ETM

ENGINEERING & TECHNOLOGY MANAGEMENT

Title: A Feasibility Study For a New Adventure of Apparel Manufacturing

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Abstract: An imagined US apparel company, funded with $2 million, wants to open an international branch to decrease production cost thereby maximize profit. The paper thus uses two decision models to compare two investment alternatives to achieve that purpose.

A Feasibility Study For a New Adventure of Apparel Manufacturing

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EMP-P9801

Decision Making in Engineering and Technology Management

TEAM - 2

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- *Topic: A Feasibility Study For A New Adventure Of Apparel Manufacturing*

1. Executive Summary

This project stems from a common desire of the team members that we want to start our own businesses sometime after we complete our education. The first thing for a new adventure is business planning. For a team project, we need to decide for which kind of business we want to work together and what are the alternatives for our decision. After two weeks' exploration all of us agree on apparel manufacturing and our focus is footwear segment. We start from an hypothesis that: we come from a well established US apparel company, and being funded with $2 million, we are going to open a new international branch to decrease our production cost thereby maximize our net profit. Also, the under-planning branch will have a long-term impact on the company's global strategy. We are interested in Asia, where the labor cost, raw material cost and land cost are cheaper. However, the decision problem we have is where to build the new branch. China and Thailand are equally attractive to us but limited by funding and guided by strategic rationality we believe that for the first step we can only choose one between these two countries. This work is to compare the two investment alternatives at a preliminary level. We use two decision models in this work, single criteria decision model and multi criteria decision model. Due to the possible flaws in both models and data, the results may not be reliable. The results are waiting for verification by another in-depth investigation.

2. *Introduction*

Who We Are? — A Starting Hypothesis

We are West Pacific Apparel Inc. Founded in 1992, having gone through the good and bad, the company now is on the way of steadily growing up with annual sales around $10 million. The company manufactures series of apparel products. Among them, the footwear series with a brand "WestPa" have built up an excellent product image. Now the company decides continuing to emphasize "WestPa" footwear series. The company's mission is to become a famous name in the U.S. apparel industry and global textile market.

What Do We Want To Do?

U.S. textile firms are becoming increasingly global, transferring production to more cost-effective locations, courting apparel manufacturers in developing countries and steadily expanding exports.

For example, Worldtex, Dominion Textile, and Burlington Industries have established their foreign sales and production network in Latin America, Asia and Europe. [1] Even though these companies are among the forerunners of international textile trade, more U.S. operations are expected to follow their footsteps.

As a developed country, the United States in many regards is tapped out as a growth market. Americans can consume only a limited amount of textile goods. Internationally, however, textile consumption is expected to rise with growing purchasing power.

Relocating closer to their consumer base not only reduces transportation costs, but also increases a company's gross margin, since textile manufacturers can capitalize on the lower labor costs that exist in most developing countries.

We all know the world is becoming a smaller place. Seizing the opportunities presented by emerging economies is becoming the name of the game. The company

believes that: to provide appropriate returns to shareholders well into the next century, we must move off the sidelines and become international players.

However, just to start from the data [2] we have collected and to simplify the decision problem we have, in the first model adopted in this project, we calculate expected NPV for the two investment alternatives based on an assumption that we still target only U.S. footwear market in 3 years.

3. Problem Definition

West Pacific Apparel Inc. is on the way of steadily growing up with annual sales around $10 million. The company manufactures series of apparel products. Among them, the footwear series with a brand "WestPa" has built up an excellent product image. Now the company decides continuing to emphasize "WestPa" footwear series. The company's mission is to become a famous name in the U.S. apparel industry and global textile market.

The company believes it is a good time to open its foreign production establishment at present and the top management is interested in Asