rubber, metal and automobiles posses higher percentage of value-added. Naturally, the government interest will be given to these groups before pharmaceutical industry. Even though the working group on Industrial Restructuring proposed that pharmaceutical industry be placed in the 2.6 % value-added group which is lower than the allocation by the Ministry of Public Health, the industry still gains interest from the working group which means that value-added is not the main factor of consideration.

5.4.3 Direction for Development

Because of economic crisis and the Ministry of Public Health regulations on quality control standards, either G.M.P. or Bioequivalence, drug

factories being to feel the need of clear direction and the pattern of pharmaceutical industry so that the production can be developed accordingly. At the same time it is difficult if not impossible for the government to set a certain direction. In the past, problem occurred when what the government set was not what the private sector can follow. For example, a 100% GMP program issued in the year 2000 is still unaccomplished.

The Ministry of Industry seems to envision the survival of the Pharmaceutical and Chemical Industry thus introducing strategies for industrial restructuring to be achieved by the year 2002. However, the result of this study shows that it is not possible that the said strategy will achieve every targets set in the reform strategy by the year 2002 especially in raw materials. Thus, in the future, direction for pharmaceutical industry development should include into consideration the required pattern as well as the practical pattern. The former pattern is ideal for private sector while the latter may need 5 years, 10 years or 20 years for development depends on cooperation and environmental factors.

The two patterns point to the same direction of finished drug production as the first priority. Management development should be the first follow by research development in coordination with government sector, and the development of non-active ingredients together with herbal raw materials. The development of active-ingredients should be the last. Pattern that should be study and follow-up continuously is the establishment of quality control institute in conjunction with foreign institution. The government should have measures to promote domestic production of drugs of which the patent expired this requires fully coordination of the three parties involved.

5.5 Foreigner's policies involved pharmaceutical industry in Thailand.

Research and development of drug manufacture has 2 direction such as product development and invent new chemical entity. Both direction need financial support according to study of Robert Balance et al. They divided countries into 2 groups by research innovation as industrialized countries and developing countries. Industrialized countries have drug factories that one part conduct research themselves and have their own brand name. The other part produced generic name. There is competitiveness between two parts like drug factories in developing countries but all of the owners are people in that country. This phenomena in developing countries are different from industrialized countries because the owners of first part usually are the foreigners. So Public Health policies in each country should established to support domestic manufacturers depend on the proportion between two parts.

In industrialized countries such as U.S.A., drug manufacturers develop new chemical entities to be new drugs about 40 substances per year or 80 percent of new drugs (Robert Balance, Janos Pogany & Helmut Forstner, 1992:86). Surely U.S.A government will allocate 1 in 5 of their budget to support research in drug manufacturers. However other industrialized countries such as Denmark has allocated 7% of the budget to support generic drug research while developing countries have allocated the budget to support less then 1% such as Philippines has allocated 0.6% of the budget (Robert Balance, Janos Pogany & Helmut Forstner, 1992:256).

Beside policy support research, all industrialized countries have policies for control drug prices to prevent drug distributors pricing with over profit due to they are

the original developers. Result of this policy make the original companies receive only 11.1 percent of total research budget (Henry G. Grabowski & John M. Vernon, 1994:383-406). Policy for control drug price in developing countries are different from developed countries because they want to support local manufacturers and help their people to use the low price of drugs such as China, controlled price policy concern social interest more than economic. But in some countries such as India, research drug have been excepted to be controlled price for 5 years. The organization that responsible this job is vary in each country such as China, public sector is response to limit drug prices and Malaysia , drugs producers response their pricing.

Quality assurance policy in developed countries is divided to control new drugs and generic drugs. Public agencies will strict on quality of drugs. All developed countries have policy to quarantine quality, safety and efficacy. These agencies are different in each country such as Australia, public sector will evaluate drug safety in human use both pre-marketing and post marketing. Furthermore they has Australian Drug Evaluation Committee (ADEC). This committee has authority to approve new drug to be distributed in drug market by consideration from data of the company. In Japan inspectors from public and private sectors will evaluate drug that has been distributed in drug market for 6 years. These inspectors will inspect both drug plant and inventory according to Pharmaceutical Affairs Law. In U.K. Drug Law is very strictly in products quality so there is frequency inspection. In China there has quality assurance by GMP certificate since 1992, it has government laboratory center to control drug quality 1100 centers around China and it has network to control and

inspect. These centers have personnel more than 13,000 persons (Richard, Albert I. Wertheimer & T.Donald Rucker, 1992:117).

Policy support domestic manufacturers or competition between trade name and generic drugs is also different. In developed countries that invent new chemical entities, these substances have been protected for 20 years such as Australia, it has the regulation that forbid pharmacists to dispense generic drugs if the physicians prescript original trade names. It allow only in the health care centers that have few items of products. In U.K. has the similar regulation. In U.S.A generic products must be approved by bioequivalence study before distributed in drug market. Bioequivalence standard in U.S.A is limited that average amount of drug absorption must be different from the original products less than 20%. After approval U.S.A FDA will publish all generic name and approval items. The reasons these process is the government want to protect the original manufacturers from local copy producers that under qualified and the government support the original factories by prolonging the period before generic drugs have been approved. In developing countries all factories have been quality controlled by GMP certificate and pharmacists have authority to dispense generic products substitute original products by consideration status of the patient such as in Taiwan, public hospitals pricing the drug gain 50% profit from their cost so the pharmacists like to dispense original trade name while private sector like to dispense generic products.

At present developed countries accept that in the future trend of proportion between using generic products and original products are higher because they can reduce drug expenditure. In U.S.A, some state begin to allow the pharmacists to

dispense generic name in order to original products while government support drug information about approval drug list. In U.K. effectiveness of drugs are strictly controlled. If the product has toxicity, its manufacturer must be sued. In developed countries generic drugs producers are minor part and these countries have higher value of export than import value include that their original products can be distributed around the world.

Limitations of data collection and interpretation

Although this study has some strength in

- Identifying economic index to indicate opportunity cost and other factors that have not been study before

- Deciding the 18 items of drug to be used as samples in the study of dosage forms and packing which have not been study in depth in the economic points of view.

- Using of Delphi technique in identifying patterns of Pharmaceutical industry since opinions gathered from the specialists will be most similar to that of the group

- Qualitative methods and exit development using SWOT analysis, interview, and focus group discussion.

- No previous study in pharmacology using methods employed in this study have been conducted since Pharmaceutical industry is a complicate process both the active ingredients and the production process.

But there are some conditions that limit data collection and interpretation such as:

- At the time of the study, the country is under the economic crisis, the depreciation of baht value affected the differentiation of the rate of exchange in each

year, thus affected the calculation of production capacity. Estimation and conversion of value of production into the amount of production are based on the rate of exchange. Moreover, the 1998 rate of exchange is assumed as the rate of exchange in the year 2002, which are the target year because it is the highest rate of exchange.

- Less time allowed for the follow-up of questionnaires resulting in the inability to obtain sufficient data such as factory price, cost of production in certain drug items e.g. Nifedipine 5 mg. and Mebendazole 500 mg. Thus calculation of the index is not possible.

- Insufficient data to be selected for the calculation. In some case, data can be obtained from only one information. Thus the research is compelled to use raw figures received as a basis for calculation instead of using average cost of production. So the result of the calculation does not represent the industrial population.

- Factories answering the questionnaires may be in different groups from those which SWOT analysis and interview technique was conducted since very few factories cooperated in giving information according to the inclusive criteria.

Problems and Obstacles in this study

- The questionnaires: the first set of questionnaires have been returned less than anticipated due to the identification of the respondents who, in turn, reluctant to reveal the confidential data of the factory cost of production.

- The interview: the managers or representatives have limit time for interview. Furthermore, it needs to make an appointment for at least a month in advance due to ether maters that require management's attention such as G.M.P.

evaluation or ISO evaluation in some factories. In another case, the owner of the factory had to go abroad and response the interview.

- The factory: the questions asked are unanswerable in some factories that do not operate in a certain field as asked in the questionnaire. For example, factory with no export experience left out the questions on export promotion or competition in foreign countries.

- The interviewees: the positions of the interviewees affected the information given. For example, the factory manager does not want to give opinions on drug competitions or drug prices. This problem can be lessen by conducting group interview. The group members consist of managing director, factory manager, marketing manager, finance manager and so on.

- The interviewers: the interviewer many have left out some points in concentration to take notes or recording. This problem is lessen by using the panel of interviewers technique.

- The Delphi technique: the interviewers many not be able to ask questions which when answered can not convert into numeric figures, since the managers omit same questions or sometimes instead of answering the question directly, they express their opinions which can not be converted into figures. Thus make if difficult to interpret the data.

- Incomplete data to be interpreted into numeric figures for the second round of Delphi technique due to the omission of questions as mentioned before. The researcher thus evaluates only the interpreted data and marks "X" for the unanswered questions for the Delphi members to complete.

- Dateline for the return of questionnaires : Some interviewees comment that the dateline for returning the questionnaires should not be fixed. Since they may not be able to return them at the set time.

- Some interviewees are unfamiliar with the Delphi technique. The researcher thus added information on this technique to the questionnaire sent. Some interviewees suggested that then should not be too many rounds of interview as the answers are almost the same. Thus bored the interviewees.

- The inability to quote the wholesale prices form three countries namely Brunei, Indonesia and Cambodia regardless of much efforts from the researcher.

Research Benefits

- Economic theories have been applied to the study of manufacturing industry with the emphasis on the in depth study of pharmaceutical industry. This study can be applied to the actual work of research and development or the registration of new drug formulas or competitions analysis.

- Policy makers are able to set the directive of drug factory development.

- Some obstacles and weaknesses in foreign competition have been solved.

Future Researches

- Opportunity cost of chemical substance both active and non-active ingredients to help make the decision an government supports of original or semi-finished products, patterns of the joint-ventures or purchasing form quality reliable sources such as from China or India.

- Developing Delphi technique for suitable uses in industry or other fields such as patterns of health care services, appropriate methods in medical administration by government organizations.

- In the future, if the data base is available in more details, researches should be conducted on marketing research in every pattern of drug or drug item in details.

- Study the effects of specific polices such as policy on drug purchasing in pharmaceutical business.

- Comparing government returns as a total picture such as policy on tax, policy on-drug purchasing.

- Study the appropriate patterns of co-operations among public sector, private sector and education institute for the development of competitive advantage, in the future.

- Conduct cost analysis and returns on policies to find ways in obtaining the highest benefits for both the government and private sector.

- Build to model on an equation that can evaluate both the competitive advantage and comparative advantage.

- Study the effects in transferring production bases of foreign companies in relating to production value, import and export tax.

CHAPTER VI

CONCLUSION

6.1 Status of Pharmaceutical Industry

From the study, it was found that pharmaceutical industry is a small to medium enterprise as considered from the value of capital registered which is lower than 200 million baht. In regard to their development ability from compounding or formulation, pharmaceutical manufacturers can be classified into three groups.

6.1.1 Manufacturers that have conducted a research on dosage forms, formulation and raw materials. These manufacturers specialize in the development of formulation and raw materials to create strength. They have attained the standard specified by GMP and are turning to ISO to expand their products to export market. The state, therefore, should give these manufacturers support and encouragement on research investment to acquire specialization.

Because of their large size and capital, these manufacturers survive the economic crisis. Their customers are mainly from the private sectors namely the drug stores. Some manufacturers distribute their products to certain government agencies although this is not their main channel of distribution. Some manufacturers supply OTC drugs and have a high brand loyalty. With large capital and profit gains, the manufacturers in this group are able

Also, with small profit gains, these manufacturers cannot afford sufficient found for research and formulation development. This leads to their inability to improve quality and increase production capacity. At present, local markets are highly competitive both in government and private sectors. As for the private sector, price not quality are their main consideration the production firms and drug quality. In the government sector, drug procurement is made under the 19 offices of the Prime Minister regulation, item 60 and 61. In particular, the present situation has been affected by the impact of the medication reform measurement of good Health at Low Cost and the drug distribution measurement of GPO.

In conclusion, the government should give technical support to these manufacturers so that they can carry on their production development. The state must have a role in quality inspection and encourage the competition between the two groups on equivalent price bases. With the implementation of bioequivalence, two distinctive groups can be identified. The state must work incorporation with educational institutions to enforce the quality control regulation.

With the improvement certain present terms and conditions. These manufacturers will be able to continue operation and conditions, these manufacturers will be able to continue operation or adjust themselves to the competitive market. The terms required of are as follow.

Condition 1

There should be detailed changes in the 1992 items 60 and 61 of the1982 procurement regulation of the office of Prime Minster because this regulation favors GPO while the future domestic market should be a free trade one.

Condition 2

GPO should change its role in being the local manufacturers' competition to being a developer of domestic drug production industry.

Condition 3

The government should issue a measure requiring health care centers to purchase drugs of GMP standard rather than focusing their purchase on the price factor only. In this way, the manufacturers in second group will be able to compete with suppliers from other categories.

6.1.3 Manufacturers who supply their products to the market where state control hasn't been extended to these manufactures will not be able to continue operation if they do not invest in development or if they face tight control from the state. They might have to stop business in a very short time due to the following reasons:

a. When the GMP is effective in the year 2000.

According to this law small manufacturers set aside huge capital for development to comply with GMP requirement. Good GMP system such as validation practice demands great expenditure and factories with limited capital will not be able to increase their investment for this purpose.

b. High price competition. Some drug manufacturers forfeit profits for alternative pharmaceuticals sales. They even reduce their production cost and not bother about the product quality. These manufacturers have to stop operation if there is a price competition form large manufacturers and if the consumers and health care centers begin to adopt the criteria of quality product selection.

c. Bioequivalence regulation. This regulation aims at upgrading pharmaceutical standard production in the country.

This practice, however, eliminate small in manufacturers from the competition circle especially if the new law regulations specify the licensed age of all drugs for five years.

The manufacturers in this group are small enterprises of generic drugs production who compete on price basis and supply their products to some uncontrolled health centers. Most of these factories are situated in Bangkok where plant expansion is not allowed. They do not conduct research and development on either former formulas or new formulas. The manufacturers in this group concern only cost reduction instead of quality. They consider pharmaceutical products as ones with high profit returns and easy to produce.

Among the three groups of manufacturers mentioned above, haven't made any effort to upgrade themselves into group 2 standard. There fore they should turn to other fields of business or stop their drug operation. As drugs are health products, the consumers' well beings and life safety should receive greater consideration than huge profit gains. The agencies who have a vital role in screening these factories are GPO and health care service. Controlling methods can be either directly or indirectly adopted. The

indirect control involves a strict measure on pharmaceutical standard quality by mean of careful selection and random inspection on each purchasing. Direct control includes strict inspection by GMP standard, severe punishment and disclosure of information which is a part of consumers' rights defined by the new constitution law.

6.2 Finished Drug in Professional Context

Generic drugs and drug manufacturers are something that users cannot decide for themselves. However there is some exceptions to this. Some drugs and producers can be decided on by consumers. This comes from the result of advertising together with the knowledge of the consumers in securing treatment. As a whole, professionals and specialists are still having an important role in the selection of pharmaceutical products. In professional prospective, modern finished drugs in Thailand can be classified into 6 groups.

6.2.1 Original products, which are under the patent production and are not registered in the pharmaceutical list in Thailand. These drugs belong to the group that requires a two-year follow up. They can be registered after passing the consideration of GPO. There are about 30 SMP per year.

According to the regulation, these drugs are not allowed to be sold on the market. They must be prescribed by specialist physicians only. However, this drug group is attractive in the eye of local manufacturers. Because after the SMP expires, manufacturers can start a research to obtain formula so as to apply for Bioequivalence test. This cannot be done while the drugs are still protected by patent privilege.

6.2.2 Original products, which are still under the patent protection and are allowed to be sold in the market. The remaining patent protection date is around 3 to 5 years. During this time the international suppliers can set higher distribution because local manufacturers cannot produce them. Total sales of price the product depends on their ability to approach physicians in the health care centers.

The use rate of these drugs is part of the imported drug cost of the country. Usually the price is high. So those with large volume of use rate have attracted the interest of local manufacturers. Who will study production process and embark on manufacturing after the patent protection date expire. According to the regulation, the bioequivalence of these new drugs to be registered is extended to 4-5 years of development process. This can be seen from the 2 to 3 items of new registration request among the 30 SMP items so original producers can prolonged their high profit. Local manufacturers think that they should be allowed to study formulation while original products are in SMP monitoring and bioequivalence study are flexible while FDA think that quality assurance of local manufacturer products should be used these tools for increasing consumers confidence.

6.2.3 Original products that are off-patented. These drugs are pricing lower than in patented drugs but still higher than local manufacturers' price. These drugs can be sell in domestic drug market because multinational companies use many strategic marketing plans such as:

- Reducing the cost of production by contract out local factory or joint venture using raw materials import from the parent company in foreign countries. In this way, the

company will be able to cut down transportation cost, analysis cost, and tariff thus lower the selling price to a certain degree. However these foreign companies are still in need of strategies in other fields of competition.

- Sales promotion through various types of media such as radio and television should be increased to gain access to consumers. These drugs are those in the group that consumers can acquire in any drug stores since the value of drugs sales in these drug stores are second only to the hospitals in drug distribution channels. Drugs in this group may include the OTC drugs. For drugs that must be distributed by hospitals only or drugs that require the physician prescriptions, strategies used by foreign companies are those that differentiate the quality and efficacy of drugs locally produced so that medical personnel feel confident in choosing imported drugs. The sales promotion can also be done by motivating medical personnel.

6.2.4 Imported generic drugs whose prices in same source are lower than that of domestic drugs.

6.2.5 Drugs produced by well-established company of large capital factory. These companies aim at competing with imported drugs so they emphasize on the quality of the drugs. These factories conduct researches and development in raw materials, drug formulas or new drugs whose patent protection are expired. The R&D expenditure affected the prices of drugs produced when comparing with generic drugs or patent-expired drugs locally produced. However, the prices of drugs from this group are still lower than imported drugs.

6.2.6 Generic drugs or highly consumed drugs, which have been produced by Thai factories for a certain period of time. Drugs from these factories are produced when raw materials imported from various sources are available in the market where price competition is in the early stage. Mostly, the drugs produced are for price competition among local factories. Hospitals are their main customs since the hospitals are regarded as high value distribution channel. Since the office of the Prime Minister has issued the regulations on procurement and supply in 1987 declaring that drugs identified in the essential drug list must be purchased from the GPO. These factories turn to compete with each other using drug stores as the distribution channels as the essential drug list which are not produced by GPO.

Prices are set by controlled prices and the methods of purchasing. So this instigated competition among some factories who have to reduce their prices below the cost. This creates dual standard factories while efforts have been made to use GMP as a criterion to upgrade the factory standards. However question arises for these channels of distribution of which pricing is the only criterion regardless of the quality, whether it is necessary to upgrade the factories. The effects of this are that the market share of the developed factories is reduced and the factories get pressures from the Ministry of Public Health regulations on drug procurement as well as from price competitions.

6.3 Roles of pharmaceutical agencies in drug industry development.

Those involving in drug industry development are divided into four parties namely, the users comprising general public and health care centers, the private sectors

comprising drug manufacturers and private organizations who help with personnel development, the government agencies and lastly, the educational institutions.

6.3.1 The users. This includes general consumer, medical personnel and government and private health clinics.

a. General consumer should turn to use locally manufacturing drugs while the manufacturers themselves have to maintain quality standard to bring in benefits and efficacy. Techniques in information distribution must be controlled and knowledge on drug selection and treatment securing must be initiated in educational institutes supervised by Ministry of Education.

b. Medical personnel. As drugs are health products, they must be screened by medical authority who has to keep in mind the benefits of the users, not only for the revenue gained from local producing. To be aware of this will prevent them form being the sales promotion tools of foreign drug companies. Moreover, health service system should be revolutionized so that drug acquiring procedures can be rightly inspected. At present, drug selection is still under the consideration of authoritative personnel in the medical field.

c. Health care centers. There must be standard quality set for drugs to be used in the centers. Priority is put on drug's efficacy, raw material quality and finished drugs. Information network should be linked among agencies for necessary information other than price issues. These health care agencies should have more roles in consumer protection and the promotion of quality drug manufacturers. For these health care centers,

cost research is of great importance because it will promote activities which will be truly beneficial to the consumers. The changing role form producers to inspectors

6.3.2 Manufacturers. They are private and government manufacturers and other private organizations.

a. Manufacturers and factories whose main responsibility is development because they are the ones to obtain most benefits. Their target operation is to gain profits and their present cost concerns the account cost only. So it is essential that these factories should consider social cost and social interest as well. If these factories fail to improve themselves, in the long run they may not survive the screening control form the state and the consumers. Useful information should be collected and distributed to other agencies who can lend them support and assistance. Manufacturers that concern only profit gains more than public interest should be deprived of cooperation form other members of the group. This cooperation includes information access and others. They should maintain a joint attempt in preventing the price war and the price dump so that they can survive the present economic situation.

b. Other private organizations and professional agencies. The nature of the organizations in this category is non-profit making business whose aim is to assist on technical development and be center for those of the same interest. Examples of these are Industrial Pharmaceutical Association which provides assistance on scientific and technical development to manufacturers.

c. Thai Pharmaceutical Manufacturer Association TPMA. This agency should have an increasing role in promoting cooperation among companies and not isolate

themselves from other due to the conflict of interest which makes their inter-relationship different from that of PPA. In order to achieve this target, the TPMA has to increase more activities such as collecting and distributing useful information for member companies. Membership fees may have to be increased to recruit more staff and operation workers. Through this effort, TPMA will be able to supply useful information and support on legal matters between state and public or making a protest on some legal conflicts. Today, TPMA is still lacking funds to compete with international drug companies.

6.3.3 Government agencies. This includes BOI FDA and other related agencies. It is suggested that private businesses be offered a chance to help with law drafting especially the ones concerning medicines and be invited by the state as its consultants. They will offer the government guidelines and alternative methods without interfering in the state administration policy. The government, on the other hand, should discard the pessimistic attitudes of the regulations towards the private sector. In order to achieve their development goal, state and private institutions should be honest in sharing information network and dismiss the 'pretending' attitudes toward each other. As long as the country can start is development more early than the neighborhood countries, the advantage gains will prove to be greater. The government's concept of creating locally – owned industry should be changed. Instead, it should encourage and support research work and stop the 'copy research' practice. Interest sharing among one's circle must be eliminated because this practice leads to information leakage and corruption, the culture commonly practice in Asia. One weakness in the part of the state is that there is still a lack of systematic problem solving. This, results in the lack of systematic inspection.

a. The board of investment. This is a state agency whose main duty is to give support to private sectors. To promote finished drug industry, the BOI has to look at the situation from all perspective angles and be careful not to being disadvantage to local industry. This Is because Thailand's drug industry has a lower potential than that of the foreign owned companies. It these foreign firms are able to secure the same support from BOI, they well, then, have an advantage over the local firms. Moreover, instead of lowering their drug prices to compete with those produced domestically, these companies resort to price raising and gain more on profit ratio. So a more appropriate way for BOI to do is by motivating drug manufacturers to produce raw materials and conduct researches as has already been done at present. This will lead to technology transfer and future joint venture between Thai and foreign companies. BOI should also provide alternatives in investment promotion. Projects that enhance the development of finished drugs should be encouraged and scrutinized by sub-committee comprising specialists and qualified personnel on pharmacology. This will stimulate drug manufacturing companies and privatized institutions to launch more projects on research and development. Besides, BOI should give support to researches that help drug manufacturing industry. It should motivate foreign suppliers to invest on raw materials. This promotion may come in the form of either state or private operation.

b. Ministry of commerce. This includes department of export promotion and department of economic commerce. Both organizations have an important role in expanding export market and reducing trade barriers for local producers. Provided that

they have correct information from all concerned, these agencies have a high potential of negotiation with foreign countries.

c. Ministry of Public Health

The FDA in particular should be an independent organization whose duty is to oversee the country' drug system. FDA's sub-divisions are taking care of production industry, drug information service and others. This integrated work covers the whole drug system of the country. If it is enlarged, it will be able to handle the complete cycle of information on raw materials and finished drugs starting from import, manufacturing, distribution, and export. The information gained is an essential element for drug industry development. As every system, namely production, distribution and consumption is closely linked to each other, to establish new drug institution to improve the system will take a slow growth. Hence, development work will become slower as a result. A better solution is by innovation. Under this method, FDA will have more power and capacity. Some parts of FDA structure, however, have undergone necessary development. This includes personnel and information service. Where work operation comes in the form of agency cooperation, committee, and ministry of foreign affairs' working committee. The ministry of foreign affairs also help the promotion work by holding exhibitions, rendering information on standard practice of quality drug production in Thailand in comparison with international market to obtain more foreign confidence.

d. Ministry of foreign. Marketing promotion by exhibition and public relation about GMP of domestic drug producers can be constructed by Ministry of Foreign. These

activities can confident the foreigner consumers in pharmaceutical products from Thailand.

6.3.4. Educational Institutions

The educational institutions should work cooperatively with government agencies and manufacturers by conducting researches to serve social needs. These institutions possess qualified personnel capable of conducting all forms of research. One weakness lies in the lack of linkage between the researches and the people who perform practical work. So there is still no concrete implementation of these researches' findings. One example of this is a clinical experiment on herbal drugs to ensure their safe use for humans. Educational institutions should change the methods of teaching so that their personnel could shift to different academic endeavors.

6.4 Policy affecting pharmaceutical industry development

Policies concerning development of pharmaceutical industry consist of those of the government sectors, private sectors and educational institution. Each sector's policy affects pharmaceutical manufacturing industry in the following ways.

6.4.1. Government sector.

The policy of the government sector has a main purpose in upgrading the quality standard to international one. In reality, there may be some mistakes in interpreting the policy into a the plan or a project and or in the project implementation. The government policy may be affected by international agreements or by the pressure of international such as the patent law which is issued in exchange for the export quota and the control price

which is decided by international companies. The government policy can be classified according to its original source which.

I. The ministry of public health's policies

a. The government policy on drug procurement. This policy refers to especially the section which require eighty percent of the government budget buy essential drugs from GPO if GPO has produced. Although its value is about 6 percent of government budget but private manufacturers think that it is not fair to use this regulation as a tool to make revenue. GPO think that it is not necessary to determine because currently products of GPO are accepted by consumers both public agencies and Thai's people. So this point in this regulation should be withdrawn. Otherwise this point is filled in the commodity regulation by the reason that local manufacturers are not firms. But other perspective is GPO may not be more firm.

Weakness of GPO in competition with local manufacturers is marketing process not quality assurance. Market representators are minor factor to increase sale volume in public hospitals. Defect factor is complicated process of purchasing such as documents and authorization. Process of purchasing between public hospitals and local companies are easier than GPO process. Other reason is operation of state enterprise is not flexible as private sector such as distribution , exchange, management of damage products from transportation etc.

Objective of this regulation is reduction of drug expenditure from physicians in new drugs , otherwise physicians often prescribe imported drugs of multinational companies.

Oppositely physicians approach is being forced so they avoid to use essential drugs because these drugs are not effective and up to date. This regulation will be completion if medical professions has been developed consciousness to concern social problems since they are the students.

b. Good health at low cost policy

This policy should prove to be an effective solution for the unnecessary use of drug during the present time of economic crisis. The word low cost in this context refers to the appropriate and unexaggerated use of drugs while the word cost refers to the cost per overall treatment.

The weakness of this policy is the purchasing criteria whereby marks and are given and graded according to the sources of raw materials,. drug qualifications and methods of purchasing are of no problems in the price control. Whole purchasing or separate purchasing of each agency presents no negotiation problems for the government hospitals due to the faster and more convenient information system of the present day. The main problem lies in the consideration of drug qualification where emphasis is put on price aspects rather than quality. Provincial purchasing is merely a strategy employed to cut off over profit quoted by drug suppliers.

The solution to this problem is by assessing the treatment cost per each case. This treatment cost is evaluated from the most effective method and the drug used. More emphasis is put on the assessment of the most economical but effective alternative such as cost-benefit or cost-utility. The result of this assessment will be used for the benefits of health care service.

To solve the problem concerning pharmaceutical products, priority should be given to drug to drug quality, not price. It is not necessary to purchase drugs that offer the lowest price, instead they should be quality drugs with reasonable price. The agencies who can solve this problem are hospital's pharmaceutical officers or provincial health care chief officer. These agencies will define drug specification and increase work on quality control. Two other important agencies are Medical Science Department and Science Center who must take a greater role in accelerating their quality inspection work. In the case when work operation cannot keep pace with demands from the hospitals, cooperation from education institutions, office of the provincial public health office and hospitals should be sought after so that the consumer protection goal will be achieved.

c. Quality up grading policies such as GMP certificate and bioequivalence study. These policy aims at raising faith from local and international especially when GMP is introduced in the year 2000. As an international standard practice, GMP brings about awareness in quality control for every step of work process. However, there is one obstacle to this. That is the inconsistency practice that may arise from the unreadiness of the working personnel. To solve the problem, there should be a guideline manual for the manufacturers so that they can follow the same standard practice. Also addition training for responsible officers should be given.

Policy on the standard quality of the drugs requesting for registration. This is the Bioequivalence regulation that ensures the quality of drugs to be registered and also those distributed in the market. It helps up level research development of drug manufacturers

and enable them to be immunized against tough competition for the next two or three years to come.

The weakness of this policy lies on inadequate number of research and development agencies to inspect and approve the quality of the manufacturers if they are allowed to embark on their own research. It is therefore necessary for FDA to seek trilateral cooperation because FDA alone cannot carry out the work all by itself. At present cooperation from Naresaun University is being secured but this will prove insufficient if the new drug law has become effective. According to this new regulation, the registration expire date is 5 years. In the present time of economic crisis and under the regulation of patent law, the slow development of drugs will result in foreign trade imbalance. One strategy to reduce the use of new drugs that cannot be produced in Thailand is by required use of essential drug list. However, medical progress may somehow deter the use of essential drug list especially in medical school hospitals.

To solve the problem, there should be an attempt to accelerate the time in producing patent-expired drugs in Thailand. This can be done by encouraging educational institutions to conduct research and development to meet the need of the country.

d. Control price policy This policy should be returned and voluntarily adopted by private health care centers. However drug control price should be made by careful study of information and improve it to the modern practice. The control price of 1987 was obtained by information required from the government agencies, thus, the too low price quoted may be the result of private sector's competition.

Control price list should be based on information gained from both buyers and sellers. The buyers refer to manufacturers and distributors and the sellers refer to health care centers both private and governmental. Control price can be calculated from production cost structure, initiated profits in relation with research and development budget of the producers. It should be noted that reliable standard price depends on correct information from both sellers and buyers. The control price setting authority must have an effective measure in assisting concealed or ambiguous price information. favorable consideration should be given to those supplying correct information.

e. The government policy in authorizing FDA to be drug produced should be maintained in order to stabilize the prices. however, it is not necessary for the state to demand that government agency buy the products from FDA. This is because FDA's years of endeavors be and its non profit making target can guarantee quality and low price. Moreover its management system can also ensure that the quality standard of drug produced will not change to gain the benefits.

f.. Consumer Protection policy

The state support for hospital to produce generic and parenteral solution to save up the budget can create unfair practice. To avoid this, the government should consider the specific purpose of each agency and the quality control methods of good standard protection. State agencies should produce drugs that are not manufactured by private firms or the drugs belonging to freshly prepared group. Close observation towards the quality of selected drugs used in health care centers will increase the need for more inspectors in production standard control industry in Thailand.

To decide which drug lists are to be produced by government agencies depends on cost assessment which must be done on the basis of quality control so that users can obtain full protection standard. This quality control is specially stressed on combine formula which are produced and controlled by FDA and of which price does not exceed the standard one. Health care center should compare their production cost with the one purchased from FDA in view of consumer protection rather their out put work. The solution to this is by improving report and work assessment systems of the Ministry of Health based on the order of importance of the work responsible by health care centers.

II. Office of the Prime Minister. The policy that has an important role and needs correct information is the investment promotion policy which is under the responsibility of BOI. This is a policy on modern finished drug manufacturing which should be promoted in development or research aspects. This includes tax exempt on machinery, income or soft loan and with no restriction to the nationality of the producers. The benefit is a technology transfer for the Thai people (although the number). According to the procedure requirement, private sectors who wish to obtain the promotion will submit their projects to BOI. BOI then asks educational institutions to be the subcommittee screening the most appropriate projects that can obtain investment promotion.

III. Ministry of Commerce The main policies of Ministry of Commerce are:

a. Policy on price control of internal trade department. the problem of price control policy is that local manufacturers are not able to develop themselves because of the lack of fund for research and development. This is due to the fact that, unlike other products, pharmaceutical are controlled by standard quality and efficacy so local

producers do not have enough profits to set aside for this purpose. While using this policy to control local drug price, the state on the other hand can not control original drugs especially those which patent right protection have not expired. Also drugs produced from these local producers have to compete in prices in the existing drug market. So if the government wishes to proceed on with this policy, it should be devised together with the standard price list and be a requisite measure for all health care services.

IV. Ministry of Industry

The industrial restructuring programs for each specialization of Ministry of Industry reflects an inconsistency in the government's management. This study also showed that the substitution capacity in imports and exports that have achieved target strategy is the successful endeavor on the part of drug manufacturers. Other government's non-support terms can not achieve the target in 5 years.

This study indicates that policy planning and design should be initiated by the assessment and by the opinion of manufacturers of all levels. The government must state clearly supporting or non supporting policy, including definite and its time duration of work plan.

6.4.2 Private sector

the private sector's policies that hinder development are:

a. Market policy Price reduction and market dump eliminate the medium-sized manufacturers. This is due to the fact that large manufacturers have enough capital power to reduce their price without affecting the cost while small manufacturers

To solve the problem, all inspecting agencies namely hospitals, Medical Science Department and educational institutions must work co-operately in inspection and distribution of on formation. This is to ensure that the quality of cheap- prices drugs is the same as that of the more expensive ones.

b. Production policy

Drug manufacturers have to be vary of the GMP standard to ensure marketing strength. In the time when information plays vital role in our daily life, consumer protection organizations begin to play a greater role. If the producers do not keep in mind the consumer rights and even if the penalty from the regulation have not reached these companies. The punishment from society may prove much harsher.

c. Research and development policy

Drug manufacturers always stress that unlike other products drugs are health products because they are vital to life quality of the people. However in practice these companies spend very little fund on research and development. This is contrary to the principle that certain profit gained from product sales should be allotted for research and development program or to finance the research project.

Support request on the research and production of active ingredients and other raw materials should be granted to both local and foreign producers because raw materials are one factor that affects the country's competition ability.

From various opinions sources, weakness of pharmaceutical industry in Thailand is the country's inability to produce raw materials. This raises a question why we to do this. Unless the production work attains standard and size, production cost will be higher than

import. From the comparative advantage study, it is seen that finished drugs production requires lower production cost if imported raw materials are used. So it is better to use imported raw materials. At the same time, we should accelerate the full cycle production in order to cope with future trade agreement and also expand our drug market abroad. Moreover, this will create comparative advantage in finished drug manufacturing in Thailand.

6.5 Impact of trade agreement on pharmaceutical industry.

There are two indirect impacts

6.5.1 AFTA (ASEAN Free Trade Agreement)

6.5.2 WTO (World Trade Organization)agreement

these two agreements have brought about certain trade limitations which affect both private and government. Export Commercial department, for example assumes only a role of private industry representative to negotiate on trade barriers problems, especially thoase concerning non tariff barriers. However the most important principle is the maintaining of original markets and the expansion to a new one.

To keep locally original market, the producers have to upgrade the quality of their products to internationally accepted one so that hey can compete with competitors from other Asia countries. The producers have to use trade agreement for the benefits of acquiring important materials at the price which is not difference from that of other countries. Apart from market expansion towards international standard recognition, drug differentiation which originates from research and development must be established. Private sectors therefore have to be worry of the free trade impact and improve themselves

to be able to cope with the demanding terms of agreement. This can be done by introducing innovation on administration, management and concept, increasing research and development, improving production standard and having readiness for tough competition from locally and international. For those who can not survive the competition, it is better for them to stop operation or merge with other producers to bring about strength and develop specialization in line with international standard.

6.6 Policy recommendation

6.6.1 The government who sets development policy and solves the economic crisis problem. In its work plan the government should study the impact on the overall image of the country. To solve problems even health the state should take a holistic approach instead of focusing its operation isolately. An example of this is in the case of a corruption in drug purchasing , the solution is by using a whole procurement method. Price competition must be accounted for because it will have an impact on drug quality and drug industry. To lower drug price for the purpose of competition will have an adverse effect on small enterprises who produce quality products but can not survive the competition where lower than production cost price is used.

6.6.2 government sectors who oversees drug matters should change their role as producers, or suppliers to inspectors and support lenders. Their roles include drug quality control , factory standard. These agencies can work in cooperation with educational institutions in inspecting drug quality from every steps from the beginning when it is produced until it is stored by health care centers. Severe punishment through civil and criminal courts must be carries out to punish those supplying wring standard products

6.6.3 Organization that collect drug data. This organization would be independent such as university. This organization would be accepted by all sectors that it only collect drug data without any impacts to private manufacturer activities such as revenue and tax. It should be supported from public agencies that can control private producers to give their data such as FDA and custom department. details are determined by this organization that are useful in development drug industry.

6.6.4 Establishment organization or institute for drug development. It may be include function in 6.6.3 because it consist of specialists in drug research and development and laboratory equipment that have been supported by educational institutes , Medical Science department and GPO. It has financial support from private sector so its operation cost must be accepted from manufacturers. In the case of research project of local manufacturers, they can use their personal to run their studies by themselves. Finally local producers can except their tax of their studies expenditure.

6.6.5 Certain period of policy. Public sector's plans are short term and long term but they are shorter than private policies because of difference interest. These public policies affect projects and operators both in public and private agencies. Policy decision making must be consistency to practice such as GMP guideline that is always changed so local manufacturers must adjust their operation plans.

6.7 Main factors contributing to target achievement of pharmaceutical product development.

The main development purposes of drug industry to be considered are self-sufficiency and export expansion. Conclusion from the study on quantity and quality shows that there are two main factors for development success. They are

6.7.1 Self-sufficiency Indication for the 10 selected drugs list shows that there is a relatively advantage and a capacity to increase their own production. However the essential factors to gain the target achievement is by increasing demand for local drug and reduce the supply of the imported ones. A successful strategy should be carried out from the beginning by encouraging people to used locally produced drugs. Physicians have to take an important role in changing the attitude and social value in the imported drugs preference. Professional council must issue a measure and penalty for professional and health care centers., give favor to the multinational drug companies instead of the domestic producers.

This method will be successful if physicians and users have confidence in the quality and effectiveness of local generic drugs. So the producers must be create faith in consumers by regarding the standard quality of local manufacturers, and presenting reports on effectiveness guarantee pharmaceutical to the physicians

There are some perspective on political economy affect successfulness self-sufficiency strategy. Business and politic have been closed relationship since King Tak Sin prefer some gift to China. Combination capitalism with international trade will restructure political economic power. Commercial politics will join with large multinational companies and some Thai's business men. Some policy is happened from multinational firms to lead Thai's people in seeking behaviors and self medication such as

using western medicine when sickness and using same preparation as original products (Suchada Jakpisut, 2000:161-161) announcement of PPA about the committee to set criteria for removing dangerous drugs to be OTC drugs according to WHO and other countries may be good sample for application of social theories to explain this event. Reducing these problems will be conducted from empowerment of Thai's manufacturers and public agencies to negotiate and criticize impacts from this activity. Beside impact from free trade agreements, government must aware invasion of transnational companies to influence pattern of drug distribution that prefer high profit to foreign companies. Prolonging period of generic production from patent law, bioequivalence study, otherwise reducing market share in drugstores to compensate with purchasing regulation in public sectors are strategic plan of developed countries to overcome developing countries especially in Thailand.

6.7.2 Export There is one indication that the 11 selected drug list gain comparative advantage in opportunity cost but they still have to face tough competition from Singapore, Vietnam and Laos. Most noticeable is in the case of Laos and Vietnam where there is drug import from China and India. These two countries are capable of producing their own raw material, resulting in the cheaper wholesale price than Thailand.

As for Singapore and other ASEAN countries where Thailand can compete on drug prices, the drugs are mostly from multinational companies in other regions such as America, Europe and Australia.

Strategies used for these drugs competition are employed for drugs produced in Asia. Manufacturers from private sectors may realize that the importance of creating brand

loyalty among ASEAN countries depends on the capability of the producers. The use of this strategy may prove appropriate with drugs imported from other ASEAN countries. On the other hand, brand loyalty resulted in a high price of imported drug for developing countries such as Laos. Thai's manufacturers should change their strategy by adopting product differentiation As an alternative. This product differentiate will specify quality, efficacy, taste, usage and the like.

Studies in pharmaceutical industry in Thailand from 1986 to present face the problem of unclarified data. FDA collected value and volume of drug production and import by pharmacological groups while custom department has collected value and volume in weight of drug imported and exported by custom code. Value of the produced, imported and exported drugs are collected in many steps of production and distribution. Some agencies collected value of production cost, while others collected wholesale price or retail price. Statistical value data of drugs published may confuse some policy decision makers. Private firms did not want to give their information to public agencies because they are afraid of bad impacts that will be return to them such as tax and competitors. In the past seriously competition may be made some factories gain more benefit than others so they have more influence than others. Now his strategy must be changed because drug manufacturers and medical professionals will be inspected by the consumers. Free trade agreement that break down border of trade so their competitors changed from Thai's local manufacturers to abroad firms. Aggregation of large and small firms is first priority to strengthened because network of world's large multinational companies try to cooperate and dictate national drug policy in developing countries. If local manufacturers still

compete with each other instead of collaborate and develop strategic plans, they may be taken over by multinational companies or down size to be re-packing factories.

The centralization of government official, businessman and professional council conduct monopolization of health service and health management system. Twelve governance comment concept and approach of health system reform that it's time to abolish this activity and come in force of all governance to construct social benefit and reduce defect in health system. Thai governance should create health system, which is honest and can be verified. They recommend establishment the national health council and multiprofessional councils. These organizations will decentralize and support community or local management (Report,2000:12). This recommendation is agreed by the vision of pharmacist governance in health system reform. Especially strategy in drug system which combine western and eastern medicine, research and development in herbal medicine for self sufficiency, international standard of quality assurance, promotion cost effectiveness of drug utilization and construction of information network to access Thai's people. These activities are expected to response vision of health system in 4 aspects such as policy, service, personnel and management system (Pharmacist council, 2000).

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APPENDIX

APPENDIX A TABLES

APPENDIX B TOOLS FOR COLLECTING DATA

APPENDIX C GLOSSARY

APPENDIX A

TABLES

Table 24 Location of establishment by region

	Location(region , province)	Number (N=68)	Percent
1	Bangkok Metropolitan	53	77.94
2	Vicinity		
	Nonthaburi	4	5.88
	Nakorn Prathom	3	4.41
	Pathumthani	2	2.94
	Samuthprakarn	5	7.36
3	Region		
	Ratchaburi	1	1.47
	Total	68	100.00

Table 25 Number and percent of establishments by person engaged compared with industrial census 1997.

List	Number	Percent (N=68)	Data from Industrial census (N=178)
- person engaged			
- 1-19 persons	6	8.9	12.9
- more than 20 persons	59	86.8	87.1
- non available	3	4.4	-
Total	68	100.00	100.00

Table 26 Number and percentage of establishments by legal organization compared with industrial census 1997.

List	Number	Percent (N=68)	Data of industrial census (N=178)
- company Ltd., public company	59	86.76	71.9
-limited partnership, juristic partnership	8	11.77	24.2
-other(state enterprise)	1	1.47	3.9
total	68	100.00	100.00

Table 27 Number of establishments by number of pharmacists engaged

Number of pharmacists engaged	Number of establish-ments	Percent	Number of formulas
- 2 persons	12	17.6	1-58
-3 persons	13	19.1	4-142
-4 persons*	14*	20.6	5-168
-5 persons	8	11.8	49-284
-6 persons	6	8.8	35-176
-7 persons	2	2.9	12-110
-8 persons	1	1.5	358
-9 persons	1	1.5	139
-10 persons	2	2.9	125
-12 persons	1	1.5	166
-15 persons	2	2.9	51-117
-16 persons	1	1.5	232
-17 persons	1	1.5	58
-180 persons	1	1.5	174
- non available	3	4.4	-
total	68	100.00	

Table 28 Number of establishments by dosage form received GMP certificates

Groups of dosage form received GMP certificates	Number of establish-ments	Tablet	Capsule	Liquid	Injection	Cream and ointment	Powder	other
7	1	1	1	1	1	1	1	1
6	12	12	12	12	10	12	11	3
5	19	19	19	19	3	18	16	1
4	9	9	7	9	1	6	3	1
3	6	6	6	6	0	0	0	0
2	5	1	1	4	0	2	2	0
1	7	1	0	1	2	0	0	3
0	9	-	-	-	-	-	-	-
Total	68	49	46	52	17	39	33	9

Table 29 Number of establishments received GMP certificate compared with Drug Control Division statistic

List	Number of establishments reply	Number of establishment from Drug Control Division statistic
2 year GMP certificate	24	46
produce tablet	19	36
non-produce tablet	5	10
1 year GMP certificate	35	83
produce tablet	31	74
non-produce tablet	4	9
Non received GMP certificate	9	47
	2	
produce tablet	7	
non-produce tablet		
Total	68	176

Table 30 Number and percentage of establishments by registered value compared with industrial census 1997.

List	Number of establishments	Percent (N=68)	Statistic from industrial census
less than 1 million baht	1	1.5	10.7
1-9 million baht	26	38.2	44.4
0-49 million baht	21	30.9	34.8
50-99 million baht	9	13.2	5.1
100-200 million baht	3	4.4	3.9
More than 200 million baht	3	4.4	1.1
Non available	5	7.4	-
Total	68	100.00	100.0

Table 31 Number and percentage of establishments by foreigner investment compared with industrial census 1997.

List	Number	Percent	Statistic from industrial census
Foreigners investment	9	13.2	12.4
No foreigners investment	56	82.4	87.6
Non available	3	4.4	-
Total	68	100.00	100.00

Table 32 Number and percentage of establishments by type of production.

List	Number	Percent (N=68)
Own's brand name	57	83.8
Generic name ordered	8	11.8
Thai own trade name	14	20.6
Multinational trade name	7	10.3

Table 33 Number and percentage of establishments by number of formulas

List	Number of formulas		Number of producers	
	Minimum	Maximum	Number	Percent
Produce tablet (1-228 formulas)	1	228	48	70.59

Table 33 Number and percentage of establishments by number of formulas. (cont.)

List	Number of formulas		Number of producers	
	Minimum	Maximum	Number	Percent
Produce capsule (1-70 formulas)	1	70	43	63.24
Produce injection (4-125formulas)	4	125	16	23.53
Produce liquid dosage form (2-61formulas)	2	61	51	75.0
Produce powder (1-24 formulas)	1	24	32	47.06
Produce cream and ointment (1-72formula)	1	72	40	58.82
Produce other dosage form (1-19formulas)	1	19	18	26.47

Table 34 Number and percentage of establishments by period of operations.

Period of operation(years)	Number	Percent (N=68)	Statistic from industrial census (N=178)
Less than 5 years	4	5.88	7.9
5-9 years	3	4.41	7.9
10-19 years	15	22.06	29.2
20-29 years	10	14.71	29.2
30 years and more	31	45.59	25.8

Table 34 Number and percentage of establishments by period of operations. (cont.)

Period of operation(years)	Number	Percent (N=68)	Statistic from industrial census (N=178)
Non available	5	7.35	-
Total	68	100.00	100.00

Table 35 Minimum and maximum capacity utilization.

Capacity	Capsule (34 factories)		Tablet (38 factories)	
	Full capacity (capsule)	Real capacity (capsule)	Full capacity (tablet)	Real capacity (tablet)
Minimum	500,000	200,000	3,000,000	600,000
Maximum	175,000,000	166,250,000	3,800,000,000	3,420,000,000

Table 36 Full and real capacity of tablet and capsule production

Capacity (1 million tablet or capsule)	Number of tablet producers		Number of capsule producers	
	Full capacity	Real capacity	Full capacity	Real capacity
Less than 1	0	2 (5.26)	2 (5.88)	8 (23.53)
1-50	10 (26.32)	16 (42.11)	18 (52.94)	22 (64.71)
50-100	7 (18.42)	3 (7.89)	10 (29.41)	3 (8.82)
100-150	25 (65.79)	6 (15.79)	3 (8.82)	0
150-200	6 (15.79)	3 (7.89)	1 (2.94)	1 (2.94)

Table 36 Full and real capacity of tablet and capsule production. (cont.)

Capacity (1 million tablet or capsule)	Number of tablet producers		Number of capsule producers	
	Full capacity	Real capacity	Full capacity	Real capacity
200-250	2 (5.26)	1 (2.63)	-	-
250-300	1 (2.63)	4 (10.53)	-	-
300-350	0	0	-	-
350-400	1 (2.63)	0	-	-
400-450	1 (2.63)	1 (2.63)	-	-
450-500	2 (5.26)	0	-	-
500-1000	4 (10.53)	1 (2.63)	-	-
1000-2000	1 (2.63)	0	-	-
2000-3000	0	0	-	-
More than 3000	1 (2.63)	1 (2.63)	-	-
Total of numbers	38 (100)	38 (100)	34 (100)	34 (100)

Note: If value of capacity is between 2 range, it is categorized in the lower group

(number) is number of establishments as percent

Table 38 Average percentage of real capacity and full capacity

List	Tablet	Capsule
Number of producers	38	34
Full capacity	13,232,000,000	1,671,360,000

Table 38 Average percentage of real capacity and full capacity. (cont.)

List	Tablet	Capsule
Real capacity	7,856,564,701	805,991,980
Percentage	59.38	48.22

Table 39 Number and percentage of establishments by present export market.

Number of exporters		Number of export Countries	Number of ASEAN	Other countries
Number	Percent		Countries	
1	2.86	1	0	1
5	14.29		1	0
2	5.71	2	2	0
7	20.00	3	3	0
1	2.86		2	1
1	2.86		4	0
1	2.86	4	3	1
2	5.71		2	2
3	8.57	5	5	0
4	11.43		4	1
2	5.71		6	0
2	5.71	6	4	2
1	2.86		3	3

Table 39 Number and percentage of establishments by present export market. (cont.)

Number of exporters		Number of export Countries	Number of ASEAN	Other countries
Number	Percent		Countries	
1	2.86	7	4	3
1	2.86		5	2
1	2.86	8	8	0
Total 35	100.00			

Table 40 Percentage of exporters by exported countries.

Countries	Number of exporters	Percent n=35
Asian countries		
Laos (PDR)	25	71.43
Myanmar	20	57.14
Malaysia	18	51.43
Cambodia	18	51.43
Singapore	12	34.29
Vietnam	10	28.57
Philippines	7	20.0
Indonesia	4	11.43
Brunei	-	-

Table 40 Percentage of exporters by exported countries. (cont.)

Countries	Number of exporters	Percent n=35
Middle east countries	4	11.43
China	5	14.29
Hong Kong	6	17.14
Europe countries	3	8.57
Japan	1	2.86
Sri Lanka	4	11.43
South America(Costa Rica)	2	5.71
U.S.A.	1	2.86
Other (South Africa)	1	2.86

Table 41 List of pharmaceutical products by exported countries.

Exported countries	Dosage form		Pharmacological group
Laos	Tablet & capsule	-	analgesic &antipyretic ,anthelmintic , cardiovascular contraceptive, antibiotic, gastrointestinal tract, inflammatory, anti-fungal, antihyperlipidemia, thyroid, vitamin, steroid, central nervous system, respiratory tract
	Cream &ointment	-	analgesic, steroid
	Solution	-	antiseptic, eye drop, lens irrigation
	Inhaler	-	aromatic inhaler
	Lozenge	-	antiseptic

Table 41 List of pharmaceutical products by exported countries. (cont.)

Exported countries	Dosage form	Pharmacological group
Laos	Injection	
	Other	
Myanmar	Tablet &capsule	- analgesic&antipyretic, cardiovascular, contraceptive, antibiotic, gastrointestinal tract, anti-inflammatory, vitamin, steroid, central nervous system, respiratory tract, antihistamine
	Cream &ointment	- analgesic
	Solution	- antiseptic, eye drop, lens irrigation
	Inhaler	- aromatic inhaler
	Lozenge	- antiseptic
	Injection	- intravenous solution
	Other	- enema
Malaysia	Tablet & capsule	- contraceptive, antibiotic, gastrointestinal tract, anti-inflammatory, vitamin, steroid, tthyroid
	Cream &ointment	- analgesic
	Solution	- antiseptic, aromatic oil, lens irrigation
	Inhaler	- aromatic inhaler
	Injection	- intravenous solution
	Other	- enema, tonic, plaster
Cambodia	Tablet &capsule	- analgesic, anthelmintic, contraceptive, antibiotic, gastrointestinal tract, anti-inflammatory, steroid, central nervous system, respiratory tract
	Ointment	- analgesic
	Solution	- antiseptic, aromatic oil, lens irrigation

Table 41 List of pharmaceutical products by exported countries. (cont.)

Exported countries	Dosage form	Pharmacological group
Singapore	Inhaler	- aromatic inhaler
	Lozenge	- antiseptic
	Injection	- intravenous solution
	Tablet &capsule	- analgesic, gastrointestinal tract, anti-fungal, cardiovascular system, antihyperlipidemia, antibiotic
	Cream	- analgesic
	Solution	- aromatic oil, lens irrigation
	Injection	- intravenous solution, antibiotic
	Other	- enema, plaster
Vietnam	Tablet &capsule	- analgesic &antipyretic, cardiovascular, contraceptive, antibiotic, gastrointestinal tract, antihyperlipidemia, respiratory tract
	Cream	- analgesic
	Solution	- aromatic oil
	Inhaler	- aromatic inhaler
	Injection	- intravenous solution
	Other	- plaster
Philippines	Tablet &capsule	- cardiovascular, antibiotic, gastrointestinal tract, antihyperlipidemia
	Cream	- analgesic
	Injection	- intravenous solution
	Other	- enema

Table 41 List of pharmaceutical products by exported countries. (cont.)

Exported countries	Dosage form	Pharmacological group
Indonesia	Tablet & capsule	- antibiotic, steroid
	Other	- plaster
Middle east countries	Tablet & capsule	- analgesic &antipyretic , antibiotic, gastrointestinal tract, respiratory tract, steroid
	Other	- plaster
China	Ointment	- analgesic
	Solution	- antiseptic, aromatic oil
	Lozenge	- antiseptic
Hong Kong	Tablet & capsule	- cardiovascular, antibiotic, gastrointestinal tract, anti-viral
	Other	- enema
Japan	Capsule	- antibiotic
	Ointment	- balm
	Solution	- aromatic oil
	Inhaler	- aromatic inhaler
Sri Lanka	Tablet &capsule	- antibiotic, anti-hyperlipidemia, anti-inflammatory
	Other	- enema
Europe	Inhaler	- aromatic inhaler
	Ointment	- balm
	Other	- plaster

Table 42 Number and percent of establishments by export expand in the future.

Manufacturers	Number	Percent
- No export expand	21	30.89
Thai's owners	20	29.41
Foreign 's owners	1	1.48
- Plan to expand export	27	39.70
Thai's owners	22	32.35
Foreign 's owners	5	7.35
- Non available	20	29.41
Total	68	100.00

Table 43 Number and percent of establishment by exported expand countries.

Country	Number of producers	Percent (n = 27)	Reason
ASEAN countries			
Laos	17	62.96	Neighborhood country
Myanmar	20	74.07	Increase sale value and
Malaysia	13	48.15	Expand market
Cambodia	16	59.26	Consumer demand match
Singapore	8	29.63	with products of
			producers
Vietnam	9	33.33	
Philippines	11	40.74	

Table 43 Number and percent of establishment by exported expand countries. (cont.)

Country	Number of producers	Percent (n = 27)	Reason
Indonesia	9	33.33	
Brunei	5	18.52	
Middle east countries	2	7.41	Expand market
China	1	3.70	
Hong Kong	2	7.41	
Europe countries	1	3.70	
Japan	1	3.70	
Sri Lanka	3	11.11	
South America countries	1	3.70	
U.S.A.	1	3.70	
Other countries	1	3.70	

Table 44 Dosage form and pharmacological group planned to export by countries.

Exported countries	Dosage form	Pharmacological group
ASEAN countries		
Laos	Tablet & capsule	- analgesic & antipyretic, gastrointestinal tract, vitamin
	Injection	- vaccine
	Other	- aromatic oil, balm, plaster

Table 44 Dosage form and pharmacological group planned to export by countries.

(cont.)

Exported countries	Dosage form	Pharmacological group
Myanmar	Tablet & capsule	- analgesic, cardiovascular, antibiotic, gastrointestinal, vitamin, respiratory tract, OTC drug
	Other	- herbal medicine, aromatic oil, balm , plaster
Malaysia	Tablet & capsule	- cardiovascular, OTC drug
	Injection	- antibiotic
	Other	- herbal medicine, aromatic oil, balm, plaster
Cambodia	Tablet & capsule	- analgesic & antipyretic, antibiotic, gastrointestinal tract, anti-malaria , vitamin
	Other	- balm
Singapore	Tablet & capsule	- gastrointestinal tract, cardiovascular
	Injection	- antibiotic
	Other	- balm
Vietnam	Tablet & capsule	- OTC drug , analgesic & antipyretic
	Injection	- antibiotic
	Other	- balm

Table 44 Dosage form and pharmacological group planned to export by countries.

(cont.)

Exported countries	Dosage form	Pharmacological group
Philippines	Tablet & capsule	- cardiovascular , OTC drug , gastrointestinal
	Inhaler	tract, analgesic & antipyretic
	Other	-herbal medicine , balm
Indonesia	Tablet & capsule	- OTC drug
	Injection	-antibiotic
	Other	- herbal medicine, balm
Brunei	Other	- balm
Middle east countries	Other	- plaster
China	Other	- plaster
Hong Kong	Other	- plaster
Japan	Other	- plaster
Europe	Other	- plaster

Table 47 Production cost of 18 selected drugs

Name	Pack-ing	Number of Producers	Domestic cost		Foreign cost		Total	
			Minimum – maximum	Average	Minimum-maximum	Average	Minimum-maximum	Average
Amoxycillin 500 mg.	500	9	32.90 - 135.00	83.08 ± 33.45	440.00 - 901.00	646.55 ±137.58	537.50 - 982.78	729.63 ±136.08
Ampicillin 500 mg.	500	11	36.63 - 230.00	111.79 ± 55.78	425.00 - 783.52	592.26 ±114.09	522.50 - 910.00	704.05 ±132.72
Antacid	1000	9	25.00 - 117.29	61.67 ± 30.29	20.15 - 113.91	72.55 ±29.50	95.00 - 180.00	134.22 ±29.36
Antacid	50x10	4	14.93 - 54.00	40.94 ± 17.62	25.67 - 78.58	43.94 ±23.68	79.67 - 93.51	84.89 ±6.40
Bromhexine 8 mg.	1000	9	17.43 - 81.20	47.39 ± 85.04	10.33 - 36.00	25.21 ±9.63	43.03 - 117.20	72.60 ±25.86
Cefalexin 250 mg.	100	1	28.17	28.17	187.87	187.87	216.04	216.04
Cefalexin 250 mg.	10x10	1	49.00	49.00	200.00	200.00	249.00	249.00
Cefalexin 250 mg.	500	1	107.00	107.00	908.00	908.00	1015.00	1015.00
Cimetidine 400 mg.	500	8	38.01 - 183.00	84.66 ± 51.12	123.68 - 228.00	165.01 ±44.36	155.71 - 340.00	249.68 ±84.50
Diclofenac 25 mg.	1000	9	21.25 - 142.00	73.21 ± 37.43	16,00 - 97.14	60.83 ±29.09	37.50 - 222.00	134.04 ±51.94
Glibenclamide 5 mg.	500	3	28.18 - 35.79	32.51 ± 3.91	21.00 - 48.51	33.19 ±14.02	56.79 - 76.69	65.71 ±10.11

Table 47 Production cost of 18 selected drugs. (cont.)

Name	Packing	Number of Producers	Domestic cost		Foreign cost		Total	
			Minimum – maximum	Average	Minimum-maximum	Average	Minimum-maximum	Average
Glibenclamide 5 mg.	1000	3	70.00 - 90.00	80.76 ± 10.09	19.75 - 100.00	53.25 ±48.65	102.03 - 190.00	134.01 ±56.53
Glibenclamide 5 mg.	50x10	2	92.00 - 141.00	116.00 ± 34.65	19.75 - 48.51	34.13 ±20.34	140.14 - 160.85	150.50 ±14.64
Ibuprofen 200 mg.	500	7	25.14 - 82.00	50.58 ± 21.74	46.13 - 252.50	97.42 ±73.43	76.79 - 322.50	148.00 ±81.41
Ibuprofen 200 mg.	1000	9	56.61 - 100.00	80.33 ± 15.35	82.00 - 220.00	128.62 ±46.24	150.20 - 287.00	208.95 ± 47.31
Ketoconazole 200 mg.	100	1	50.00	50.00	310.00	310.00	360.00	360.00
Ketoconazole 200 mg.	10x10	3	25.62 - 58.33	44.32 ± 16.85	152.81 - 220.00	196.49 ±37.87	178.43 - 275.00	240.81 ±54.11
Ketoconazole 200 mg.	25x10	2	55.72 - 128.04	91.88 ± 51.14	279.17 - 423.86	102.31	407.20 - 479.58	443.39 ±51.17
Ketoconazole 200 mg.	50x10	1	244.30	244.30	883.55	883.55	1127.85	1127.85

Table 47 Production cost of 18 selected drugs. (cont.)

Name	Packing	Number of Producers	Domestic cost		Foreign cost		Total	
			Minimum – maximum	Average	Minimum-maximum	Average	Minimum-maximum	Average
Mebendazole 100 mg.	250	1	84.74	84.74	116.67	116.67	201.40	201.40
Mebendazole 100 mg.	1000	1	26.00	26.00	157.32	157.32	183.32	183.32
Norfloxacin 200 mg.	100	1	13.53	13.53	34.92	34.92	48.45	48.45
Norfloxacin 200 mg.	500	4	41.92 - 175.00	105.76 ± 58.34	100.00 - 367.78	208.91 ±117.93	177.29 - 409.70	314.67 ±111.11
Norfloxacin 200 mg.	1000	2	17.00 - 90.00	53.50	99.00 - 700.00	399.5	116.00 - 790.00	453.00
Norfloxacin 200 mg.	10x10	1	13.41	13.41	48.86	48.86	62.27	62.27
Norfloxacin 200 mg.	50x10	2	155.00 - 175.52	165.26 ± 14.51	100.00 - 225.00	162.5 ±88.39	275.52 - 380.00	327.76 ±73.88
Norfloxacin 200 mg.	5x4	1	9.57	9.57	5.71	5.71	15.28	15.28
Paracetamol 500 mg.	100	1	4.20	4.20	5.65	5.65	9.85	9.85
Paracetamol 500 mg.	1000	23	14.00 - 249.18	56.91 ± 46.61	25.00 - 104.00	71.28 ±27.95	48.00 - 396.13	128.19 ±66.51

Table 47 Production cost of 18 selected drugs. (cont.)

Name	Packing	Number of Producers	Domestic cost		Foreign cost		Total	
			Minimum – maximum	Average	Minimum-maximum	Average	Minimum-maximum	Average
Paracetamol 500 mg.	10x10	1	66.44	66.44	53.33	53.33	119.76	119.76
Paracetamol 500 mg.	50x10	3	58.00 - 192.00	115.03 ± 69.19	27.50 - 39.00	34.83 ±6.37	97.00 - 230.00	149.86 ±70.57
Piroxicam 10 mg.	500	5	76.66 - 127.85	93.04 ± 23.88	11.25 - 61.17	29.51 ±22.58	87.91 - 157.85	122.55 ±36.74
Piroxicam 10 mg.	1000	5	52.00 - 182.88	112.84 ± 49.57	27.00 - 140.00	73.71 ±59.72	118.76 - 240.00	186.56 ±45.80
Piroxicam 10 mg.	10x10	1	22.00	22.00	14.75	14.75	36.75	36.75
Propanolol 10 mg.	1000	2	65.34 - 69.31	67.33 ± 2.81	5.00 - 9.80	7.43.39	74.31 - 75.14	74.73 ±0.59
Ranitidine 150 mg.	100	1	153.16	153.16	552.73	552.73	705.90	705.90
Vitamin B1-6-12	1000	8	19.85 - 110.00	51.60 ± 36.96	106.05 - 255.50	148.83 ±52.41	126.63 - 281.50	200.43 ±57.37
Vitamin B1-6-12	500	3	29.71 - 51.00	37.89 ± 11.47	67.63 - 95.90	85.84 ±15.80	100.58 - 145.00	123.73 ±22.27

Table 49 Domestic resource cost calculated by using minimum cost of production of each item.

Name	Packing	Domestic cost of production (direct cost)	Foreign cost of production (direct cost)	Factory price (1996)	Exchange rate (ER) (1996)	Real exchange rate(EER) (1996)	Domestic resource cost (DRC) (baht/dollar)	DRC/EER
Amoxycillin 500 mg. Cap.	500	97.50	440.00	600.00	25.85	26.10	15.75	0.60
Ampicillin 500 mg. Cap.	500	97.50	425.00	600.00	25.85	26.10	14.40	0.55
Antacid tab.	50X10	54.00	25.67	105.00	25.85	26.10	17.60	0.67
Antacid tab.	1000	35.00	60.00	120.00	25.85	26.10	15..08	0.58
Bromhexine 8 mg. Tab.	1000	17.43	25.60	48.00	25.85	26.10	20.11	0.77
Cimetidine 400 mg. Tab.	500	48.40	107.32	1080.00	25.85	26.10	1.29	0.05
Diclofenac 25 mg. Tab.	1000	21.25	16.25	150.00	25.85	26.10	4.11	0.16
Glibenclamide 5 mg. Tab.	50X10	92.00	48.51	445.00	25.85	26.10	6.00	0.23
Glibenclamide 5 mg. Tab.	500	35.79	21.00	126.17	25.85	26.10	8.80	0.34
Glibenclamide 5 mg. Tab.	1000	82.28	19.75	270.00	25.85	26.10	8.50	0.33
Ibuprofen 200 mg. Tab.	500	25.14	51.65	90.00	25.85	26.10	16.95	0.65
Ibuprofen 200 mg. Tab.	1000	56.61	93.59	180.00	25.85	26.10	16.94	0.65

Table 49 Domestic resource cost calculated by using minimum cost of production of each item. (cont.)

Name	Packing	Domestic cost of production (direct cost)	Foreign cost of production (direct cost)	Factory price (1996)	Exchange rate (ER) (1996)	Real exchange rate(EER) (1996)	Domestic resource cost (DRC) (baht/dollar)	DRC/EER
Ketoconazole 200 mg. Tab.	10X10	25.62	152.81	275.00	25.85	26.10	5.42	0.21
Ketoconazole 200 mg. Tab.	25X10	128.04	279.17	700.00	25.85	26.10	7.87	0.30
Norfloxacin 200 mg. Tab.	50X10	175.52	100.00	450.00	25.85	26.10	12.96	0.50
Norfloxacin 200 mg. Tab.	500	77.29	100.00	360.00	25.85	26.10	7.68	0.29
Norfloxacin 200 mg. Tab.	1000	17.00	99.00	1400.00	25.85	26.10	0.34	0.01
Paracetamol 500 mg. Tab.	50X10	58.00	39.00	200.00	25.85	26.10	9..31	0.36
Paracetamol 500 mg. Tab.	1000	23.00	25.00	80.00	25.85	26.10	10.81	0.41
Piroxicam 10 mg. Cap.	500	76.66	11.25	100.00	25.85	26.10	22.33	0.86
Piroxicam 10 mg. Cap.	1000	91.76	27.00	966.67	25.85	26.10	2.52	0.10
Propanolol 10 mg. Tab.	1000	69.31	5.00	572.00	25.85	26.10	3.16	0.12
Vitamin B 1-6-12 tab.	500	32.95	67.63	170.00	25.85	26.10	8.32	0.32

Table 49 Domestic resource cost calculated by using minimum cost of production of each item. (cont.)

Name	Packing	Domestic cost of production (direct cost)	Foreign cost of production (direct cost)	Factory price (1996)	Exchange rate (ER) (1996)	Real exchange rate(EER) (1996)	Domestic resource cost (DRC) (baht/dollar)	DRC/EER
Vitamin B 1-6-12 tab.	1000	20.58	106.05	261.68	25.85	26.10	3.42	0.13

Table 50 Domestic resource cost calculated by using maximum cost of production

List	Packing	Domestic cost of production (direct cost)	Foreign cost of production (direct cost)	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate(EER) 1996	Domestic resource cost (DRC)	DRC/EER
Amoxycillin 500 mg. Cap.	500	81.78	901.00	1600.00	25.85	26.10	3.02	0.12
Ampicillin 500 mg. Cap.	500	230.00	680.00	1800.00	25.85	26.10	5.31	0.20
Antacid tab.	50X10	14.93	78.58	130.00	25.85	26.10	7.51	0.29
Antacid tab.	1000	80.00	100.00	400.00	25.85	26.10	6.89	0.26

Table 50 Domestic resource cost calculated by using maximum cost of production. (cont.

List	Packing	Domestic cost of production (direct cost)	Foreign cost of production (direct cost)	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate(EER) 1996	Domestic resource cost (DRC)	DRC/EER
Bromhexine 8 mg. Tab.	1000	81.20	36.00	300.00	25.85	26.10	7.95	0.30
Cimetidine 400 mg. Tab.	500	183.00	212.00	1080.00	25.85	26.10	5.45	0.21
Diclofenac 25 mg. Tab.	1000	142.00	80.00	500.00	25.85	26.10	8.74	0.33
Glibenclamide 5 mg. Tab.	50X10	141.00	19.75	445.00	25.85	26.10	8.57	0.33
Glibenclamide 5 mg. Tab.	500	28.18	48.51	500.00	25.85	26.10	1.61	0.06
Glibenclamide 5 mg. Tab.	1000	90.00	100.00	350.00	25.85	26.10	9.31	0.36
Ibuprofen 200 mg. Tab.	500	70.00	252.50	325.00	25.85	26.10	24.96	0.96
Ibuprofen 200 mg. Tab.	1000	67.00	220.00	500.00	25.85	26.10	6.19	0.24
Ketoconazole 200 mg. Tab.	10X10	58.33	216.67	850.00	25.85	26.10	2.38	0.09
Ketoconazole 200 mg. Tab.	25X10	55.72	423.86	2090.00	25.85	26.10	0.86	0.03
Norfloxacin 200 mg. Tab.	50X10	155.00	225.00	450.00	25.85	26.10	17.81	0.68

Table 50 Domestic resource cost calculated by using maximum cost of production. (cont.)

List	Packing	Domestic cost of production (direct cost)	Foreign cost of production (direct cost)	Factory price 1996	Exchange rate (ER) 1996	Real exchange rate (EER) 1996	Domestic resource cost (DRC)	DRC/EER
Norfloxacin 200 mg. Tab.	500	41.92	367.78	2000.00	25.85	26.10	0.66	0.03
Norfloxacin 200 mg. Tab.	1000	90.00	700.00	1400.00	25.85	26.10	3.32	0.13
Paracetamol 500 mg. Tab.	50X10	192.00	38.00	200.00	25.85	26.10	30.64	1.17
Paracetamol 500 mg. Tab.	1000	249.18	146.95	242.00	25.85	26.10	67.77	2.60
Piroxicam 10 mg. Cap.	500	127.85	30.00	335.00	25.85	26.10	10.84	0.42
Piroxicam 10 mg. Cap.	1000	100.00	140.00	966.67	25.85	26.10	1.13	0.12
Propanolol 10 mg. Tab.	1000	65.34	9.80	572.00	25.85	26.10	3.00	0.12
Vitamin B 1-6-12 tab.	500	51.00	94.00	360.00	25.85	26..10	4.96	0.19
Vitamin B 1-6-12 tab.	1000	26.00	255.50	464.00	25.85	26.10	3.22	0.12

* = Item which has one cost of production

Table 51 Value of production, import and export of antibiotic groups forecast by linear regression (unit: million dollars).

Year	Production value	R^2	Imported value	R^2	Exported value	R^2
1995	182.293	-	131.582	-	9.400	-
1996	185.124	-	63.251	-	10.401	-
1997	153.521	-	62.890	-	40.304	-
1998	101.618	-	30.296	-	11.032	-
1999	118.685	.608	29.992	.603	12.953	.048
2000	119.065	.644	40.247	.638	14.559	.048
2001	125.975	.659	40.038	.653	13.767	.047
2002	125.574	.666	45.445	.660	14.525	.047

Table 52 Value of production, import and export of other group (unit: million dollars).

Year	Production value	R^2	Imported value	R^2	Exported value	R^2
1995	380.471	-	170.593	-	6.824	-
1996	381.249	.958	184.713	-	7.388	-
1997	387.952	.962	339.289	-	13.572	-
1998	402.466	.542	165.913	-	6.636	-
1999	361.696	.351	165.904	1.00	6.635	1.00
2000	361.699	.352	151.041	.814	7.138	.831
2001	364.534	.352	162.461	.811	6.787	.828

Table 52 Value of production, import and export of other group (unit: million dollars). (cont.)

Year	Production value	R^2	Imported value	R^2	Exported value	R^2
2002	362.585	.351	154.430	.810	7.107	.827

Table 53 Value of production , import and export of vitamin group (unit: million dollars).

Year	Production value	R^2	Imported value	R^2	Exported value	R^2
1995	27.509	-	18.301	-	5.629	-
1996	27.509	1.000	9.862	-	3.395	-
1997	28.029	.921	14.71	-	12.793	-
1998	27.348	.343	7.385	-	2.765	-
1999	26.169	.217	10.221	.416	3.682	.280
2000	26.619	.221	9.757	.420	5.067	.285
2001	26.479	.220	10.742	.420	4.791	.285
2002	26.683	.220	10.500	.420	5.247	.285

Table 54 Production and import value of 18 selected drugs 1996-1997

Name	Production		Import	
	1996	1997	1996	1997
	Volume(tab./cap.) [value] (Baht)	Volume(tab./cap.) [value] (Baht)	Volume(tab./cap.) [value] (Baht)	Volume(tab./cap.) [value] (Baht)
Amoxycillin 500 mg.	107,029,720 [276,384,644.04]	126,223,002 [283,095,866.14]	-	775,080 [2,748,925.00]
Ampicillin 500 mg.	60,907,499 [147,375,164.46]	61,593,668 [99,069,205.80[	1,449,000 [11,663,000.00]	3,616,500 [4,964,055.00]
Bromhexine 8 mg.	91,243,970 [51,047,153.39]	141,875,380 [81,467,736.33]	2,700,000 [737,700.00]	1,600,000 [496,000.00]
Cefalexin 250 mg.	3,543,900 [811,888,984.80]	6,121,350 [19,666,640.61]	169,900 [878,751.00]	271,591 [2,256,194.85]
Cimetidine 400 gm.	80,364,196 [89,615,223.69]	103,613,503 [72,759,040.93]	250,000 [263,925.00]	NA
Diclofenac 25 mg.	49,000,531 [37,096,458.60]	87,449,371 [48,432,947.84]	500 [0.00]	0 [0.00]
Glibenclamide 5 mg.	118,279,056 [110,916,029.54]	178,985,880 [167,511,834.99]	2,850,000 [1,587,850.00]	7,828,000 [2,075,490.00]
Ibuprofen 200 mg.	84,725,051 [33,219,402.44]	105,142,416 [37,018,718.05]	1,000,000 [500,000.00]	1,650,000 [758,500.00]
Ketoconazole 200 mg.	29,473,716 [34,958,338.17]	26,405,240 [137,503,436.98]	99,000 [360,723.00]	6,271,580 [23,669,264.50]
Mebendazole 100 mg.	6,726,576 [5,980,276.00]	28,302,036 [14,629,600.78]	0 [0.00]	40,000 [54,945.00]
Mebendazole 500 mg.	4,843,280 [77,619,601.00]	5,719,824 [84,170,642.50]	0 [0.00]	0 [0.00]

Table 54 Production and import value of 18 selected drugs 1996-1997 (cont.)

Name	Production		Import	
	1996	1997	1996	1997
	Volume(tab./cap.) [value] (Baht)	Volume(tab./cap.) [value] (Baht)	Volume(tab./cap.) [value] (Baht)	Volume(tab./cap.) [value] (Baht)
Norfloxacin 200 mg.	25,086,830 [32,010,963.89]	28,541,342 [45,655,726.79]	170,000 [666,400.00]	NA
Nifedipine 5 mg.	13,610,600 [12,075,108.00]	13,293,400 [9,998,764.00]	2,371,700 [48,300,686.75]	8,720,000 [34,807,160.00]
Paracetamol 500 mg.	1,499,008,921 [296,775,268.68]	1,708,705,950 [278,221,926.17]	0 [0.00]	0 [0.00]
Piroxicam 10 mg.	14,025,172 [50,576,464.66]	122,377,485 [54,721,812.33]	3,720,000 [7,562,333.32]	3,259,500 [9,585,739]
Propanolol 10 mg.	35,029,500 [14,795,395.50]	87,743,100 [30,967,674.37]	2,550,000 [757,350.30]	5,250,000 [1,427,405]
Ranitidine 150 mg.	26,828,320 [66,086,535.60]	15,820,820 [44,853,252.31]	2,908,700 [4,793,359.00]	3,722,340 [4,901,724]
Viamin B1-6-12	231,516,467 [119,543,693.21]	282,763,127 [149,803,317.19]	1,000 [680.00]	2,000 [1,000]

source: FDA

Table 55 Analysis of strength , weakness in current operation.

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
Internal environment														
1. Internal image and prestige	1	3.33	5	16.67	23	76.67	2	0	0	1	5	3	12	8
2. Organization structure	5	16.67	7	23.33	17	56.67	2	0	1	4	7	5	10	2
3. Planning and control system	5	16.67	7	23.33	17	56.67	1,2	1	2	2	7	8	8	1
4. Delegation of authority	6	20.0	5	16.67	18	60.0	1	1	0	5	5	9	8	1
5. Communication network	5	16.67	8	26.67	16	53.33	0,2	0	1	4	8	5	8	3
6. Hierarchy of objective	5	16.67	4	13.33	20	66.67	2	1	0	4	4	7	10	3
7. Strategic management system	5	16.67	4	13.33	20	66.67	1	2	0	3	4	11	7	2
8. Ability of management team	3	10.0	5	16.67	21	70.0	1	1	1	1	5	10	9	2
9. Policy of head company	2	6.67	8	26.67	13	43.33	0	1	0	1	8	7	3	3
10.Location of plant	3	10.0	8	26.67	18	60.0	0	1	0	2	8	6	6	6
Operation Management														
1. Operation cost	13	43.33	4	13.33	12	40.0	1	2	4	7	4	8	0	4

Table 55 Analysis of strength , weakness in current operation. (cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
2. Use of technology	6	20.0	9	30.0	14	46.67	0,1	0	1	5	9	9	3	2
3. Raw materials cost	13	43.33	5	16.67	11	36.67	-1	3	3	7	5	4	4	3
4. Adequate availability of raw materials	8	26.67	8	26.67	13	43.33	0	1	3	4	8	5	4	4
5. Efficient and effective equipment and machinery	7	23.33	2	6.67	20	66.67	1	1	2	4	2	13	5	2
6. Inventory control	8	26.67	6	20.0	15	50.0	1	2	3	3	6	8	2	5
7. Human resource in management	5	16.67	9	30.0	15	50.0	0,1	0	2	3	9	9	4	2
Marketing and distribution management														
1. Market share	6	20.0	6	20.0	17	56.67	1	1	2	3	6	10	3	4
2. Distribution system	3	10.0	8	26.67	18	60.0	1	1	0	2	8	9	8	1
3. Market research	11	36.67	8	26.67	10	33.33	0	2	3	6	8	5	5	0
4. Sales force productivity	8	26.67	4	13.33	17	56.67	2	1	1	6	4	6	8	3
5. price competitiveness	15	50..0	5	16.67	9	30.0	-1	4	3	8	5	2	5	2

Table 55 Analysis of strength , weakness in current operation. (cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
6. Business image	1	3.33	6	20.0	22	73.33	2	0	0	1	6	6	10	6
7. Human resource in marketing	9	30.0	3	10.0	17	56.67	1,2	1	1	7	3	8	8	1
8. Use of IT in operation	8	26.67	8	26.67	12	40.0	0	1	2	5	8	5	7	0
R&D and Engineering														
1. R&D facilities	12	40.0	9	30.0	8	26.67	0	4	0	8	9	6	2	0
2. R&D funding	15	50.0	5	16.67	9	30.0	-1	4	3	8	5	5	4	0
3. Development of new products	11	36.67	8	26.67	10	33.33	0	1	3	7	8	4	5	1
4. Human resource in R&	12	40.0	7	23.33	10	33.33	-1	2	2	8	7	5	4	1
Human resource management														
1. Recruitment practice	5	16.67	12	40.0	12	40.0	0	0	0	5	12	8	3	1
2. Training programs	8	26.67	7	23.33	14	46.67	1	0	0	8	7	11	2	1
3. Reward system	5	16.67	11	36.67	13	43.33	0	1	2	2	11	7	4	2
4. Quality of corporate staffs	8	26.67	5	16.67	16	53.33	1	0	0	8	5	11	2	3

Table 55 Analysis of strength , weakness in current operation. (cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
5. Cost of labor	8	26.67	13	43.33	8	26.67	0	0	1	7	13	6	2	0
6. Performance appraisal system	6	20.0	8	26.67	15	50.0	1	1	0	5	8	12	3	0
7. Turn over and absenteeism	7	23.33	12	40.0	10	33.33	0	0	0	7	12	6	1	3
8. Favor system	4	13.33	19	63.33	6	20.0	0	0	1	3	19	1	4	1

Table 56 Evaluation of opportunity and threats in operation.

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
External Environment														
1. Gross Domestic Products	6	20.0	13	43.33	9	30.0	0	0	1	5	13	6	3	0
2. Per capita income	10	33.33	7	23.33	11	36.67	-1	0	1	9	7	6	5	0
3. Inflation	16	53.33	7	23.33	5	16.67	-1	0	2	14	7	5	0	0

Table 56 Evaluation of opportunity and threats in operation. (cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
4. Foreign exchange impact	25	83.33	1	3.33	2	6.67	-1	8	6	11	1	1	0	1
5. Wage level	19	63.33	5	16.67	4	13.33	-1	1	6	12	5	2	1	1
6. Raw material supply	13	43.33	7	23.33	8	26.67	-1	2	3	8	7	4	3	1
7. Manpower supply	9	30.0	10	33.33	9	30.0	0	1	1	7	10	7	2	0
Social factors														
1. Growth rate of population	1	3.33	4	13.33	23	76.67	1	1	0	0	4	17	4	2
2. Ecological impacts	6	20.0	18	60.0	4	13.33	0	1	0	5	18	3	1	0
3. Consumer protection	6	20.0	15	50.0	7	23.33	0	1	1	4	15	4	2	1
4. Family size change	4	13.33	14	46.67	10	33.33	0	0	0	4	14	7	2	1
5. Distribution of population age	4	13.33	16	53.33	8	26.67	0	1	0	3	16	6	0	2
6. Population education change	6	20.0	8	26.67	14	46.67	1	1	1	4	8	10	3	1
7. Degree of unionization	9	30.0	19	63.33	0	-	0	0	0	9	19	0	0	0

Table 56 Evaluation of opportunity and threats in operation. (cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
Technological change														
1. Maturity and volatility of technology	4	13.33	6	20.0	17	56.67	1	1	0	3	6	13	3	1
2. Complexity of technology	6	20.0	12	40.0	10	33.33	0	1	0	5	12	8	1	1
3. Patents	22	73.33	3	10.0	3	10.0	-1	5	7	10	3	3	0	0
4. Product R&D requirement	8	26.67	4	13.33	16	53.33	1	1	0	7	4	9	6	1
5. Process R&D requirement	6	20.0	3	10.0	19	63.33	1	0	2	4	3	11	5	3
6. Technology transfer	5	16.67	4	13.33	19	63.33	1	1	0	4	4	14	3	2
Politic and legal														
1. Essential drug list	20	66.67	4	13.33	5	16.67	-1	5	7	8	4	3	2	0
2. Purchasing regulation of public health center	25	83.33	1	3.33	3	10.0	-3	12	6	7	1	1	1	1
3. Controlled price	21	70.0	5	16.67	3	10.0	-1	5	7	9	5	2	1	0
4. Environment law ISO 14000	13	43.33	11	36.67	5	16.67	0	2	2	9	11	4	1	0
5. International standard ISO	10	33.33	12	40.0	7	23.33	0	1	1	8	12	5	1	1

Table 56 Evaluation of opportunity and threats in operation.. (cont.)

List /score	Percentage of informants by group						Percentage of informants by score							
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
6. Good Manufacturing Practice(GMP)	3	10.0	6	20.0	20	66.67	1	2	0	1	6	11	7	2
7. Tariff	14	46.67	10	33.33	5	16.67	0	2	3	9	10	2	2	1
8. Value added tax(VAT)	18	60.0	9	30.0	2	6.67	-1	4	4	10	9	1	1	0
9. Advertising law	16	53.33	10	33.33	3	10.0	0	4	3	9	10	1	1	1
10.Government support	12	40.0	4	13.33	13	43.33	1	7	2	3	4	9	2	2
Economic index of ASEAN														
1. Gross National Product(GNP)	6	20.0	12	40.0	11	36.67	0	0	0	6	12	9	0	2
2. Per capita income	5	16.67	13	43.33	11	36.67	0	0	0	5	13	8	1	2
3. Population growth	2	6.67	11	36.67	16	53.33	1	0	0	2	11	11	3	2
4. Natural resource	2	6.67	21	70.0	6	20.0	0	0	0	2	21	6	0	0
5. Climate	4	13.33	16	53.33	9	30.0	0	0	0	4	16	7	2	0
6. Membership in regional economic blocks	4	13.33	14	46.67	9	30.0	0	1	0	3	14	8	1	0
7. Monetary and fiscal policies	5	16.67	16	53.33	7	23.33	0	0	0	5	16	5	1	1

Table 56 Evaluation of opportunity and threats in operation.(cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
8. Inflation	14	46.67	11	36.67	4	13.33	0	1	2	11	11	3	0	1
9. Taxation system	9	30.0	14	46.67	6	20.0	0	3	0	6	14	5	0	1
10. Interest rate	10	33.33	13	43.33	6	20.0	0	0	2	8	13	4	2	0
11. Wage and salary levels	10	33.33	14	46.67	5	16.67	0	1	2	7	14	4	1	0
International laws of ASEAN														
1. Legal tradition	16	53.33	10	33.33	3	10.0	-1	1	2	13	10	3	0	0
2. Patent ,trade mark law	19	63.33	10	33.33	0	-	-1	3	4	12	10	0	0	0
3. Law affecting business firm	18	60.0	8	26.67	3	10.0	-1	3	2	13	8	3	0	0
ASEAN political factor														
1. Stability of government	5	16.67	17	56.67	7	23.33	0	0	1	4	17	5	1	1
2. Strength of opposition parties and group	6	20.0	21	70.0	2	6.67	0	0	0	6	21	2	0	0
3. Foreign policies	5	16.67	18	60.0	6	20.0	0	0	2	3	18	4	1	1
ASEAN cultural factor														

Table 56 Evaluation of opportunity and threats in operation.(cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
1. Customs, norms, value and beliefs	4	13.33	24	80.0	1	3.33	0	0	1	3	24	1	0	0
2. Language	6	20.0	22	73.33	1	3.33	0	1	1	4	22	1	0	0
3. Attitudes	6	20.0	18	60.0	5	16.67	0	1	1	4	18	5	0	0
4. Religious beliefs	3	10.0	25	83.33	1	3.33	0	0	0	3	25	1	0	0
Evaluation of rivalry among competitors														
Entry barriers														
1. Economics of scale	8	26.67	5	16.67	16	53.33	1	2	1	5	5	10	5	1
2. Product differentiation	7	23.33	6	20.0	16	53.33	1	0	3	4	6	11	4	1
3. Brand identity	3	10.0	4	13.33	22	73.33	2	1	1	1	4	7	13	2
4. Switching cost	13	43.33	8	26.67	7	23.33	0	2	4	7	8	5	2	0
5. Capital for R&D requirement	15	50.0	7	23.33	6	20.0	-2,0	2	7	6	7	4	2	0
6. Access to distribution channels	6	20.0	10	33.33	12	40.0	0	2	0	4	10	8	3	1
7. Access to latest technology	8	26.67	7	23.33	12	40.0	1	1	1	6	7	8	3	1

Table 56 Evaluation of opportunity and threats in operation.(cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
8. Access to raw materials	14	46.67	4	13.33	10	33.33	-1	1	4	9	4	3	6	1
9. Government protection	10	33.33	16	53.33	2	6.67	0	2	1	7	16	1	0	1
10. Experience effect cost	3	10.0	6	20.0	19	63.33	1	1	0	2	6	10	5	4
Exit barriers														
1. Asset specialization	4	13.33	10	33.33	14	46.67	0	1	1	2	10	3	8	3
2. Fixed cost of exit	6	20.0	8	26.67	14	46.67	1	1	1	4	8	9	3	2
3. Strategic interrelationship	8	26.67	9	30.0	11	36.67	0	1	2	5	9	6	2	3
4. Emotional barriers	7	23.33	9	30.0	12	40.0	0	1	2	4	9	6	1	5
5. Government and social restriction	8	26.67	11	36.67	9	30.0	0	1	2	5	11	4	3	2
Rivalry among competitors														
1. Number of equality balanced competitors	2	6.67	3	10.0	23	76.67	1	0	1	1	3	11	7	5
2. Industrial growth	3	10.0	5	16.67	20	66.67	1	0	1	2	5	13	5	2
3. Fixed or storage cost	5	16.67	5	16.67	18	60.0	1	0	0	5	5	15	0	3

Table 56 Evaluation of opportunity and threats in operation.(cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
4. Brand loyalty	4	13.33	7	23.33	17	56.67	1	0	2	2	7	9	6	2
5. Capacity increase	3	10.0	0	-	25	83.33	1	0	1	2	0	15	6	3
6. Diversity of competitors	0	-	13	43.33	12	40.0	0	0	0	0	13	8	3	1
7. Strategic stakes	2	6.67	3	10.0	23	76.67	1	0	0	2	3	12	6	5
Power of buyers														
1. Number of buyers	2	6.67	4	13.33	22	73.33	1	0	1	1	4	10	6	6
2. Availability of substitutes of the industrial products	3	10.0	1	3.33	24	80.0	2	0	0	3	1	9	9	6
3. Buyers switching cost	3	10.0	14	46.67	11	36.67	0	1	0	2	14	9	2	0
4. Buyers' threat of backward integration	2	6.67	5	16.67	21	70.0	1	0	0	2	5	14	3	4
5. Contribution to quality or service of buyers products	8	26.67	5	16.67	15	50.0	1	1	4	3	5	11	4	0
6. Total buyers' cost contributed by the industry	5	16.67	9	30.0	14	46.67	0	0	1	4	9	8	4	2

Table 56 Evaluation of opportunity and threats in operation.(cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
7. Buyer 's profitability	1	3.33	6	20.0	21	70.0	1	0	0	1	6	13	6	2
Power of suppliers														
1. Number of suppliers	11	36.67	5	16.67	12	40.0	-1,1	1	2	8	5	8	3	1
2. Availability of substitute for the suppliers' product	12	40.0	5	16.67	11	36.67	-1	0	3	9	5	5	4	2
3. Supplier's threat of backward integration	12	40.0	9	30.0	7	23.33	0	1	3	8	9	3	4	0
4. Industry threat of backward integration	10	33.33	8	26.67	9	30.0	-1	0	1	9	8	7	2	0
5. Supplier's contribution to quality or service of the industry product	10	33.33	3	10.0	15	50.0	-1	0	2	8	3	7	6	2
6. Total industry cost contributed by supplier	10	33.33	2	6.67	16	53.33	1	1	2	7	2	9	4	3
7. Important of the industry to supplier group	9	30.0	8	26.67	10	33.33	0	2	1	6	8	6	3	1
Availability of substitutes														
1. Availability of class substitutes	1	3.33	2	6.67	25	83.33	1	0	0	1	2	9	8	8

Table 56 Evaluation of opportunity and threats in operation.(cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
2. User's switching cost	2	6.67	5	16.67	21	70.0	2	0	0	2	5	8	9	4
3. Substitute producer's profitability and aggressiveness	1	3.33	8	26.67	19	63.33	0,1	0	0	1	8	8	6	5
4. Substitute price value	1	3.33	4	13.33	23	76.67	1	0	0	1	4	11	6	6
Government action														
1. Industry protection	10	33.33	8	26.67	9	30.0	0	1	3	6	8	6	1	2
2. Industry regulation	12	40.0	4	13.33	12	40.0	1	2	5	5	4	7	2	3
3. Investment promotion policy	6	20.0	9	30.0	12	40.0	0	2	1	3	9	7	3	2
4. Consistence of policies	6	20.0	10	33.33	12	40.0	0	1	2	3	10	9	1	2
5. Capital movement among country	4	13.33	16	53.33	8	26.67	0	0	1	3	16	8	0	0
6. Custom's duties	8	26.67	11	36.67	9	30.0	0	1	2	5	11	5	3	1
7. Registration regulation and process	9	30.0	3	10.0	16	53.33	1	3	2	4	3	8	4	4
8. Foreign exchange	7	23.33	13	43.33	8	26.67	0	0	1	6	13	6	2	0

Table 56 Evaluation of opportunity and threats in operation.(cont.)

List /score	Percentage of informants by group							Percentage of informants by score						
	Weakness		Zero		Strength			Score						
	Number	Percent	Number	Percent	Number	Percent	Mode	-3	-2	-1	0	1	2	3
9. Foreign ownership	3	10.0	16	53.33	9	30.0	0	0	2	1	16	8	1	0
10. Assistance provided to competitors	4	13.33	8	26.67	16	53.33	0	0	1	3	8	6	6	4

Table 57 Factor analysis for strength and weakness.

List	R (correlation coefficient)
Factor 1 Internal environment	
Context 1 Management	
1. Strategic management system	.921
2. Ability of management team	.917
3. Hierarchy of objective	.911
4. Organization structure	.893
5. Planning and control system	.837
6. Communication network	.830
7. Delegation of authority	.807
8. Policy of head company	.790
9. Internal image and prestige	.733
Context 2 Location	
1.Location of plant	.809
Factor 2 Operation Management	
Context 1 Production Management	
1. Raw materials cost	.925
2. Operation cost	.861
3. Adequate availability of raw materials	.838
4. Inventory control	.800
5. Efficient and effective equipment and machinery	.791

Table 57 Factor analysis for strength and weakness. (cont.)

List	R (correlation coefficient)
6. Use of technology	.604
Context 2 Personal Management	
1. Human resource in management	.877
Factor 3 Marketing and distribution management	
Context 1 Marketing Development	
1. Market research	.872
2. Sales force productivity	.753
3. Distribution system	.751
4. Use of IT in operation	.687
5. Business image	.665
Context 2 Marketing competition	
1. price competitiveness	.859
2. Market share	.785
3. Human resource in marketing	.687
Factor 4 R&D and Engineering	
1. R&D facilities	
2. R&D funding	
3. Development of new products	
4. Human resource in R&D	
Factor 5 Human resource management	

Table 57 Factor analysis for strength and weakness. (cont.)

List	R (correlation coefficient)
Context 1 Personnel management	
1. Recruitment practice	.905
2. Training programs	.904
3. Reward system	.899
4. Quality of corporate staffs	.830
5. Performance appraisal system	.551
Context Turn over of personnel	
1. Turn over and absenteeism	.769
2. Cost of labor	.691
3. Favor system	.668

Table 58 Factor analysis of opportunity and threats.

List	R (correlation coefficient
Factor 6 External Environment	
Context 1 Economic indicators	
1. Gross Domestic Products	.952
2. Per capita income	.855
3. Wage level	.665
4. Foreign exchange impact	.621

Table 58 Factor analysis of opportunity and threats. (cont.)

List	R (correlation coefficient
5. Inflation	.583
Context 2 factor endowment	
1. Manpower supply	.912
2. Raw material supply	.749
Factor 7 Social factors	
Context 1 Social change	
1. Distribution of population age	.945
2. Growth rate of population	.701
3. Consumer protection	.851
4. Ecological impacts	.812
5. Family size change	.796
6. Population education change	.793
Context 2 Union	
1. Degree of unionization	.918
Factor 8 Technological change	
1. Maturity and volatility of technology	
2. Complexity of technology	
3. Patents	
4. Product R&D requirement	
5. Process R&D requirement	

Table 58 Factor analysis of opportunity and threats. (cont.)

List	R (correlation coefficient
6. Technology transfer	
Factor 9 Politic and legal	
Context 1Purchasing of public sector	
1. Controlled price	
2. Essential drug list	.903
3. Purchasing regulation of public health center	.867
4.Government support	.541
Context 2 Regulation	
1. Advertising law	.734
2. Good Manufacturing Practice(GMP)	.716
3. Value added tax(VAT)	.628
4. Tariff	.553
Context 3 Standard	
1. International standard ISO	.946
2. Environment law ISO 14000	.901
Factor 10 Economic index of ASEAN	
Context 1 Population variables	
1. Population growth	.932
2. Gross National Product(GNP)	.867
3. Per capita income	.850

Table 58 Factor analysis of opportunity and threats. (cont.)

List	R (correlation coefficient
4. Climate	.764
5. Membership in regional economic blocks	.714
Context 2 Finance	
1. Taxation system	.957
2. Wage and salary levels	.9
3. Inflation	.811
Context 3 Government policies	
1. Monetary and fiscal policies	.792
2. Natural resource	.788
3. Interest rate	.666
Factor 11 International laws of ASEAN	
1. Law affecting business firm	.945
2. Legal tradition	.872
3. Patent ,trade mark law	.840
Factor 12 ASEAN political factor	
Context 1 Government	
1. Stability of government	.923
2. Foreign policies	.890
Context 2 Opposition parties	
1. Strength of opposition parties and group	.974

Table 58 Factor analysis of opportunity and threats. (cont.)

List	R (correlation coefficient
Factor 13 ASEAN cultural factor	
Context 1 Language	
1. Attitudes	.919
2. Language	.839
Context 2 Beliefs	
1. Religious beliefs	.823
2. Customs, norms, value and beliefs	-.607
Evaluation of rivalry among competitors	
Factor 14 Entry barriers	
Context 1 Advantage of the former firms	
1. Experience effect cost	.806
2. Economics of scale	.770
3. Access to latest technology	.739
4. Government protection	.690
5. Product differentiation	.687
6. Access to raw materials	.685
7. Capital for R&D requirement	.640
8. Brand identity	.517
Context 2 Channel of distribution	

Table 58 Factor analysis of opportunity and threats. (cont.)

List	R (correlation coefficient
1. Access to distribution channels	.803
Context 3 Operational cost	
1. Switching cost	.672
Factor 15 Exit barriers	
1. Fixed cost of exit	.962
2. Emotional barriers	.911
3. Asset specialization	.907
4. Government and social restriction	.891
5. Strategic interrelationship	.852
Factor 16 Rivalry among competitors	
Context 1 Operation	
1. Fixed or storage cost	.832
2. Capacity increase	.820
3. Diversity of competitors	.757
4. Brand loyalty	.594
Context 2 Policy of firm	
1. Strategic stakes	.788
2. Industrial growth	-.561
Context 3 Competitors	
1. Number of equality balanced competitors	.700

Table 58 Factor analysis of opportunity and threats. (cont.)

List	R (correlation coefficient
Factor 17 Power of buyers	
Context 1 Characteristic of buyers	
1. Buyers switching cost	.868
2. Availability of substitutes of the industrial products	.631
3. Buyer 's profitability	.579
4. Total buyers' cost contributed by the industry	.574
Context 2 Number of buyers	
1. Number of buyers	-.636
2. Buyers' threat of backward integration	.510
Context 3 Buyer easticity	
1. Contribution to quality or service of buyers products	.881
Factor 18 Power of suppliers	
Context 1 Raw materials	
1. Number of suppliers	.856
2. Availability of substitute for the suppliers' product	.813
3. Total industry cost contributed by supplier	.776
4. Supplier's threat of backward integration	.750

Table 58 Factor analysis of opportunity and threats. (cont.)

List	R (correlation coefficient
5. Supplier's contribution to quality or service of the industry product	.519
Context 2 Raw material producers	
1. Important of the industry to supplier group	.759
2. Industry threat of backward integration	-.671
Factor 19 Availability of substitutes	
1. User's switching cost	.928
2. Substitute producer's profitability and aggressiveness	.917
3. Substitute price value	.904
4. Availability of class substitutes	.710
Factor 20 Government action	
Context 1 government action to Thai's manufacturers	
1. Industry regulation	.892
2. Investment promotion policy	.827
3. Registration regulation and process	.780
4. Industry protection	.758
5. Custom's duties	.723
6. Consistence of policies	.697
7. Foreign exchange	.586

Table 58 Factor analysis of opportunity and threats. (cont.)

List	R (correlation coefficient
Context 2 Government action to competitors	
1. Assistance provided to competitors	.803
2. Foreign ownership	-.653
3. Capital movement among country	.609

Table 59 Percentage of experts in Delphi forecast result.

Likelihood of realization 0 = lowest 50 = realization with condition 100 = highest realization

Period of realization (year's time) 0 = present time or nearly future 5, 10, 20 years hence (5 = between 1-5 year hence, 10 = 5-10 years hence, 20 = 10-20 years hence) >20 = more than 20 years hence inf. = long time or infinity

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
1. Industrial aspect											
1.1 All factories received GMP certificate	100	4	4	92	5	-	96	4	-	-	-
1.2 Some factory meet requirement ISO	100	-	-	100	0	84	16	-	-	-	-
1.3 Quality management system meet requirement of ISO or GMP	100	-	-	100	5	12	80	8	-	-	-
1.4 Sufficient member and quality of pharmaceutical and scientific personal	100	-	4	96	0	72	20	4	4	-	-
2. Operation											
2.1 Specialization	100	4	8	88	5	-	76	20	-	-	4
2.2 Environment and rapid quality control	100	4	4	92	0	84	8	4	-	-	4
2.3 Production of international marketing personals	100	-	4	96	0	96	-	-	4	-	-
2.4 Support in plant movement or machine adjustment	100	12	12	76	5	-	84	4	4	-	8

Table 59 Percentage of experts in Delphi forecast result. (cont.)

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
2.5 Increase R & D expense	100	-	12	88	0	68	16	12	4	-	-
3. Drug marketing competition											
3.1 Product image is accepted in domestic drug market	100	-	8	92	0	80	16	-	4	-	-
3.2 Image of Thai's pharmaceutical product is accepted in foreign drug market	100	-	16	84	0	80	12	8	-	-	-
3.3 Brand name is accepted in developing countries	100	-	20	80	5	4	84	8	-	4	-
3.4 Free trade in domestic market	0	92	8	-	20	-	8	4	88	-	-
3.5 International trade is promoted to be counter trade	0	84	12	4	5	-	76	4	4	4	12
3.6 Thailand is leader of ASEAN in drug export by increase export value in 2003 to be 3 times of export value in 1997	100	-	20	80	5	4	76	16	4	-	-
3.7 Thailand is ASEAN leader in chemical export by increase export value in 2003 to be 3 times of export volume in 1997	0	88	8	4	>20	-	-	-	12	80	8
4. Production											
4.1 Thailand is some finished drug production that accepted by developing countries	100	4	8	88	10	8	8	80	4	-	-

Table 59 Percentage of experts in Delphi forecast result. (cont.)

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
4.2 Thailand is hub of some chemical production that accepted by developing countries	0	84	4	12	100	-	-	4	4	12	80
4.3 Change the out of date machine to increase productivity	100	4	4	92	10	4	4	88	4	-	-
4.4 Increase production to import substitute 50%	100	-	8	92	0	80	8	8	4	-	-
4.5 Production some commercial raw materials for import substitution	0	88	4	8	100	4	-	4	4	4	84
4.6 Thailand is base of drug and medicinal herb extraction production	100	-	8	92	20	-	-	16	84	-	-
4.7 Using domestic raw materials to produce value added pharmaceutical products	100	4	16	80	20	-	-	12	80	4	4
5. Institute for Development											
5.1 Institute for training of production technology and quality control	100	4	12	84	20	-	-	12	88	-	-
5.2 Quality assurance institute that co-ordinate with foreign institute	50	8	72	20	>20	-	-	12	8	76	4
5.3 Information center of marketing and technology of ASEAN	100	4	-	96	20	-	-	8	92	-	-
5.4 Funding to support and motivate exporters	100	4	12	84	5	-	80	12	4	4	-
6. Government action											

Table 59 Percentage of experts in Delphi forecast result. (cont.)

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
6.1 Government promote investment with foreigners for technology transfer and confidence	100	4	12	84	5	4	72	20	-	4	-
6.2 Government support using latest technology and equipment	100	4	16	80	20	-	8	24	64	-	4
6.3 Finished drug industry has investment promotion by maximum profit in all regions	0	88	12	-	20	-	-	8	84	4	4
6.4 Strategy in promotion off patent drug in Thailand and still used in developing countries	50	4	88	8	20	-	8	8	80	4	-
6.5 Tax restructuring and import-export duties	100	-	4	96	5	4	92	-	4	-	-
6.6 Government is leader in R&D	100	-	4	96	20	4	8	8	76	-	4
7. Collaboration of public and private sector											
7.1 Co-operation between private sector and academic in technology transfer and improvement	100	-	-	100	0	84	8	8	-	-	-
7.2 Co-operation of public and private sector in expand foreign market	100	4	4	92	0	80	16	-	-	-	4

Table 59 Percentage of experts in Delphi forecast result. (cont.)

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
7.3 Co-operation of public and private sector in seeking raw material that high quality and low cost by purchasing large volume	**100**	**12**	**4**	**84**	**100**	-	-	-	**8**	**4**	**88**
7.4 Public and private sector co-operate to obviate export barriers	**100**	-	**4**	**96**	**0**	**80**	16	4	-	-	-
7.5 Co-operation to exchange benefit beyond investment promotion legal	**100**	**8**	**4**	**88**	**5**	-	**84**	**4**	**4**	-	**8**

Note : bold alphabet are maximum value

Table 60 Number and percentage of establishments by export compared with industrial census 1997.

List	Number	Percent (N=68)	Statistic from industrial census (N=178)
No export	28	41.18	65.7
Thai's owners	25	36.77	
Foreigner 's owners	3	4.41	
Export	35	51.47	34.3
Thai's owners	29	42.65	
Foreigner's owners	6	8.82	
Non available	5	7.35	-
Total	68	100.00	100.00

Table 72 Term of trade of Amoxycillin 500 mg. at minimum and maximum wholesale price.

Country	Packing	Wholesale price/ cap(baht)	Term of trade Packing 500 capsule	
			Minimum price (1.66)	Maximum price (5.08)
Malaysia	500	13.29	800.60	261.61
Myanmar	10	110.09	6631.93	2167.13

Table 72 Term of trade of Amoxycillin 500 mg. at minimum and maximum wholesale price. (cont.)

Country	Packing	Wholesale price/ cap(baht)	Term of trade Packing 500 capsule	
			Minimum price (1.66)	Maximum price (5.08)
Singapore	500	2.18	131.33	42.91
Vietnam	1(Austria)	2.70	162.65	53.15
	1(Australia)	2.84	171.08	55.91
	12(France)	3.02	181.93	59.45
	100(Vietnam)	0.92	55.42	18.11
Philippines	50	16.67	1004.22	328.15
Laos	10x10	2.75	165.66	54.13

Note : Country in blanket is manufacturer

Table 73 Term of trade of Ampicillin 500 mg. at minimum and maximum wholesale price.

Country	Packing	Wholesale price /capsule(baht)	Term of trade Packing 500 capsule	
			Minimum price (2.89)	Maximum price (4.32)
Malaysia	1	7.96	275.43	184.26
Myanmar	10	110.09	3809.34	2548.38
Singapore	500	2.86	98.96	66.20

Table 73 Term of trade of Ampicillin 500 mg. at minimum and maximum wholesale price. (cont.)

Country	Packing	Wholesale price /capsule(baht)	Term of trade Packing 500 capsule	
			Minimum price (2.89)	Maximum price (4.32)
Vietnam	1(Austria)	2.59	89.62	18.75
	1(Vietnam)	0.81	28.03	59.95
Philippines	100	15.49	535.99	358.56
Laos	1000(Laos)	0.52	17.99	12.04
	1000(China)	0.52	17.99	12.04
	10x10 (Vietnam)	0.98	33.91	22.69

Table 74 Term of trade of Antacid at minimum and maximum wholesale price.

Country	Packing	Wholesale price /tablet (Baht)	Term of trade Packing 500 & 1000 tab.		Term of trade Packing 50x10	
			Minimum price (0.17)	Maximum price (0.46)	Minimum price (0.35)	Maximum price (0.76)
Malaysia	50	1.35	794.12	293.48	385.71	177.63
Myanamr	10	20.83	12252.94	4528.26	5951.43	2740.79
Singapore	500	0.95	558.82	206.52	271.43	125.00

Table 74 Term of trade of Antacid at minimum and maximum wholesale price. (cont.)

Country	Packing	Wholesale price /tablet (Baht)	Term of trade Packing 500 & 1000 tab.		Term of trade Packing 50x10	
			Minimum price (0.17)	Maximum price (0.46)	Minimum price (0.35)	Maximum price (0.76)
Vietnam	1(Austria)	4.05	2382.35	880.43	1157.14	532.89
	1(Thailand)	4.32	2541.18	939.13	1234.29	568.42
Philippines	100	3.51	2064.71	763.04	1002.86	461.84
Laos	50x10 (Thailand)	0.35	205.88	76.09	100.00	46.05
	10x10 (Laos)	0.37	217.65	80.43	105.71	48.68

Table 75 Term of trade of Bromhexine 8 mg. at minimum and maximum wholesale price.

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 500 tab.	
			Minimum price (0.35)	Maximum price (1.02)
Malaysia	100	3.51	1002.86	344.12
Myanmar	10	38.68	11051.43	3792.16
Singapore	1000	0.41	117.14	40.20
Vietnam	1	0.22	62.86	21.57

Table 75 Term of trade of Bromhexine 8 mg. at minimum and maximum wholesale price. (cont.)

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 500 tab.	
			Minimum price (0.35)	Maximum price (1.02)
Philippines	100	6.60	1885.71	647.06
Laos	10x10(Laos)	1.54	440.00	150.98
	10x10 (Thailand)	0.90	257.14	88.24

Table 76 Term of trade of Cimetidine 400 mg. At minimum and maximum wholesale price.

Country	Packing	Wholesale price/ tab. (baht)	Term of trade packing 50 tab.		Term of trade packing 500 tab.		Term of trade packing loose packed	
			Minimum price (2.60)	Mixiumum price (4.91)	Minimum price (1.96)	Maximum price (3.12)	Minimum price (2.32)	Maximum price (2.89)
Malaysia	120	31.82	1223.85	648.07	1623.47	1019.87	1371.55	1101.04
Myanmar	10	47.61	1831.15	969.65	2429.08	1525.96	2052.16	1647.40
Singapore	120	2.49	95.77	50.71	127.04	79.81	107.33	86.16
Vietnam	1(Canada)	1.84	70.77	37.47	93.88	58.97	79.31	63.67
Philippine	60	19.77	760.38	402.65	1008.67	633.65	852.16	684.08
Laos	10x10 (Thailand)	0.90	34.62	18.33	45.92	28.85	38.79	31.14
	10x10(India)	1.03	39.62	20.98	52.55	33.01	44.40	35.64

Table 77 Term of trade of Diclofenac 25 mg. At minimum and maximum wholesale price.

Country	Packing	Wholesale price/ tablet (baht)	Term of trade Paxking 500&1000 tab.		Term of trade Packing 10x10	
			Minimum price (0.18)	Maximum price (2.47)	Minimum price (0.81)	Maximum price (1.04)
Malaysia	1000	4.90	2722.22	198.38	604.94	471.15
Myanmar	10	88.07	48927.78	3565.59	10872.84	8468.27
Singapore	1000	0.45	250.00	18.22	55.56	43.27
	1000	0.59	327.78	23.89	72.84	56.73
Vietnam	30(Austria)	68.00	37777.78	2753.04	8395.06	6538.46
Philippines	500	8.53	4738.89	345.34	1053.09	820.19
Laos	10x10(India)	0.29	161.11	11.74	35.80	27.88
	10x10	1.00	555.56	40.49	123.46	96.15

Table 78 Term of trade of Ibuprofen 200 mg. At minimum and maximum wholesale price.

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 500&1000tablet		Term of trade Packing 50x10	
			Minimum price (0.27)	Maximum price (0.69)	Minimum price (0.36)	Maximum price (1.37)
Malaysia	20	2.29	848.15	331.88	636.11	167.15
Myanmar	10	101.16	37466.67	14660.87	28100.00	7383.94
Singapore	1	2.27	840.74	328.99	630.56	165.69
Vietnam	1	0.54	205.19	80.29	153.89	40.44
Philippines	100	6.36	2355.56	921.74	1766.67	464.23
Laos	500 (Thailand)	0.90	333.33	130.43	250.00	65.69

Table 79 Term of trade of Mebendazole 100 mg. at minimum and maximum wholesale price.

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 500 tab.		Term of trade Packing loose packed	
			Minimum price (0.69)	Maximum price (3.20)	Minimum price (1.93)	Maximum price (2.51)
Malyasia	72	16.58	2402.90	518.13	859.07	430.65
Myanmar	1	493.91	71581.16	15434.69	25591.19	12828.83
Vietnam	1	0.24	34.78	7.50	12.44	6.23
Laos	6x12(Thailand)	2.61	378.26	81.56	135.23	67.79
	6x12(Thailand)	2.08	301.45	65.00	107.77	54.03

Table 80 Term of trade of Norfloxacin 200 mg. at minimum and maximum wholesale price.

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 500 tab.		Term of trade Packing loose packed	
			Minimum price (0.81)	Maximum price (1.91)	Minimum price (8.78)	Maximum price (13.86)
Malaysia	10	25.56	3155.56	1338.22	291.12	184.42
Myanmar	10	127.94	15795.06	6698.43	1457.18	923.09
Singapore	100	58.25	7191.36	3049.74	663.44	420.27

Table 80 Term of trade of Norfloxacin 200 mg. at minimum and maximum wholesale price. (cont.)

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 500 tab.		Term of trade Packing loose packed	
			Minimum price (0.81)	Maximum price (1.91)	Minimum price (8.78)	Maximum price (13.86)
phillippines	100	43.02	5311.11	2252.36	489.98	310.39

Table 81 Term of trade of Paracetamol 500 mg. At minimum and maximum wholesale price.

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 100tab.		Term of trade Packing 1000 tab.		Term of trade Packing loose packed	
			Minimum price(0.14)	Maximum price(0.33)	Minimum price (0.13)	Maximum price(0.28)	Minimum price (0.46)	Maximum price(0.52)
Malaysia	1,000	0.36	257.14	109.09	276.92	128.57	78.26	69.23
Myanmar	10	342.17	244,407.14	103,687.88	263,207.69	122,203.57	74,384.78	65,801.92
	10	517.71	369,792.86	156,881.82	396,238.46	184,896.43	112,545.65	99,559.62
Singapore	10	2.72	1,942.86	824.24	2,092.31	971.43	591.30	523.08

Table 81 Term of trade of Paracetamol 500 mg. At minimum and maximum wholesale price. (cont.)

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 100tab.		Term of trade Packing 1000 tab.		Term of trade Packing loose packed	
			Minimum price(0.14)	Maximum price(0.33)	Minimum price (0.13)	Maximum price(0.28)	Minimum price (0.46)	Maximum price(0.52)
Vietnam	1	0.11	78.57	33.33	84.62	39.29	23.91	21.15
	1(France)	0.61	435.71	184.85	469.23	217.86	132.61	117.31
	100(Australia)	1.35	964.29	409.09	1,038.46	482.14	293.48	259.62
Philippines	50	18.03	1,285.71	545.45	1,384.62	642.86	391.30	346.15
	1000	1.80	12,878.57	5,463.64	13,869.23	6,439.29	3,919.57	3,467.31
Laos	10x50(Thailand)	0.18	128.57	54.55	138.46	64.29	39.13	34.62
	10x50(Vietnam)	0.17	122.86	52.12	132.31	61.43	37.39	33.08
	1000	0.14	101.93	43.24	109.77	50.96	31.02	27.44
	1000	0.13	97.86	41.52	105.38	48.93	29.78	26.35
	1000(Thailand)	0.09	62.14	26.36	66.92	31.07	18.91	16.73

Table 82 Term of trade of Vitamin B1-6-12 at minimum and maximum wholesale price.

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 500& 1000 tab.	
			Minimum price (0.42)	Maximum price (0.68)
Malaysia	100	3.58	852.38	526.47
Myanmar	10	178.52	42504.76	26252.94
Singapore	1000	0.29	69.05	42.65
	1000	1.81	430.95	266.18

Table 82 Term of trade of Vitamin B1-6-12 at minimum and maximum wholesale price. (cont.)

Country	Packing	Wholesale price/tablet (baht)	Term of trade Packing 500& 1000 tab.	
			Minimum price (0.42)	Maximum price (0.68)
Vietnam	1(France)	4.46	1061.90	655.88
	1(Vietnam)	0.41	97.62	60.29
Philippines	100	13.50	3214.29	1985.29
Laos	10x120(Vietnam)	0.42	100.00	61.76
	10x10(Laos)	0.33	78.57	48.53

Table 83 Sensitivity and critical point of DRC/EER .

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
Amoxicillin500mg.	Domestic cost of production	83.08	0.20	425.00	411.56
Packing 500 cap.	Foreign cost of production	646.55	0.20	987.00	52.66
	Factory price	1,069.67	0.20	729.00	-31.85
	ER/EER	0.9	0.20	5.1	413.16
Ampicillin 500 mg.	Domestic cost of production	117.79	0.25	472.00	300.71

Table 83 Sensitivity and critical point of DRC/EER .(cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
Packing 500 cap.	Foreign cost of production	592.26	0.25	946.00	59.73
	Factory price	1,063.05	0.25	709.00	-33.31
	ER/EER	0.99	0.25	4.00	302.48
Antacid tablet	Domestic cost of production	61.67	0.46	135.00	118.91
Packing 1000	Foreign cost of production	72.55		145.50	100.55
	Factory price	206.80		134.00	-35.20
	ER/EER	0.99		2.18	119.35
Antacid tablet	Domestic cost of production	40.94	0.44	93.00	127.16
Packing 50x10	Foreign cost of production	43.94		96.00	118.48
	Factory price	136.67		84.50	-38.17
	ER/EER	0.99		2.27	128.41
Bromhexine 8 mg.	Domestic cost of production	47.39	0.31	155.00	227.07
Packing 1000	Foreign cost of production	25.21		132.50	425.59
	Factory price	179.44		72.50	-59.60
	ER/EER	0.99		3.25	227.01

Table 83 Sensitivity and critical point of DRC/EER. (cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
Cefalexin 250 mg.	Domestic cost of production	28.17	0.09	315.00	1,018.21
Packing 100	Foreign cost of production	1/87.87		472.00	151.24
	Factory price	500.00		216.00	-56.80
	ER/EER	0.99		11.10	1,016.87
Cefalexin 250 mg.	Domestic cost of production	107.00	0.09	295.00	175.70
Packing 500	Foreign cost of production	908.00		1,094.00	20.48
	Factory price	1,200.00		1,014.00	-15.50
	ER/EER	0.99		2.73	174.69
Cefalexin 250 mg.	Domestic cost of production	49.00	0.09	101.00	106.12
Packing 10x10	Foreign cost of production	200.00		251.50	25.75
	Factory price	300.00		248.50	-17.17
	ER/EER	0.99		2.05	106.27
Cimetidine 400 mg.	Domestic cost of production	84.66	0.26	328.00	287.43
Packing 500	Foreign cost of production	165.01		406.00	146.05
	Factory price	490.00		249.00	-49.18

Table 83 Sensitivity and critical point of DRC/EER. (cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
	ER/EER	0.99		3.85	287.38
Diclofenac 25 mg.	Domestic cost of production	73.21	0.26	280.00	282.46
Packing 1000	Foreign cost of production	60.83		265.50	336.46
	Factory price	338.33		133.50	-60.54
	ER/EER	0.99		3.8	282.35
Glibenclamide 5 mg.	Domestic cost of production	32.51	0.13	250.00	668.99
Packing 500	Foreign cost of production	65.70		280.75	327.32
	Factory price	313.09		98.00	-68.70
	ER/EER	0.99		7.6	664.70
Glibenclamide 5 mg.	Domestic cost of production	80.76	0.31	258.00	219.47
Packing 1000	Foreign cost of production	53.25		230.00	331.92
	Factory price	310.00		133.50	-56.94
	ER/EER	0.99		3.18	219.97
Glibenclamide 5 mg.	Domestic cost of production	116.00	0.28	417.00	259.48
Packing 50x10	Foreign cost of production	34.13		335.00	881.54

Table 83 Sensitivity and critical point of DRC/EER. (cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
	Factory price	450.00		149.00	-66.89
	ER/EER	0.99		3.6	262.23
Ibuprofen 200 mg.	Domestic cost of production	50.58	0.33	153.00	202.49
Packing 500	Foreign cost of production	97.42		199.50	104.78
	Factory price	250.00		147.50	-41.00
	ER/EER	0.99		3.02	203.87
Ibuprofen 200 mg.	Domestic cost of production	80.33	0.38	210.00	161.42
Packing 1000	Foreign cost of production	128.62		257.00	99.81
	Factory price	336.67		208.50	-38.07
	ER/EER	0.99		2.6	161.61
Ketoconazole 200 mg.	Domestic cost of production	50.00	0.16	305.00	510.00
Packing 100	Foreign cost of production	310.00		563.00	81.61
	Factory price	612.50		359.50	-41.31
	ER/EER	0.99		6.05	508.74
Ketoconazole 200 mg.	Domestic cost of production	44.32	0.17	267.00	502.44

Table 83 Sensitivity and critical point of DRC/EER. (cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
Packing 10x10	Foreign cost of production	196.49		417.50	112.48
	Factory price	461.37		240.50	-47.87
	ER/EER	0.99		6.00	503.71
Ketoconazole 200 mg.	Domestic cost of production	91.88	0.07	1,350.00	1,369.31
Packing 25x10	Foreign cost of production	102.31		1,356.00	1,225.38
	Factory price	1,447.50		194.00	-86.60
	ER/EER	0.99		14.6	1,369.04
Ketoconazole 200 mg.	Domestic cost of production	244.30	0.11	2,270.00	829.19
Packing 50x10	Foreign cost of production	883.55		2,907.00	229.01
	Factory price	3,150.00		1,127.00	-64.22
	ER/EER	0.99		9.3	835.76
Mebendazole 100 mg.	Domestic cost of production	84.74	0.63	134.00	58.13
Packing 250	Foreign cost of production	116.67		166.00	42.28
	Factory price	250.00		201.00	-19.60
	ER/EER	0.99		1.58	58.98

Table 83 Sensitivity and critical point of DRC/EER .(cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
Mebendazole 100 mg. Packing 1000	Domestic cost of production	26.00	0.18	143.00	450.00
	Foreign cost of production	157.32		274.10	74.23
	Factory price	300.00		183.25	-38.92
	ER/EER	0.99		5.5	453.40
Norfloxacin 200 mg. Packing 100	Domestic cost of production	13.53	0.08	170.00	1,156.47
	Foreign cost of production	34.92		190.80	446.39
	Factory price	204.30		48.40	-76.31
	ER/EER	0.99		12.5	1,157.74
Norfloxacin 200 mg. Packing 500	Domestic cost of production	105.76	0.16	665.00	528.78
	Foreign cost of production	208.91		764.00	265.71
	Factory price	869.09		314.00	-63.87
	ER/EER	0.99		6.25	528.87
Norfloxacin 200 mg. Packing 1000	Domestic cost of production	53.50	0.07	805.00	1,404.67
	Foreign cost of production	399.50		1,147.00	187.11
	Factory price	1,200.00		452.50	-62.29

Table 83 Sensitivity and critical point of DRC/EER .(cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
	ER/EER	0.99		15	1,409.28
Norfloxacin 200	Domestic cost of	9.57	0.30	32.00	234.38
mg.	production				
Packing 5x4	Foreign cost of	5.71		27.90	388.62
	production				
	Factory price	37.38		15.25	-59.20
	ER/EER	0.99		3.3	232.04
Norfloxacin 200	Domestic cost of	13.41	0.07	203.00	1,413.80
mg.	production				
Packing 10x10	Foreign cost of	48.86		236.70	384.45
	production				
	Factory price	250.00		62.20	-75.12
	ER/EER	0.99		15	1,409.28
Norfloxacin 200	Domestic cost of	165.26	0.57	290.00	75.48
mg.	production				
Packing 50x10	Foreign cost of	162.50		285.00	75.38
	production				
	Factory price	450.00		326.00	-27.56
	ER/EER	0.99		1.74	75.08
Paracetamol 500	Domestic cost of	4.20	0.41	10.20	142.86
mg.	production				
Packing 100	Foreign cost of	5.65		11.60	105.31
	production				

Table 83 Sensitivity and critical point of DRC/EER .(cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
	Factory price	15.78		9.82	-37.77
	ER/EER	0.99		2.42	143.50
Paracetamol 500 mg.	Domestic cost of production	56.91	0.50	113.00	98.56
Packing 1000	Foreign cost of production	71.28		127.00	78.17
	Factory price	183.42		128.00	-30.21
	ER/EER	0.99		1.98	99.23
Paracetamol 500 mg.	Domestic cost of production	115.03	0.63	181.00	57.35
Packing 50x10					
	Foreign cost of production	34.83		101.00	189.98
	Factory price	215.00		149.00	-30.70
	ER/EER	0.99		1.56	56.97
Paracetamol 500 mg.	Domestic cost of production	66.44	0.99	67.00	0.84
Packing 100x10	Foreign cost of production	53.33		54.00	1.26
	Factory price	119.77		119.50	-0.23
	ER/EER	0.99		1	0.62

Table 83 Sensitivity and critical point of DRC/EER .(cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
Piroxicam 10 mg.	Domestic cost of production	93.04	0.44	210.00	125.71
Packing 500	Foreign cost of production	29.51		145.50	393.05
	Factory price	238.00		122.00	-48.74
	ER/EER	0.99		2.25	126.39
Piroxicam 10 mg.	Domestic cost of production	112.84	0.33	342.00	203.08
Packing 1000 's	Foreign cost of production	73.71		302.00	309.71
	Factory price	414.29		186.00	-55.10
	ER/EER	0.99		3.03	204.88
Piroxicam 10 mg.	Domestic cost of production	22.00	0.87	25.55	15.91
Packing 10 x10	Foreign cost of production	14.75		18.20	23.39
	Factory price	40.00		36.60	-8.50
	ER/EER	0.99		1.15	15.71
Propanolol 10 mg.	Domestic cost of production	67.33	0.12	570.00	746.58
Packing 1000	Foreign cost of production	7.43		505.00	6,696.77
	Factory price	572.00		74.50	-86.98

Table 83 Sensitivity and critical point of DRC/EER .(cont.)

Name / Packing	Variables	Value of Variable from questionnaire	Calculated DRC/EER	Value of variable from sensitivity test	Changed rate (percent)
	ER/EER	0.99		8.4	745.20
Ranitidine 150mg.	Domestic cost of production	153.16	0.10	1,550.00	912.01
Packing 10x10	Foreign cost of production	552.73		1,948.00	252.43
	Factory price	2,100.00		705.00	-66.43
	ER/EER	0.99		10.1	916.25
Vitamin B1-6-12	Domestic cost of production	37.89	0.21	185.00	388.26
Packing 500	Foreign cost of production	67.63		213.50	215.69
	Factory price	251.08		105.40	-58.02
	ER/EER	0.99		4.85	388.00
Vitamin B1-6-12	Domestic cost of production	51.60	0.21	240.00	365.12
Packing 1000	Foreign cost of production	106.05		293.50	176.76
	Factory price	345.00		157.50	-54.35
	ER/EER	0.99		4.65	367.88

Table 85 Sensitivity test by changing wholesale price in Laos drug market.

Name	Packing in Laos	Produced country / trade name	Wholesale price in Laos(baht) /tab.	New wholesale price(baht)	Changing price (%)
Amoxycillin 500 mg.	10X10	Laos PDR.	2.75	2.1275	- 22.64
Ampicillin 500 mg.	10X10	Mekophar(Vietnam)	0.98	2.8750	193.37
Antacid	10X10	Tanacid (Laos PDR)	0.37	0.3450	- 6.76
Bromhexine 8 mg.	10X10	Laos PDR.	1.54	0.4600	-70.13
Cimetidine 400 mg	10X10	Gracure (India)	1.03	2.5875	151.21
Diclofenac 25 mg.	10X10	Lyca (India)	0.30	0.1840	- 38.67
Diclofenac 25 mg.	10X10	Laos PDR.	2.75	0.8050	-70.73
Ibuprofen 200 mg.	500'S	Thailand	0.90	0.2645	-70.61
Mebendazole 100 mg.	6X12	Thailand	2.08	1.9205	- 7.67
Mebendazole 500 mg.	1X10	Laos PDR.	12.08	14.9500	23.76
Paracetamol 500 mg.	10X50	HGpharm (Vietnam)	0.17	0.4600	170.59
Paracetamol 500 mg.	1000'S	Laos PDR.	0.14	0.1265	- 9.64
Paracetamol 500 mg.	100'S	KPN(Laos PDR.)	1.37	0.1380	- 89.93
Vitamin B1-6-12	10X120	Tirneurin (Cophar,Vietnam)	0.42	0.5175	23.21
Vitamin B1-6-12	10X10	Neuro B1 6 12(Laos PDR.)	0.33	0.3450	4.55

Table 86 Sensitivity test by changing wholesale price from Thailand.

Name	Packing in Laos	Produced country / trade name	Wholesale price from Thailand (baht) /tab.	New wholesale price(baht)	Changing price (%)
Amoxycillin 500 mg.	10X10	Laos PDR.	1.85	2.3913	29.26

Table 86 Sensitivity test by changing wholesale price from Thailand. (cont.)

Name	Packing in Laos	Produced country / trade name	Wholesale price from Thailand (baht) /tab.	New wholesale price(baht)	Changing price (%)
Ampicillin 500 mg.	10X10	Mekophar(Vietnam)	2.50	0.8522	- 65.91
Antacid	10X10	Tanacid (Laos PDR)	0.30	0.3217	7.23
Bromhexine 8 mg.	10X10	Laos PDR.	0.40	1.3391	234.78
Cimetidine 400 mg	10X10	Gracure (India)	2.25	0.8956	- 60.20
Diclofenac 25 mg.	10X10	Lyca (India)	0.16	0.2608	63.00
Diclofenac 25 mg.	10X10	Laos PDR.	0.70	2.3912	241.60
Ibuprofen 200 mg.	500'S	Thailand	0.23	0.7826	240.26
Mebendazole 100 mg.	6X12	Thailand	1.67	1.8087	8.31
Mebendazole 500 mg.	1X10	Laos PDR.	13.00	10.5040	- 19.20
Paracetamol 500 mg.	10X50	HGpharm (Vietnam)	0.40	0.1478	-63.05
Paracetamol 500 mg.	1000'S	Laos PDR.	0.11	0.1217	10.64
Paracetamol 500 mg.	100'S	KPN(Laos PDR.)	0.12	1.1913	892.75
Vitamin B1-6-12	10X120	Tirneurin (Cophar,Vietnam)	0.45	0.3652	- 18.84
Vitamin B1-6-12	10X10	Neuro B1 6 12(Laos PDR.)	0.30	0.2869	- 4.37

Table 87 Sensitivity test by changing premium rte and transportation fee.

Name	Packing (Laos)	Producer country/ Trade name	New Premium rate	Percent change	New Transporta-tion fee	Percent Change
Amoxycillin 500 mg.	10X10	Laos PDR.	0.3865	673.00	0.4364	99,899.09
Ampicillin 500 mg.	10X10	Mekophar(Vietnam)	-	- 100.00	-	35,536.36

Table 87 Sensitivity test by changing premium rte and transportation fee.(cont.)

Name	Packing (Laos)	Producer country/ Trade name	New Premium rate	Percent change	New Transporta-tion fee	Percent Change
Antacid	10X10	Tanacid (Laos PDR)	0.1333	166.60	0.1833	99,902.70
Bromhexine 8 mg.	10X10	Laos PDR.	2.7500	5,400.00	2.8000	99,900.00
Cimetidine 400 mg	10X10	Gracure (India)	-	- 100.00	-	41,516.16
Diclofenac 25 mg.	10X10	Lyca (India)	0.7750	1,450.00	0.8250	99,900.00
Diclofenac 25 mg.	10X10	Laos PDR.	2.8285	5,557.00	2.8785	99,901.82
Ibuprofen 200 mg.	500'S	Thailand	2.8130	5,526.00	2.8630	99,901.11
Mebendazole 100 mg.	6X12	Thailand	0.1455	191.00	0.1955	99,900.72
Mebendazole 500 mg.	1X10	Laos PDR.	-	-100.00	-	84,375.52
Paracetamol 500 mg.	10X50	HGpharm (Vietnam)	-	- 100.00	-	38,536.36
Paracetamol 500 mg.	1000'S	Laos PDR.	0.1727	245.40	0.2227	99,902.14
Paracetamol 500 mg.	100'S	KPN(Laos PDR.)	10.3170	20,534.00	10.3667	99,897.08
Vitamin B1-6-12	10X120	Tirneurin (Cophar,Vietnam)	-	- 100.00	-	84,748.48
Vitamin B1-6-12	10X10	Neuro B1 6 12(Laos PDR.)	-	-100.00	0.0500	99,900.00

Table 88 Sensitivity test by changing wholesale price in Vietnam drug market.

Name	Packing (Vietnam)	Producer country /trade name	Wholesale price in Vietnam (baht /tab.)	New price (baht/ tab.)	Percent change
Amoxycillin 500 mg.	100	Vietnam	0.918	2.1275	- 56.85
Amoxycillin 500 mg.	100	Austria	2.7	2.1275	26.91
Amoxycillin 500 mg.	12	France	3.015	2.1275	41.71

Table 88 Sensitivity test by changing wholesale price in Vietnam drug market.(cont.)

Name	Packing (Vietnam)	Producer country /trade name	Wholesale price in Vietnam (baht /tab.)	New price (baht/ tab.)	Percent change
Amoxycillin 500 mg.	1	Australia	2.7	2.1275	26.91
Ampicillin 500 mg.	1	Vietnam	0.81	2.8750	- 71.83
Ampicillin 500 mg.	1	Austria	2.592	2.8750	-9.84
Antacid	1	Thailand	4.05	0.4255	851.78
Bromhexine 8 mg.	1	Vietnam	0.216	0.4600	-53.05
Cimetidine 400 mg.	1	Canada	1.836	2.5875	- 29.04
Diclofenac 25 mg.	30	Vietnam(Sanofi)	0.675	0.8050	-16.16
Ibuprofen 200 mg.	1	Vietnam	0.54	0.2645	104.13
Mebendazole 100 mg.	1	Vietnam	0.243	1.9205	- 87.35
Mebendazole 500 mg.	1	Vietnam	1.485	14.9500	-90.07
Mebendazole 500 mg.	1	India(Janssen in India)	1.35	14.9500	-90.97
Paracetamol 500 mg.	1	Vietnam	0.108	0.1380	- 21.75
Paracetamol 500 mg.	1	France	0.6075	0.1380	340.17
Paracetamol 500 mg.	100	Australia(Panadol)	1.35	0.1380	878.25
Vitamin B1-6-12	1	Vietnam	0.405	0.3450	17.37
Vitamin B1-6-12	1	France	4.455	0.3450	1,191.33
Norfloxacin 400 mg.	NA	NA			

Table 89 Sensitivity test by changing wholesale price of Thailand.

Name	Packing (Vietnam)	Producer country / trade name	Wholesale price of Thailand (Baht)/tab.	New wholesale price	Percent change
Amoxycillin 500 mg.	100	Vietnam	1.85	0.7983	- 102.13
Amoxycillin 500 mg.	100	Austria	1.85	2.3478	-99.31
Amoxycillin 500 mg.	12	France	1.85	2.6217	-99.56
Amoxycillin 500 mg.	1	Australia	1.85	2.3478	-99.31
Ampicillin 500 mg.	1	Vietnam	2.5	0.7043	- 102.88
Ampicillin 500 mg.	1	Austria	2.5	2.2540	-102.88
Antacid	1	Thailand	0.37	3.5216	-100.00
Bromhexine 8 mg.	1	Vietnam	0.4	0.1878	- 100.46
Cimetidine 400 mg.	1	Canada	2.25	1.5965	-102.59
Diclofenac 25 mg.	30	Vietnam(Sanofi)	0.7	0.5869	-100.81
Ibuprofen 200 mg.	1	Vietnam	0.23	0.4695	-99.98
Mebendazole 100 mg.	1	Vietnam	1.67	0.2113	-101.92
Mebendazole 500 mg.	1	Vietnam	13	1.2913	-114.95
Mebendazole 500 mg.	1	India(Janssen in India)	13	1.1739	-114.95
Paracetamol 500 mg.	1	Vietnam	0.12	0.0939	-100.14
Paracetamol 500 mg.	1	France	0.12	0.5282	-100.00
Paracetamol 500 mg.	100	Australia(Panadol)	0.12	1.1739	-100.00
Vitamin B1-6-12	1	Vietnam	0.3	0.3521	-99.83
Vitamin B1-6-12	1	France	0.3	3.8740	-100.00
Norfloxacin 400 mg.	NA	NA			

Table 90 Sensitivity test calculated by changing premium rate and transportation fee.

Name	Packing	Producer country / trade name	New premium rate	Percent change	New transportation fee	Percent change
Amoxycillin 500 mg.	100	Vietnam		-100.00		10,793.25
Amoxycillin 500 mg.	100	Austria	0.3595	619.00	0.4095	3,603.70
Amoxycillin 500 mg.	12	France	0.5297	959.40	0.5798	298.01
Amoxycillin 500 mg.	1	Australia	0.3595	619.00	0.4095	-62.96
Ampicillin 500 mg.	1	Vietnam		-100.00		23.46
Ampicillin 500 mg.	1	Austria		-100.00		-61.42
Antacid	1	Thailand	9.8460	19592.00	9.8960	- 75.31
Bromhexine 8 mg.	1	Vietnam		-100.00		362.96
Cimetidine 400 mg.	1	Canada		-100.00		-45.53
Diclofenac 25 mg.	30	Vietnam(Sanofi)		-100.00		4,344.44
Ibuprofen 200 mg.	1	Vietnam	1.2478	2395.60	1.2978	85.19
Mebendazole 100 mg.	1	Vietnam		-100.00		311.52
Mebendazole 500 mg.	1	Vietnam		-100.00		-32.66
Mebendazole 500 mg.	1	India(Janssen in India)		-100.00		- 25.93
Paracetamol 500 mg.	1	Vietnam		-100.00		825.93
Paracetamol 500 mg.	1	France	3.9623	7824.60	4.0125	64.61
Paracetamol 500 mg.	100	Australia(Panadol)	10.1500	20200.00	10.2000	7,307.41
Vitamin B1-6-12	1	Vietnam	0.2500	400.00	0.3000	146.91
Vitamin B1-6-12	1	France	13.7500	27400.00	13.8000	- 77.55
Norfloxacin 400 mg.	NA	NA				

Table 91 Sensitivity test calculated by changing wholesale price in Singapore drug market.

Name	Packing in Singapore	Producer country / Trade name	Wholesale price in Singapore(Baht)/ tab.	New wholesale price	Percent change
Amoxycillin 500 mg.	1000		1.09	2.1275	95.56
Ampicillin 500 mg.	1000		1.43	2.8750	101.35
Antacid	500		0.95	0.3450	- 63.76
Bromhexine 8 mg.	1000		0.41	0.4600	12.76
Cimetidine 400 mg.	120		2.49	2.5875	3.79
Diclofenac 25 mg.	1000		0.45	0.1840	- 59.41
Ibuprofen 200 mg.	1		2.27	0.8050	- 64.48
Mebendazole 100 mg.	NA		NA	NA	
Mebendazole 500 mg.	NA		NA	NA	
Paracetamol 500 mg.	100		2.72	0.1380	- 94.93
Vitamin B1-6-12	1000		1.81	0.3450	- 80.97

Table 92 Sensitivity test calculated by changing wholesale price of Thailand.

Name	Packing in Singapore	Producer country/ Trade name	Wholesale price of Thailand(Baht)/tab.	New wholesale price	Percent change
Amoxycillin 500 mg.	1000		1.85	0.9460	-48.86
Ampicillin 500 mg.	1000		2.5	1.2416	-50.34
Antacid	500		0.3	0.8277	175.90
Bromhexine 8 mg.	1000		0.4	0.3547	-11.33
Cimetidine 400 mg.	120		2.25	2.1678	-3.65
Diclofenac 25 mg.	1000		0.16	0.3941	146.31
Ibuprofen 200 mg.	1		0.7	1.9708	181.54
Mebendazole 100 mg.	NA		NA	NA	
Mebendazole 500 mg.	NA		NA	NA	
Paracetamol 500 mg.	100		0.12	2.3650	1870.83
Vitamin B1-6-12	1000		0.3	1.5766	425.53

Table 93 Sensitivity test by changing premium rate and transportation fee.

Name	Packing in Singapore	Producer country / trade name	New premium rate	Percent change	New transportation fee	Percent change
Amoxycillin 500 mg.	1000		-	-	-	-
Ampicillin 500 mg.	1000		-	-	-	-
Antacid	500		207.30	4,046.00	212.30	2,023.00
Bromhexine 8 mg.	1000		-	-	-	-
Cimetidine 400 mg.	120		0.80	-84.00	5.80	-42.00
Diclofenac 25 mg.	1000		173.30	3,366.00	178.30	1,683.00
Ibuprofen 200 mg.	1		213.76	4,175.20	218.76	2,087.60
Mebendazole 100 mg.	NA		NA	NA	NA	NA
Mebendazole 500 mg.	NA		NA	NA	NA	NA
Paracetamol 500 mg.	100		2,156.50	43,030.00	2161.50	21,515.00
Vitamin B1-6-12	1000		494.40	9,788.00	499.40	4,894.00

Table 94 Sensitivity test by changing wholesale price in Malaysia.

Name	Packing in Malaysia	Wholesale price of Malaysia(Baht)/ tab.	New wholesale price	Percent change
Amoxycillin 500 mg.	500	13.29	2.1275	- 83.99
Ampicillin 500 mg.	1	3.98	2.8750	-27.73
Antacid	50	1.35	0.3450	-74.49
Bromhexine 8 mg.	100	3.51	0.4600	-86.91
Cimetidine 400 mg.	120	31.82	2.5875	-91.87
Diclofenac 25 mg.	1000	4.90	0.1840	- 96.25
Ibuprofen 200 mg.	20	2.29	0.2645	- 88.44
Mebendazole 100 mg.	72	16.58	1.9205	- 88.41
Mebendazole 500 mg.	NA		NA	NA
Norfloxacin 400 mg.	10	51.12	3.6800	- 92.80
Paracetamol 500 mg.	1000	0.36	0.1265	- 64.67
Vitamin B1-6-12	100	3.58	0.3450	-90.36

Table 95 Sensitivity test calculated by changing wholesale price of Thailand.

Name	Packing in Malaysia	Producer country / trade name	Wholesale price of Thailand(baht)/tab.	New wholesale price	Percent Change
Amoxycillin 500 mg.	500		1.85	11.5540	524.54
Ampicillin 500 mg.	1		2.50	3.4590	38.36
Antacid	50		0.30	1.1761	292.03
Bromhexine 8 mg.	100		0.40	3.0561	664.03
Cimetidine 400 mg.	120		2.25	27.6720	1,129.87
Diclofenac 25 mg.	1000		0.16	4.2635	2,564.69
Ibuprofen 200 mg.	20		0.23	1.9890	764.78
Mebendazole 100 mg.	72		1.67	14.4130	763.05
Mebendazole 500 mg.	NA		NA	NA	NA
Norfloxacin 400 mg.	10		3.20	44.4500	1,289.06
Paracetamol 500 mg.	1000		0.11	0.3113	183.00
Vitamin B1-6-12	100		0.30	3.1132	937.73

Table 96 Sensitivity test calculated by changing premium rate and transportation fee.

Name	Packing in Malaysia	New premium rate	Percent change	New transportation fee	Percent change
Amoxycillin 500 mg.	500	608.20	12,064.00	613.20	6,032.00
Ampicillin 500 mg.	1	49.12	882.40	54.12	441.20
Antacid	50	340.85	6,717.00	345.85	3,358.50
Bromhexine 8 mg.	100	768.65	15,273.00	773.65	7,636.50
Cimetidine 400 mg.	120	1,304.45	25,989.00	1,309.40	12,994.00
Diclofenac 25 mg.	1000	2,954.30	58,986.00	2,959.40	29,494.00
Ibuprofen 200 mg.	20	884.50	17,590.00	889.50	8,795.00
Mebendazole 100 mg.	72	882.50	17,550.00	887.50	8,775.00
Mebendazole 500 mg.	NA	NA	NA	NA	NA
Norfloxacin 400 mg.	10	1,487.50	29,650.00	1,492.50	14,825.00
Paracetamol 500 mg.	1000	215.46	4,209.20	220.46	2,104.60
Vitamin B1-6-12	100	1,083.40	21,568.00	1,088.40	10,784.00

Table 97 Sensitivity test calculated by changing wholesale price in Philippines.

Name	Packing in Philippines	Producer country / trade name	Wholesale price in Philippines(baht)/tab.	New wholesale price(baht)	Percent change
Amoxycillin 500 mg.	50	Clearamox(Boehringer)	16.67	2.1275	- 87.24
Ampicillin 500 mg.	100	Penbritin (Smith Kline Beecham)	15.49	2.8750	-81.45
Antacid	100	Mucaine(Wyeth)	3.51	0.3450	-90.17
Bromhexine 8 mg.	100	Bisolvon(Boehringer)	6.60	0.4600	-93.03
Cimetidine 400 mg.	60	Montion(Macropharma)	19.77	2.5875	-86.91
Diclofenac 25 mg.	500	Voltaren(Novartis)	8.53	0.1840	- 97.84
Ibuprofen 200 mg.	100	Advil(Whitehall)	6.36	0.2645	-95.84
Mebendazole 100 mg.			NA	NA	NA
Mebendazole 500 mg.	100	Antiox(Janssen)	16.80	1.9205	- 88.57
Norfloxacin 400 mg.	100	Lexinor(Astra)	43.02	3.6800	-91.45
Paracetamol 500 mg.	1000	Biogesic(Mead Johnson)	1.80	0.1265	-92.96
Vitamin B1-6-12	100	Mega B(Pharm\ INT'L)	13.50	0.3450	-97.44

Table 98 Sensitivity test calculated by changing wholesale price of Thailand.

Name	Packing in Philippines	Producer country / trade name	Wholesale price of Thailand(baht)/tab.	New wholesale price(baht)	Percent change
Amoxycillin 500 mg.	50	Clearamox(Boehringer)	1.85	14.4950	683.51
Ampicillin 500 mg.	100	Penbritin (Smith Kline Beecham)	2.50	13.4740	438.96
Antacid	100	Mucaine(Wyeth)	0.30	3.0515	917.17
Bromhexine 8 mg.	100	Bisolvon(Boehringer)	0.40	5.7375	1,334.38
Cimetidine 400 mg.	60	Montion(Macropharma)	2.25	17.1880	663.91
Diclofenac 25 mg.	500	Voltaren(Novartis)	0.16	7.4160	4,535.00
Ibuprofen 200 mg.	100	Advil(Whitehall)	0.23	5.5335	2,305.87
Mebendazole 100 mg.				NA	NA
Mebendazole 500 mg.	100	Antiox(Janssen)	1.67	14.6090	774.79
Norfloxacin 400 mg.	100	Lexinor(Astra)	3.20	37.4140	1,069.19
Paracetamol 500 mg.	1000	Biogesic(Mead Johnson)	0.11	1.5621	1,320.09
Vitamin B1-6-12	100	Mega B(Pharm\ INT'L)	0.30	11.7390	3,813.00

Table 99 Sensitivity test calculated by changing premium rate and transportation fee.

Name	Packing in Philippines	Producer country / trade name	New premium rate	Percent change	New transportation fee	Percent change
Amoxycillin 500 mg.	50	Clearamox(Boehringer)	791.10	15,722.00	796.10	7,861.00
Ampicillin 500 mg.	100	Penbritin (Smith Kline Beecham)	509.80	0,096.00	514.80	5,048.00
Antacid	100	Mucaine(Wyeth)	1059.70	1,094.00	1064.70	10,547.00
Bromhexine 8 mg.	100	Bisolvon(Boehringer)	1539.50	30,690.00	1544.50	15,345.00
Cimetidine 400 mg.	60	Montior(Macropharma)	7685.0	5,270.00	773.50	7,635.00
Diclofenac 25 mg.	500	Voltaren(Novartis)	5220.00	104,300.00	5225.00	52,150.00
Ibuprofen 200 mg.	100	Advil(Whitehall)	2656.70	3,034.00	2661.70	26,517.00
Mebendazole 100 mg.			NA	NA		NA
Mebendazole 500 mg.	100	Antiox(Janssen)	896.00	7,820.00	901.00	8,910.00
Norfloxacin 400 mg.	100	Lexinor(Astra)	1234.50	24,590.00	1239.50	12,295.00
Paracetamol 500 mg.	1000	Biogesic(Mead Johnson)	1523.10	0,362.00	1528.10	15,181.00
Vitamin B1-6-12	100	Mega B(Pharm\ INTL)	4390.00	7,700.00	4395.00	3,850.00

Table 100 Sensitivity test calculated by changing wholesale price in Myanmar.

Name	Packing in Burma	Producer country / trade name	Wholesale price in Myanmar(baht)/tab.	New wholesale price	Percent change
Amoxycillin 500 mg.	100	Kopran(India)	65.46	2.1275	-96.75
Ampicillin 500 mg.	10		110.09	2.8750	-97.39
Antacid	10	Thailand	23.80	0.3450	-98.55
Bromhexine 8 mg.	10		38.68	0.4600	-98.81
Cimetidine 400 mg.	10		47.61	2.5875	-94.56
Diclofenac 25 mg.	50	Novartis	184.47	0.1840	-99.90
Ibuprofen 200 mg.	100	Pongo(EFROGE(Pakistan)	23.80	0.2645	-98.89
Mebendazole 100 mg.	1		493.91	1.9205	-99.61
Mebendazole 500 mg.	1	Thailand	208.27	14.9500	-92.82
Paracetamol 500 mg.	12	Austria	39.67	0.1265	-99.68
Vitamin B1-6-12	10	Germany	178.52	0.3450	-99.81

Table 101 Sensitivity test calculated by changing wholesale price of Thailand.

Name	Packing in Burma	Producer country / trade name	Wholesale price in Thailand(baht)/tab.	New wholesale price	Percent change
Amoxycillin 500 mg.	100	Kopran(India)	1.85	56.9200	2,976.76
Ampicillin 500 mg.	10		2.50	95.7300	3,729.20
Antacid	10	Thailand	0.30	20.6980	6,799.33
Bromhexine 8 mg.	10		0.40	33.6350	8,308.75
Cimetidine 400 mg.	10		2.25	41.3950	1,739.78
Diclofenac 25 mg.	50	Novartis	0.16	160.4100	100,156.25
Ibuprofen 200 mg.	100	Pongo(EFROGE(Pakistan)	0.23	20.6980	8,899.13
Mebendazole 100 mg.	1		1.67	429.5000	25,618.56
Mebendazole 500 mg.	1	Thailand	13.00	181.1000	1,293.08
Paracetamol 500 mg.	12	Austria	0.11	34.4960	31,260.00
Vitamin B1-6-12	10	Germany	0.30	155.2400	51,646.67

Table 102 Sensitivity test calculated by changing premium rate and transportation fee.

Name	Packing in Burma	Producer country / trade name	New premium rate	Percent Change	New transportation fee	Percent change
Amoxycillin 500 mg.	100	Kopran(India)	3,428.40	68,468.00	3,433.09	34,230.90
Ampicillin 500 mg.	10		4,293.50	85,770.00	4,298.50	42,885.00
Antacid	10	Thailand	7,824.00	156,380.00	7,829.00	78,190.00
Bromhexine 8 mg.	10		9,560.00	191,100.00	9,565.00	95,550.00
Cimetidine 400 mg.	10		2,005.70	40,014.00	2,010.70	20,007.00
Diclofenac 25 mg.	50	Novartis	115,180.00	2303,500.00	115,190.00	1,151,800.00
Ibuprofen 200 mg.	100	Pongo(EFROGE(Pakistan)	10,239.00	204,680.00	10,244.00	102,340.00
Mebendazole 100 mg.	1		29,465.00	589,200.00	29,470.00	294,600.00
Mebendazole 500 mg.	1	Thailand	1,492.10	29,742.00	1,497.10	14,871.00
Paracetamol 500 mg.	12	Austria	35,955.00	719,000.00	35,960.00	359,500.00
Vitamin B1-6-12	10	Germany	59,395.00	1,187,800.00	10.00	-

Table 103 Cost structure of production by dosage form and packaging.

Dosage form	Packaging	Percentage of cost structure of production					
		Active ingredient	Non active ingredient	Packaging	Labor cost	Direct operation cost	Indirect operation cost
Capsule	Bottle	63.31	8.79	8.94	7.67	8.29	3.02
Tablet	Bottle	53.32	10.42	7.84	12.26	11.91	4.73
Capsule	Foil strip	79.48	2.02	13.89	3.08	0.80	0.75
Tablet	Foil strip	43.66	5.95	20.52	12.62	11.80	5.46

Table 104 Percentage of value added from sale.

Name	Packing	Percent of value added from cost of production				
		Factory price	Company price	Original price	Control price	GPO price
Amoxycillin 500 mg.	500	46.60	97.70	142.59	133.68	172.74
Antacid	1000	48.85	123.51	291.19	84.77	109.54
Glibenclamide 5 mg.	500	376.47	584.83	1,878.39	447.86	566.18
Paracetamol 500 mg.	100	60.20	100.91	783.25	123.35	194.42
Paracetamol 500 mg.	1000	30.17	46.89	194.33	28.72	82.93
Propanolol 10 mg.	1000	665.42		2,122.67	532.95	472.73

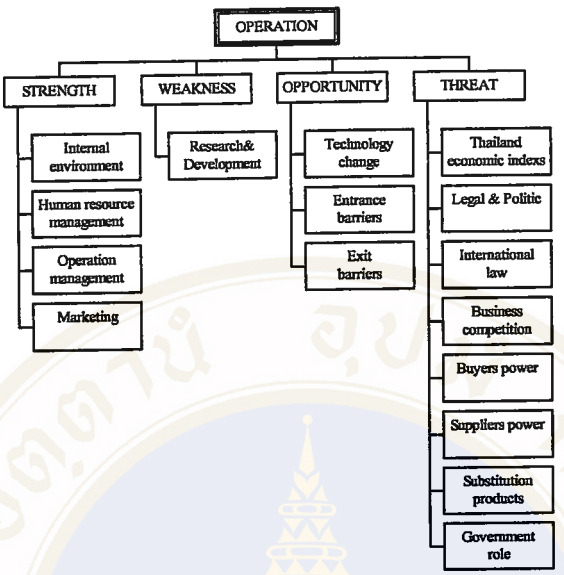

Figure 4 Strength, weakness, opportunities and threats of pharmaceutical industry

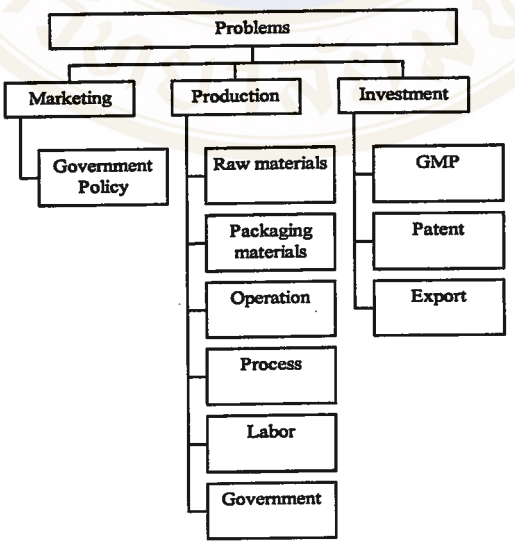

Figure 5 Problems of drug local manufacturers

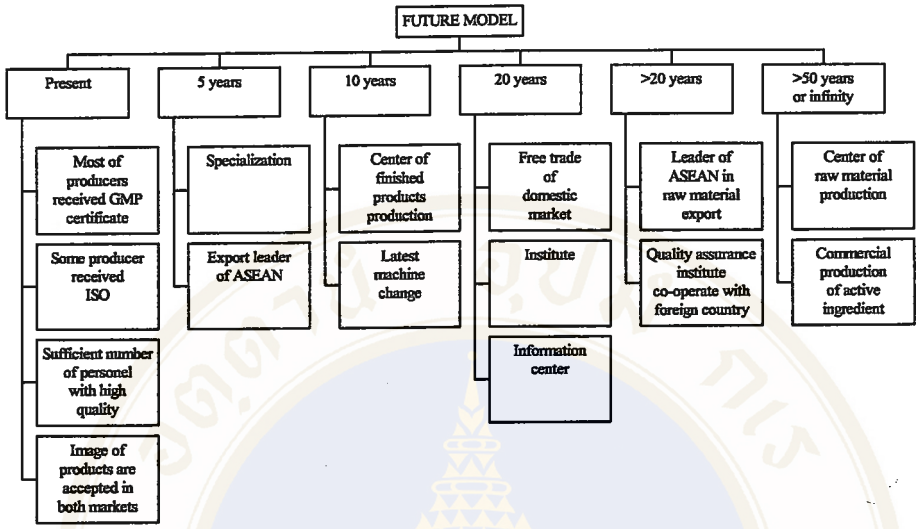

Figure 6 Future model of pharmaceutical industry in Thailand

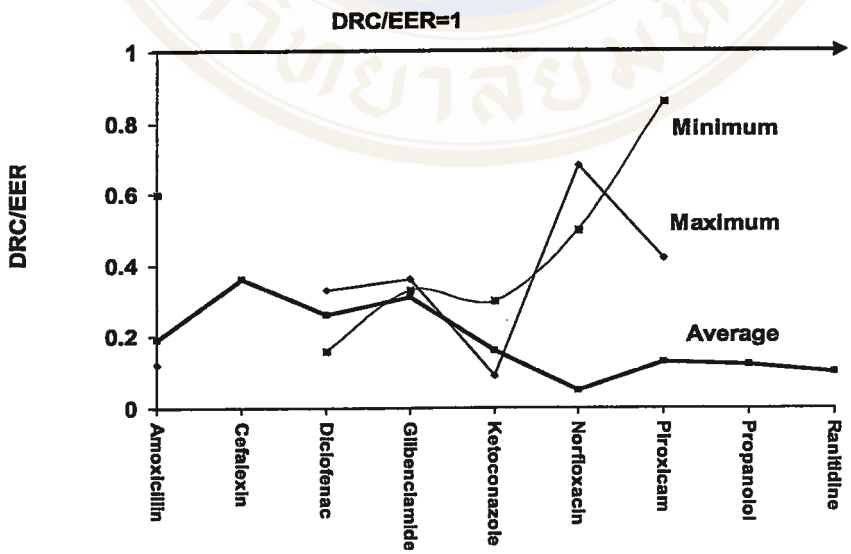

Figure 7 Domestic resource cost of drugs selected to studied potential for self-sufficiency

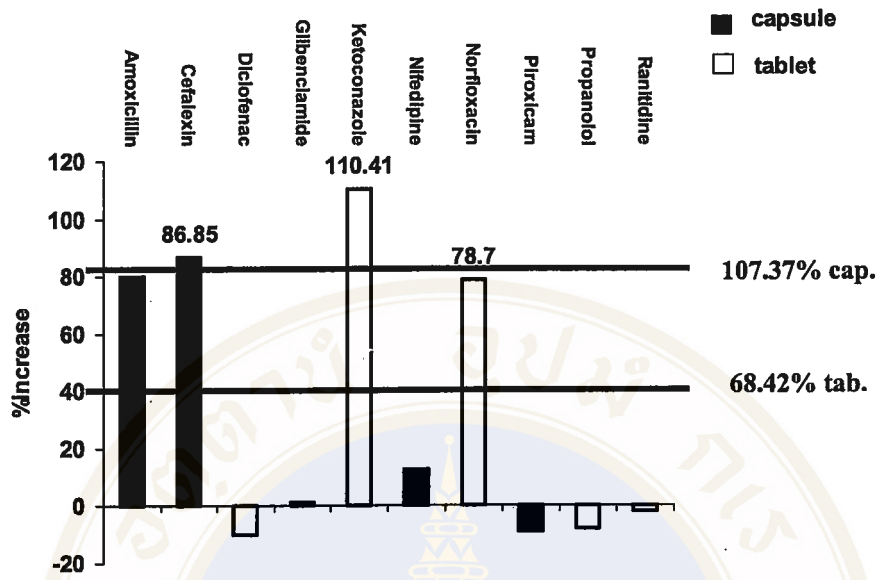

Figure 8 Production increased for self-sufficiency

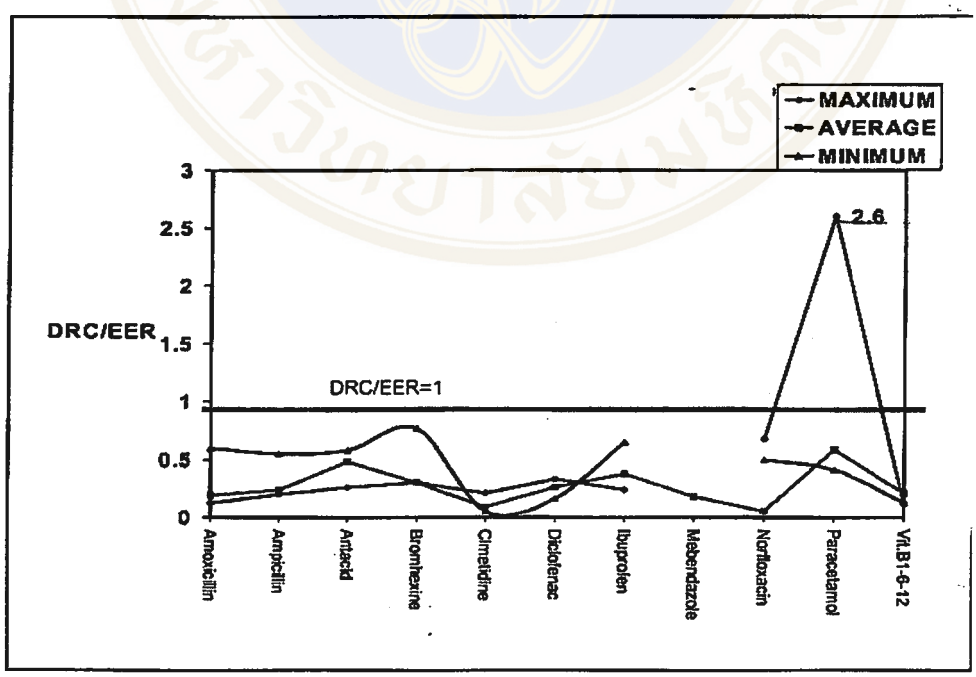

Figure 9 Domestic resource cost of 11 selected drugs studied potential for extend export

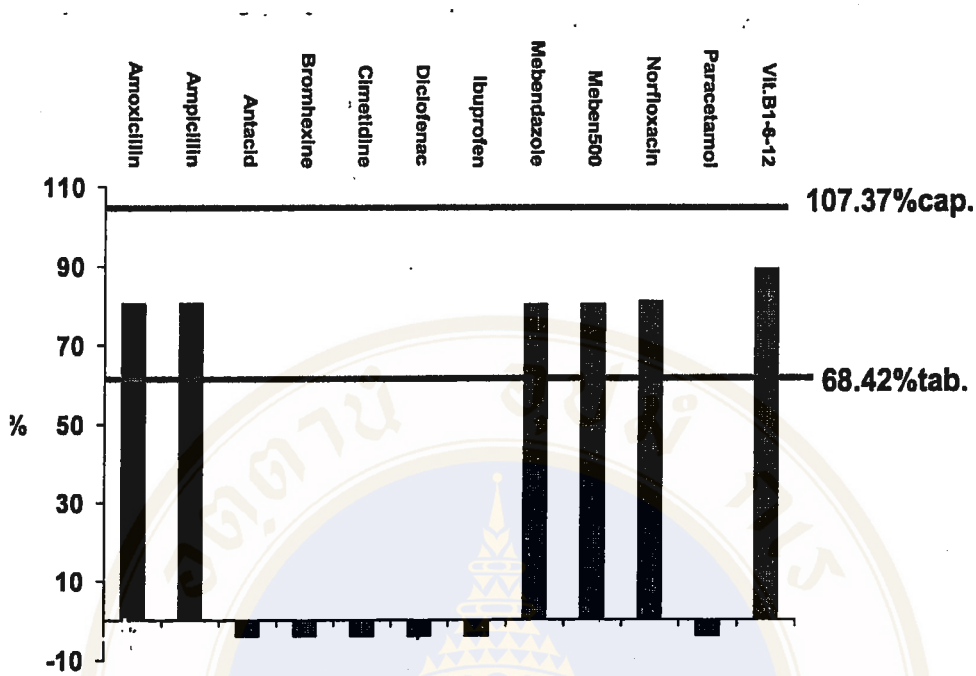

Figure 10 Production increased for extend export

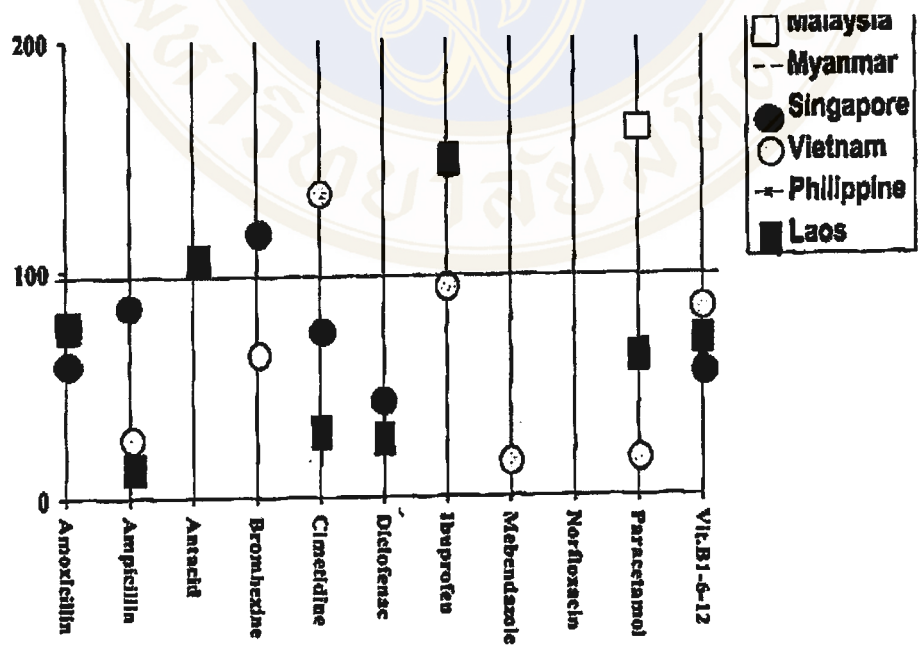

Figure 11 Term of trade of 11 selected drugs by ASEAN countries

APPENDIX B

TOOLS FOR COLLECTING DATA

Questionnaire

Potential for self-sufficiency and export of modern pharmaceutical industry in Thailand: Policy analysis

Part 1

General information

1. Name of factory
2. Number of pharmacists
3. Period of operation years
4. How much capital registered ?

☐ No

☐ Less than 1 million baht

☐ 1-9 million baht

☐ 10-49 million baht

☐ 50-99 million baht

☐ 100-200 million baht

☐ More than 200 million baht

5. How many person engaged?

☐ 1-19 persons

☐ More than 20 persons

6. Has your factory invested with foreigner?

☐ No

☐ Yes (country)

7. What type of production of your factory?

☐Your own brand name

☐Generic drug according to employers

☐Brand name of Thai's employers

☐Brand name of multinational company

8. What dosage forms that your factory produce? How many formulas of each dosage form?

☐Tablet	number of formulas……
☐Capsule	number of formulas……
☐Liquid	number of formulas……
☐Powder	number of formulas……
☐Injection	number of formulas……
☐Cream & ointment	number of formulas……
☐Other	number of formulas……

9. Did your factory export finished products to foreign countries?

☐No

☐Yes (trade name)……

……

(countries)…… ……

☐ASEAN countries such as: ☐Brunei

☐Myanmar

☐Cambodia

☐Indonesia

☐Laos

☐Malaysia

☐Philippines

☐Singapore

☐Vietnam

☐ Middle East countries

☐ Europe

☐ South America

☐ Japan

☐ U.S.A.

☐ Other

10. Does your factory plan to expand export to foreign countries mentioned below? If your factory has some plan please fill trade name and the reasons.

Country	Plan of export		Reason	Trade name
	Yes	No		
1. Brunei				
2. Cambodia				
3. Indonesia				
4. Laos				
5. Malaysia				
6. Myanmar				
7. Philippines				

8. Singapore

9. Vietnam

10. Other _____

11. Real capacity of tablet production in 1998.....tablet / year

Full capacity of tablet production in 1998.....tablet / year

Real capacity of capsule production in 1998.....capsule/year

Full capacity of capsule production in 1998.....capsule/year

Part 2 consist of 2 questions : number 12 and 13.

12. Please fill in the blank especially with data of tablet and capsule production of your factory by marking ✓ in production, dosage form and packaging. Packaging is filled by number. For strip pack please fill number per strip such as 100x10, or 25x4. Factory prices are state that whether include value added tax or not.

	Production		dosage form		packaging		Packing	factory price(baht).....VAT			volume of production (tablet or capsule)		
	yes	no	tab.	cap	Strip	loose		1996	1997	1998	1996	1997	1998
Amoxycillin 500 mg.													
2. Ampicillin 500 mg.													
3. Antacid													
4. B 1-6-12													
5. Bromhexine 8 mg.													
6.Cefalexin 250 mg.													
7. Cimetidine 400 mg.													
8. Diclofenac 25 mg.													
9. Glibenclamide 5 mg.													
10. Ibuprofen 200 mg.													
11. Ketoconazole 200 mg													
12. Mebendazole 100 mg.													

	Production		dosage form		packaging		Pack ing	factory price (baht).....VAT			volume of production (tablet or capsule)		
	yes	no	tab.	cap	Strip	loose		1196	1997	1998	1996	1997	1998
13. Nifedipine 5 mg.													
14. Norfloxacin 200 mg.													
15. Paracetamol 500 mg.													
16.Piroxicam 10 mg.													
17. Propanolol 10 mg.													
18. Ranitidine 150 mg.													

13. Form for collection of production cost (baht) per 1 lot or batch of production or 1 unit of packing in 1996 to avoid impacts of changing baht currency.

Data from all factories that replied will be averaged and used in calculation domestic resource cost that is economical indicator to show comparative advantage in drug production. If one item has several packing such as 100, 500 and 1,000 , please fill data of the biggest packing. In the case of one item was filled in both foil or strip pack(FP) and loose pack (LP), please fill data of both packaging.

Sample of filling data in question 13.

Form of production cost of 18 selected drugs. Please fill only items that your factory produced.

FP= foil pack or strip pack , LP = loose pack

1. name/packaging	Amoxycillin 500 mg ☐ FP ☐LP		Amoxycillin 500 mg ✓FP ☐LP		☐FP ☐LP	
2. volume of production per lot or batch (tablet or capsule)	1,000,000		1,000 x 100			
3. production cost (baht)	domestic cost	foreign cost	domestic cost	foreign cost	domestic cost	foreign cost
3.1 active ingredient		1,500		150		
3.2 non-active ingredient	500		50			
3.3 packaging material	500		100			
3.4 labor cost	200		20			
3.5 direct overhead	200		20			
3.6 indirect overhead	100		10			

Note: Domestic cost is value of domestic resource or materials that are process in Thailand such as plastic caplets that are imported but are processed to be containers in Thailand is catagorized to be domestic cost.

Foreign cost is value of resource or raw materials that imported from foreign country such as active ingredients that are imported by importers or distributors. These materials are not process to change their structure. Although they are repacked they are categorized to be foreign cost.

Direct and indirect overhead cost are categorized by each factory.

1. name/packaging		☐ FP ☐LP		☐FP ☐LP		☐FP ☐LP
2. volume of production per lot or batch (tablet or capsule)						
3. production cost (baht)	domestic cost	foreign cost	domestic cost	foreign cost	domestic cost	foreign cost
3.1 active ingredient						
3.2 non-active ingredient						
3.3 packaging material						
3.4 labor cost						
3.5 direct overhead						
3.6 indirect overhead						

Questions guide for in depth interview

1. What will be goals of your factory in next 5 years? What type of your factory?
   a. formulation
   b. specialization
   c. research
   d. export
2. What are the problems if your factory will increase production for self-sufficiency or export to ASEAN countries?
   a. production aspect
   b. technology
   c. cost
   d. marketing aspect
   e. financial aspect
   f. other
3. What is the cause of these problems?
   a. production problem
   b. marketing problems
   c. financial problems
   d. other problems
4. What agencies can support you in these problems? And what procedure?
   a. Ministry of Commerce
   b. Ministry of Public Health
   c. Ministry of Industry

d. Ministry of Financial

e. Ministry of labor

f. Other agencies

5. If your factory will not expand export in next 5 years, what are the reasons?

6. If your factory will increase production for self-sufficiency and export to ASEAN countries, How average cost of production per unit do you think it will be changed?

	Increase	Reduction	No change
1. operation cost of production or export			
2. raw material coat			
3. domestic resource utilization			
4. packaging material imported			
5. domestic packaging material utilization			

7. How much the exchange rate that you want? Why?

8. How much interest that you want? Why?

9. What type of investment do you want if your factory will expand export?

a. One owner

b. Joint venture with Thai's people

c. Joint venture with foreigner

10. What items or pharmacological group of raw materials that you think that Thai's manufacturers can produce? What are the reasons?
11. What items or pharmacological group of finished products that your factory wants to increase production for self-sufficiency or export and what are the reasons?
12. What are the reasons that you think that they make the manufacturers close down their business?

Please mark ✓ in the blank that match with your opnion.

1. Which elements of Internal environm .nt are strength or weakness?

0 = it is not both strength and weakness.

1 to 3 = it is strength that the level is ascending.

-1 to -3 = it is weakness that its level is descending.

Internal environment	score						
	-3	-2	-1	0	1	2	3
1. Internal image and prestige							
2. Organization structure							
3. Planning and control system							
4. Delegation of authority							
5. Communication network							
6. Hierarchy of objective							
7. Strategic management system							
8. Ability of management team							
9. Policy of head company							
10.Location of plant							

2. How about operation management in your company?

0 = it is not both strength and weakness.

1 to 3 = it is strength that the level is ascending.

-1 to -3 = it is weakness that its level is descending.

Operation Management	score						
	-3	-2	-1	0	1	2	3
1. Operation cost							
2. Use of technology							
3. Raw materials cost							

4. Adequate availability of raw materials

5. Efficient and effective equipment and machinery

6. Inventory control

7. Human resource in management

3. Which element in marketing and distribution of products is strength or weakness?

0 = it is not both strength and weakness.

1 to 3 = it is strength that the level is ascending.

-1 to -3 = it is weakness that its level is descending.

Marketing and distribution management	score						
	-3	-2	-1	0	1	2	3
1. Market share							
2. Distribution system							
3. Market research							
4. Sales force productivity							
5. price competitiveness							
6. Business image							
7. Human resource in marketing							
8. Use of IT in operation							

4. Which element in research and development that is strengh or weakness?

0 = it is not both strength and weakness.

1 to 3 = it is strength that the level is ascending.

-1 to -3 = it is weakness that its level is descending.

R&D and Engineering	score						
	-3	-2	-1	0	1	2	3
1. R&D facilities							
2. R&D funding							
3. Development of new products							

4. Human resource in R&

5. Which element in personnel is strength or weakness of your company?

0 = it is not both strength and weakness.

1 to 3 = it is strength that the level is ascending.

-1 to -3 = it is weakness that its level is descending.

Human resource management	score						
	-3	-2	-1	0	1	2	3
1. Recruitment practice							
2. Training programs							
3. Reward system							
4. Quality of corporate staffs							
5. Cost of labor							
6. Performance appraisal system							
7. Turn over and absenteeism							
8. Favor system							

6. Which economic indicator of Thailand that increase opportunity or threat in Thai's drug company?

Scale 0 = no effect

Scale 1 to 3 = increase opportunity by ascending.

Scale -1 to -3 = increase threat by descending.

External Environment	score						
	-3	-2	-1	0	1	2	3
1. Gross Domestic Products							
2. Per capita income							
3. Inflation							
4. Foreign exchange impact							
5. Wage level							
6. Raw material supply							

7. Manpower supply							

7. Which social factor that increase opportunity or threat in opoeration of your company?

Scale 0 = no effect

Scale1 to 3 = increase opportunity by ascending.

Scale -1 to -3 = increase threat by descending.

Social factors	score						
	-3	-2	-1	0	1	2	3
1. Growth rate of population							
2. Ecological impacts							
3. Consumer protection							
4. Family size change							
5. Distribution of population age							
6. Population education change							
7. Degree of unionization							

8. How technology change affect your company?

Scale 0 = no effect

Scale1 to 3 = increase opportunity by ascending.

Scale -1 to -3 = increase threat by descending.

Technological change	score						
	-3	-2	-1	0	1	2	3
1. Maturity and volatility of technology							
2. Complexity of technology							
3. Patents							
4. Product R&D requirement							
5. Process R&D requirement							
6. Technology transfer							

9. How politic and legal factor affect operation of your company?

Scale 0 = no effect

Scale1 to 3 = increase opportunity by ascending.

Scale -1 to -3 = increase threat by descending.

Politic and legal	score						
	-3	-2	-1	0	1	2	3
1. Essential drug list							
2. Purchasing regulation of public health center							
3. Controlled price							
4. Environment law ISO 14000							
5. International standard ISO							
6. Good Manufacturing Practice(GMP)							
7. Tariff							
8. Value added tax(VAT)							
9. Advertising law							
10.Government support							

10. How economic factor of ASEAN countries affect operation of your company?

Scale 0 = no effect

Scale1 to 3 = increase opportunity by ascending.

Scale -1 to -3 = increase threat by descending.

Economic index of ASEAN	score						
	-3	-2	-1	0	1	2	3
1. Gross National Product(GNP)							
2. Per capita income							
3. Population growth							
4. Natural resource							
5. Climate							
6. Membership in regional economic blocks							

Economic index of ASEAN	score						
	-3	-2	-1	0	1	2	3
7. Monetary and fiscal policies							
8. Inflation							
9. Taxation system							
10. Interest rate							
11. Wage and salary levels							

11. How international law affect operation of your company?

Scale 0 = no effect

Scale1 to 3 = increase opportunity by ascending.

Scale -1 to -3 = increase threat by descending.

International laws of ASEAN	score						
	-3	-2	-1	0	1	2	3
1. Legal tradition							
2. Patent ,trade mark law							
3. Law affecting business firm							

11. How politic factor in ASEAN countries affect operation of your company?

Scale 0 = no effect

Scale1 to 3 = increase opportunity by ascending.

Scale -1 to -3 = increase threat by descending.

ASEAN political factor	score						
	-3	-2	-1	0	1	2	3
1. Stability of government							
2. Strength of opposition parties and group							
3. Foreign policies							

13. Which cultural factor in ASEAN countries affect operation of your company?

Scale 0 = no effect

Scale1 to 3 = increase opportunity by ascending.

Scale -1 to -3 = increase threat by descending.

ASEAN cultural factor	score						
	-3	-2	-1	0	1	2	3
1. Customs, norms, value and beliefs							
2. Language							
3. Attitudes							
4. Religious beliefs							

14. How about your company when compare each element with competitors?

scale 0 = no advantage or disadvantage

scale 1 to 3 = advantage by ascending.

Scale -1 to -3 = disadvantage by descending.

Evaluation of rivalry among competitors Entry barriers	score						
	-3	-2	-1	0	1	2	3
1. Economics of scale							
2. Product differentiation							
3. Brand identity							
4. Switching cost							
5. Capital for R&D requirement							
6. Access to distribution channels							
7. Access to latest technology							
8. Access to raw materials							
9. Government protection							
10. Experience effect cost							

15. How about these elelments affect exit barrier when compare with competitors?

scale 0 = no effect

scale 1 to 3 = affect exit barrier by ascending.

Scale -1 to-3 = not affect exit barrier by ascending.

Exit barriers	score						
	-3	-2	-1	0	1	2	3
1. Asset specialization							
2. Fixed cost of exit							
3. Strategic interrelationship							
4. Emotional barriers							
5. Government and social restriction							

16. From evaluation competition in drug firms, How these elements affect opration of your business?

Scale 0 = no effect

scale 1 to 3 = increase competittiveness by ascending

scale -1 to -3 = reduce competitiveness by descending.

Rivalry among competitors	score						
	-3	-2	-1	0	1	2	3
1. Number of equality balanced competitors							
2. Industrial growth							
3. Fixed or storage cost							
4. Brand loyalty							
5. Capacity increase							
6. Diversity of competitors							
7. Strategic stakes							

17. How these elements affect power of buyers?

Scale 0 = no effect

scale 1 to 3 = increase power of buyers by ascaending.

Scale -1 to -3 = reduce poer of buyers by descending.

Power of buyers	score

	-3	-2	-1	0	1	2	3
1. Number of buyers							
2. Availability of substitutes of the industrial products							
3. Buyers switching cost							
4. Buyers' threat of backward integration							
5. Contribution to quality or service of buyers products							
6. Total buyers' cost contributed by the industry							
7. Buyer 's profitability							

18. How these elements affect power of raw materials suppliers?

Scale 0 = no effect

scale 1 to 3 = increase power of suppliers by ascending.

Scale -1 to -3 = reduce power of suppliers by descen ding.

Power of suppliers	score						
	-3	-2	-1	0	1	2	3
1. Number of suppliers							
2. Availability of substitute for the suppliers' product							
3. Supplier's threat of backward integration							
4. Industry threat of backward integration							
3. Supplier's contribution to quality or service of the industry product							
6. Total industry cost contributed by supplier							
7. Important of the industry to supplier group							

19. How availability of substitution drugs affect marketing competitiveness of drug firms?

Scale 0 = no effect

scale 1 to 3 = increase marketing competitiveness by ascending.

Scale -1 to -3 = reduce marketing competitiveness by descending.

Availability of substitutes	score						
	-3	-2	-1	0	1	2	3
1. Availability of class substitutes							
2. User's switching cost							
3. Substitute producer's profitability and aggressiveness							
4. Substitute price value							

20. How government action affect competitiveness of drug business?

Scale 0 = no effect

scale 1 to 3 = increase competitiveness by ascending.

scale -1 to -3 = reduce competitiveness by descending.

Government action	score						
	-3	-2	-1	0	1	2	3
1. Industry protection							
2. Industry regulation							
3. Investment promotion policy							
4. Consistence of policies							
5. Capital movement among country							
6. Custom's duties							
7. Registration regulation and process							
8. Foreign exchange							
9. Foreign ownership							
10. Assistance provided to competitors							

Table 105 Economic data of ASEAN countries in 1996.

Country	Area Km^2	Population (1,000)	Population growth (%)	Number of labor (1,000)	GDP (US$ Billions)	Real GDP Growth (%)	GDP/Cap. (US$)	Exports US$ million	Imports US$ million	Current Acc. % of GDP	Exchange Rate 1 US$
Brunei	5,765	305	3.1	138	5.3	3.5	17,377.0	2,608.9	2,505.2	-1.9	1.41
Indonesia	1,919,317	200,000	1.6	78,300	222.5	7.8	1,112.5	49,814.7	42,928.5	-3.4	2,383.00
Laos	236,800	4,800	2.4	2,030	2.1	7	437.5	313.1	678.1	-16.5	920.00
Malaysia	329,758	21,170	2.3	8,200	99.2	8.6	4,686.1	76,703.0	72,691.2	-4.9	2.52
Myanmar	676,577	45,570	1.84	26,860	121.0	5.8	2,655.0	885.6	1,829.2	-0.28	5.85
Philippines	300,000	71,900	2.3	29,733	83.8	5.7	1,165.4	20,543.0	31,885.0	-4.5	26.22
Singapore	648	3,612	4.2	1,802	94.1	7	26,041.0	125,006.7	131,326.4	15.0	1.41
Thailand	514,000	60,000	1.1	32,800	186.7	6.6	3,111.7	55,770.6	72,386.9	-7.9	25.34
Vietnam	330,955	75,350	2.07	34,700	23.5	9.37	311.7	6,800.0	10,200.0	-12.2	11,000
Cambodia	181040	111633	2.72	2.5	7.7	7.4	710	464	14000	N.A.	2624.1
ASEAN	4,313,820	482,707	1.78	214,563	838.2	7.2	1,736.5	338,446	366,430.5	-5.7	

Table 106 Form for collecting wholesale price of 11 selected dugs in foreign drug market.

Factory Price of the 11 selected Pharmaceutical Products

Country.....

No.	Name of drug	Brand name	Packing (100, 500 or 1,000)	company	Factory Price (unit :)	Wholesale price (unit:)
1	Amoxycillin 500 mg. cap/tab.					
2	Ampicillin 500 mg. cap./tab.					
3	Antacid tab.					
4	B 1-6-12 cap./tab.					
5	Bromhexine 8 mg. cap./tab.					
6	Cimetidine 400 mg. cap./tab.					
7	Diclofenac 25 mg. cap./tab.					
8	Ibuprofen 200 mg. cap./tab.					
9	Mebendazole 500 mg. cap./tab.					
10	Norfloxacin 200 mg. cap./tab.					
11	Paracetamol 500 mg. cap./tab.					

Note: company refer to the company who register the drug

Faculty of Pharmacy, Silpakorn University

Ampur Muang, Nakornprathom province

73000

date

Dear

Attachment Data from Delphi technique

According to interviewing you on ..... about current status and forecast future model of pharmaceutical industry in Thailand. I have already analyzed by using statistical mode of each statements. In first colume of realization and period of realization are value of your opinion. Second column of realization and period of realization are value of samples. The last column of realization and period of realization are opened for you if you want to change your opinions.

If you have already comfirmed , please return this checklist to me by using the envelop sent within..... because I will repeat it again for the precision of mode.

Sincerely yours.

Checklist of future model of pharmaceutical industry inThailand by Delphi technique

Likelihood of realization 0 = lowest 50 = realization with condition 100 = highest realization

Period of realization (year's time) 0 = present time or nearly future 5, 10, 20 years hence (5 = between 1-5 year hence, 10 = 5-10 years hence, 20 = 10-20 years hence) >20 = more than 20 years hence inf. = long time or infinity

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
1. Industrial aspect											
1.1 All factories received GMP certificate											
1.2 Some factory meet requirement ISO											
1.3 Quality management system meet requirement of ISO or GMP											
1.4 Sufficient member and quality of pharmaceutical and scientific personal											
2. Operation											
2.1 Specialization											
2.2 Environment and rapid quality control											
2.3 Production of international marketing personals											
2.4 Support in plant movement or machine adjustment											

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
2.5 Increase R & D expense											
3. Drug marketing competition											
3.1 Product image is accepted in domestic drug market											
3.2 Image of Thai's pharmaceutical product is accepted in foreign drug market											
3.3 Brand name is accepted in developing countries											
3.4 Free trade in domestic market											
3.5 International trade is promoted to be counter trade											
3.6 Thailand is leader of ASEAN in drug export by increase export value in 2003 to be 3 times of export value in 1997											
3.7 Thailand is ASEAN leader in chemical export by increase export value in 2003 to be 3 times of export volume in 1997											
4. Production											
4.1 Thailand is some finished drug production that accepted by developing countries											

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
4.2 Thailand is hub of some chemical production that accepted by developing countries											
4.3 Change the out of date machine to increase productivity											
4.4 Increase production to import substitute 50%											
4.5 Production some commercial raw materials for import substitution											
4.6 Thailand is base of drug and medicinal herb extraction production											
4.7 Using domestic raw materials to produce value added pharmaceutical products											
5. Institute for Development											
5.1 Institute for training of production technology and quality control											
5.2 Quality assurance institute that co-ordinate with foreign institute											
5.3 Information center of marketing and technology of ASEAN											
5.4 Funding to support and motivate exporters											
6. Government action											
6.1 Government promote investment with foreigners for technology transfer and confidence											

List /score	Likelihood of realization				Period of realization(year's time)						
	mode	0	50	100	mode	0	5	10	20	>20	inf.
6.2 Government support using latest technology and equipment											
6.3 Finished drug industry has investment promotion by maximum profit in all regions											
6.4 Strategy in promotion off patent drug in Thailand and still used in developing countries											
6.5 Tax restructuring and import-export duties											
6.6 Government is leader in R&D											
7. Collaboration of public and private sector											
7.1 Co-operation between private sector and academic in technology transfer and improvement											
7.2 Co-operation of public and private sector in expand foreign market											
7.3 Co-operation of public and private sector in seeking raw material that high quality and low cost by purchasing large volume											
7.4 Public and private sector co-operate to obviate export barriers											
7.5 Co-operation to exchange benefit beyond investment promotion legal											

Medical Social Science department

Faculty of Social Science and Humanity

Mahidol University Salaya

Nakornprathom province 73000

March 2000

Title: Focus group discussion in "modern pharmaceutical development"

Dear

Attachment Focus group issues

The thesis of Mrs. Pagamas Maitreemit in "Potential for self-sufficiency and export of moderm pharmaceutical industry in Thailand:Policy analysis" will effect the improvement in developing drug manufacturers in Thailand in the future.

The researcher , one of the Ph.D candidate at Faculty of Social Science and Humanity at Mahidol University, need to collect reliable data from specialists by focus group discussion in the situations, problems, limitation and strategy of Thai's drug manufacturers.

You or your representative would be the value person in this focus group discussion. I would like to welcome you at 13.00-16.30 p.m. ,27 March 2000 at Chainat Narendhon, 1st floor building , FDA, Ministry of Public Health, Nonthaburi.

Sincerely yours

Asst. prof. Dr. Luechai Sringernyuang

Schedule of Focus group Discussion

This is one part of methodology in the thesis "Potential for self-sufficiency and export of modern pharmaceutical industry in Thailand: Policy analysis". This would be result from brain storming both government and non-government sectors to promote modern pharmaceutical products and reduce the import value in these topics.

1. None correspond policies of government.

- Limitation in policy and regulation
- Pricing policy
- Export promotion policies
- Restructuring industry policy

2. Confliction of interest that affect information

- Obstacle in development of information base that is useful in pharmaceutical industry development
- etc.

3. Tri-sectors alliance setting

- Development collaboration between three sectors such as public sector, private sector and universities.

4. Other topics.

Schedule : At 01.00-04.30 p.m. at 27 March, 2000. Chinat Narendhon Conference room. 1st building FDA. ,Nonthaburi.

01.00-01.30 p.m. Presenting the result of study potential of modern pharmaceutical industry

01.30-04.30 p.m.Group discussion by moderator

Attandance

Government sector

1. Ministry of Finance	- Director general of custom department or representator
2. Ministry of Commerce	- Director general of economic commerce department or representator
	- Director general of export promotion department or representator
3. Ministry of Public Health	- Secretary-general of FDA or representator
	- Direfctor of Drug Control Division and representators
	- Director of GPO or representator
4. Ministry of University	- Representator of Faculty of Pharmacy
5. Prime Minister Secretary	- Secretary-general of BOI or representator
6. Ministry of Industry	- Director general of Industrial promotion or representator

Private sector

1. Representator of TPMA - Dr. Ninsuwan Lilarussamee
2. President of Industrial Pharmacy or representator

Moderator : Ruk Wongsakorn and Pagamas Maitreemit

Question guide for in depth interview of GPO

1. What is the GPO policies in modern drug manufacturing?

2. Does GPO have any project to produce raw materials?

3.If there is a suggestion for GPO to start not only raw material, production project , but also herbal medicine. What are you comment?

4. Are there any effects after AFTA and WTO agreement, now and the future policies?

5. How prompt is GPO to be the information center among Thai's manufacturers?

6. Does the GPO have any suggestion for other organization in pharmaceutical industry?

Question guide for in depth interview of export promotion department

1. Please state some policies in pharmaceutical export?
2. Department has any different strategy of medicine from others goods.
3. Do you promote pharmaceutical exhibition abroad?
4. Under AFTA and WTO agreement do you have any differed policies?
5. Do you have any actions to non tariff barriers among ASEAN countries?
6. Is there any suggestion from your organization?

Question guide for in depth interview of BOI

1. Please state some policies to promote investment of pharmaceutical industry?
2. Why does the committee promote only raw material producers?
3. How do drug manufacturers receive investment promotion in all regions?
4. Are there any suggestions from your organization?

APPENDIX C

GLOSSARY

1. ASEAN(Association of Southeast Asian Nations)

ASEAN has been established on August, 8 1967. It has been originated from economic cooperation to support in social, cultural and scientific information include management. Its objectives are construction the growth in life and peace of South East Asia people.

ASEAN Free Trade has been established since 1992. Its goal is reducing international tariff of the members to 0.5% within 2003 and withdrawing non-tariff barriers. There are 10 countries as its member such as Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. At first step, the members must reduce tariff in each country to 20%.

Reducing of tariff in its members affect finished pharmaceutical industry to fast track the tariff to 0.5% on January 1, 2000. The studying of Thailand industrial association and Thailand development research institute (TDRI) has categorized pharmaceutical industry in the group that can compete and extend export. The weakness of this industry is high labor cost. The advantage of this industry is skilled labors and product quality. Drug industry in Thailand is affected by AFTA as follow.

I. Tariff structure of raw materials among the members. Active ingredients are categorized in Harmonized System Code that have 10% tariff while finished products have the same rate(table 60) . In the next 3 years, Thai manufacturers will gain some

profit from tariff structure but are reduced market share by imported drugs from developed countries. In the long term seriously price competition will be occurred from the production of original products in other ASEAN countries beside Thailand and are imported to Thailand. In this case reducing raw materials which can not be produced in Thailand would strengthen Thai manufacturers and maintain domestic drug market while extend export markets. Thai Pharmaceutical Manufacturers Association has presented restructuring strategy in 1991 and 1993.

Table 60 Tariff of AFTA members in 1997

Product	Finished products	Raw material	Excipients	Equipment
Singapore/Brunei	0	0	0	0
Malaysia	0	0-12	0-3.0	1.2-3.0
Vietnam	0-5	0	-	1-5
Indonesia	0-3.75	0-10	0-40	15-30
Philippines	7-13	6-8	10-15	3-15
Thailand	5-10	5-10	10-15	5

II. Non-Tariff Barrier (NTB). Thailand has high tariff so drug prices of domestic manufacturers are expensive. There are no competition and development to extend export market that make Thai manufacturers unready to compete with multinational products. These measures will be abandoned. If Thai manufacturers cannot adapt, they will lose their market share to imported drugs while exporters face the problem of

NTB in neighborhood countries. NTB can be divided into 2 type one is technical barriers and second is legal barriers.

III. Local content and ASEAN Content. Although ASEAN members have reduced tariff to achieve free trade area but their products must be produced only in ASEAN countries not less than 40% of F.O.B. price. In semi finished products or imported raw materials to produce finished products for export to members' markets are counted to be not less than 40% of ASEAN content or ASEAN cumulative content. This law promote raw material production in member countries more than import from other countries. The countries which have original resource will usually have local content 40%. This factor indicates competitive advantage and readiness. ASEAN members cannot produce raw materials to compete in world market so they would import raw materials. There should have reliable guideline for inspection local content and prevention claim among member countries. Dr. Ninsuwan Lilarassamee has recommended strategic plan to drug manufacturers as follow

a. Construction sub-committee to export promotion. This committee has been established to collaborate with export promotion department by improving standard of laboratory for quality assurance exported drugs.

b. Improving central lab of UNIDO /UNDP which is international organization that give technology, training and consulting to pharmaceutical industry. UNIDO has laboratory study to quality control drugs so this organization should be subsidized.

c. Construction of ASEAN Consultative Committee for Standard and Quality (ACCSQ). This committee has been established since 1992 but it is not available. It should set GMP and ISO direction that will be effective soon.

d. Investment promotion from BOI. Now BOI promote only raw material producers but Thai manufacturers cannot produce yet because raw material production use high technology and petrochemie industry in Thailand is still infant industry include high capital so there is few producers that request promotion. BOI did not concern TPMA requirement about investment promotion which has been applied since 1991. TPMA expected to extend drug export in 2002 and it is too late for BOI to promote.

e. Reducing the tariff of raw materials which cannot be produced in Thailand. This activity will promote readiness in competition. Government should reduce this tariff to 0.5% in the condition that these raw materials must be active ingredients of the finished products that can be produced by domestic producers because local manufacturers can produce in lower cost of production and can export these drugs to ASEAN drug markets.

2. Bioequivalence

Bioequivalence is the study of therapeutic effectiveness between original product and generic product to assure quality, standard and safety of generic products which is registered. The procedure detemine that the producer must apply the Bioequivalence protocol to FDA. After it is approved, the producer can continue to operate. Bioequivalence study must be operated in institute listed by FDA. The process must be started according to FDA. Allowance. After Bioequivalence study protocol is

approved by FDA, the producer must send the sample of this drug by the same process as former drug registration. Then the producers can register generic drug after their drug passed Bioequivalence study and they must show its result of bioequivalence study with other application forms.

3. Government Pharmaceuticals Organization (GPO)

Government Pharmaceuticals Organization (GPO)Government Pharmaceuticals Organization (GPO) is state enterprise pharmaceutical factory. Its has value of distribution 2,354.29 million baht in 1998, total cost of production 1,038.07, 1,130.30, 1,344.83, 1,558.54 and 1,435.40 million baht in 1994-1998 respectively. Its cost of production decrease from 1997 123.14 million baht or equal 7.90 percent. Production cost of pharmaceutical products is 1,039.90 million baht. At present it join to investment with 7 factories. They are

1. General Hospital Products public company. Its products are parenteral solution and dialysis solution.

2. United Pharma Antiniotic industry co.Ltd.. It has produces raw material used in Ampicillin production.

3. That Watana Pharmaceutical Dextrose co.Ltd.. it has produced Dextrose powder used in food and drug production.

4. Medical Supply Center co.Ltd.. It has distributed products of GPO and joint venture companies to private channel.

5. Trial stage Allergy(Thailand) co.Ltd.. It produce antigen which used in allergic treatment.

6. Thai Herbal Medicine co.Ltd. that has produced herbal medicine.

7. GPO-Merrier Bioproducts co. Ltd. That has produced human vaccines.

4. SETC(State Economic and Trade Commission, Pharmaceutical Department)

SECT is the department of Ministry of Commerce of Chaina. Its function is monitoring international trade by coordination with State Drug Administration, Nation Institute for the control of pharmaceutical and biological products (SDA) which is under Prime Minister Secretary. They are the main agencies that monitor raw material quality which are direct controlled by the Prime Minister. From the visiting of Minister of Public Health from Thailand for collaboration of puschasing raw materials. China agency agree to send product list of 64 raw materials that are in USP and BP standard to Thailand Ministry of Public Health. After Thai FDA referred it to Thai drug manufacturers to select the item of raw materials include some problems, Thai FDA will return it back to China and progress contraction such as

a. Joint venture to establish the factory in Thailand to purify intermediate raw materials or Thai FDA guide to see raw material production of Thai producers.

b. Joint venture to establish the factory in Thailand to purify intermediate raw materials because Thai producers have enough potential while China prefer to support.

Thai FDA used to send well-trained personnel to see China Factories to inspect their raw material production. At present Thai manufacturers use raw materials from China so the attitude of using raw materials from USA or Europe should be abandoned. China manufacturers have produced more than 1,600 item of raw materials and about

two in three volume of production is exported to USA and Europe while the rest is used in domestic production.

Thai FDA set a conference with factories that received GMP certificate to cooperate in this project and give some recommendation to this project such as

- Thai manufacturers agree to purchase raw materials from Asian countries but regional hospital division should adapt criteria to purchase pharmaceutical products in public hospital by FDA is the coordinator.

- Thai manufacturers have recommended GPO for joint venture with China to produce raw materials. While GPO set the project to produce finished products which private sector cannot produce such as vaccine and new expensive drugs but GPO recommend the private manufacturers to collaborate among them because GPO fact the problem of privatization.

- Thai manufacturers recommend excepting equipment tax, investment promotion that FDA want the private sector to make the direction to continuing negotiation.

- Economic of scale would be achieved if concern only in ASEAN drug market. Collaboration between local manufacturers and public agency by private producers focus in business while FDA focus in quality control.

- There is few producers which can study Bioequivalence. There are more than 400 items of pharmaceutical products under special monitoring program (SMP) in 2000 and they will expire from this program about 200 items but generic drugs can be produced from local manufacturers and GPO only 8 items. Thai FDA try to promote generic drug production by contraction with Australian institutes to analyze blood

sample in bioequivalent study. The other way Thai FDA requests the collaboration of local manufacturers to produce new generic drugs.

- Exhibition of pharmaceutical products from Thailand I foreign countries to promote export is the good strategy but they expense high budget. FDA estimate that the budget of exhibition is about 20 million baht so Thai drug industry should start from low expense process of export promotion.

5. BIMST-EC

BIMST-EC is Bangladesh, India, Myanmar, Sri-lanka, Thailand-Economic Cooperation. Guideline of operation in BIMST-EC is as follow:

Cooperation aspect	Activities	usefulness
Investment and trade	Co investment in raw material productions that have high volume usage to produce finished drugs, which have high volume of consumption in BIMST-EC members.	Reduction of import raw materials from other region countries to produce finished products.
Drug information exchange	Changing information about withdrawn items, counterfeit drug, substandard products and adverse drug reaction of drugs.	Drug consumer protection

Cooperation aspect	Activities	usefulness
Personnel development	Setting training courses and demonstration agencies for personnel.	The same quality and skilled workers.

Ministry of Public Health in Thailand has set cooperation guideline in pharmaceutical products for BIMST-EC as follow:

Cooperation activities	objective	Chair/Focal point countries
Prevention and eradication of the counterfeit products	Cooperation for prevents and eradicates all of counterfeit drugs in this region.	Thailand (Drug Control Division, which has financial supported from WHO to establish center for these activities and coordinate with Cambodian border part center. These cooperation will be extend to Myanmar and Laos in the future.
Harmonization on Pharmaceutical Registration and Mutual Recognition Agreement	Collaboration on technology, Share resource person which is scarce in this region to gain maximum benefit, promote international trade and pharmaceutical industry development in this region.	Thailand is co-chair on Pharmaceutical Harmonization of this region that has already been in ASEAN countries.

Cooperation activities	objective	Chair/Focal point countries
Clinical Trial Study in this region	Development potential in clinical trial study in this region for drug consumer protecti, especially new drugs.	Thailand, because of experience on clinical trial study, suitable infrastructure, adoption of ICH GCP. Furthermore Thai FDA is coordinating with other agencies to develop to be center of clinical trial study of ASEAN countries.
GMP's Inspection	Development and improvement GMP inspection guideline to be international standard.	Thailand, because Thai FDA will adopt WHO GMP guideline to be the law and its workers have trained in Sweden and Australia institutes. Otherwise they were trained by specialists from foreign countries.
5. Investment to produce API (Active Pharmaceutical Ingredient)		

6. ISO(The International Orga ization for Standardization)

ISO is international organization on standard. Difference between ISO 9000 and GMP are as follow:

a. GMP address level of education of all workers.

b. GMP address hygiene of drug production personnel.

c. GMP focus from location selection to maintenance.

d. GMP focus on details of quality control and stability study.

e. GMP strict on all batch of production if any batch is found some defection, it must be recalled and eliminated.

f. GMP strictly control in parenteral products.

Aspects which GMP standard does not concerned are

a. Cost and price

b. Accounting system

c. Locations of laboratory room that whether it is in the plant or other plant.

d. Satisfaction of consumers

e. Focus on preventive actio. more than improvement process

(Monchulee Nitipon, 1999:)

7. CEPT(Agreement on the Common Effective Preferential Tariff)

Minister of Ministry of Finance has announcement of reduction and exception some tariff from Agreement on the Common Effective Preferential Tariff (CEPT) Scheme for the ASEAN Free Trade Area(AFTA)] and consensus of Protocol to Amend the Agreement to the Common Effective Preferential Tariff (CEPT) Scheme for the ASEAN Free Trade Area(AFTA)] point 3.2 . this point is stated that these items which are reduced or excepted the tariff must have the certificate of ASEAN countries source of production according to agreement of raw material source. Most of active

ingredients in drug production will be reduced their tariff to be 5 percent from 2000-2003.

8. United Nation Industrial Development Organization (UNIDO)

UNIDO is the organization is established beyond United Nation. It objective is development pharmaceutical industry in Thailand. In 1991 UNIDO implemented the pharmaceutical technology service center (PTSC) by agreement between TPMA and Chulalongkorn University as a program of the Thai government and UNDP. Its objective are

a. Ensure that the quality of locally manufactured drugs meet international standards and there by enhances their exportability.

b. Provide laboratory service to the industry

c. Organize consultancy services and provide technical assistance to the industry.

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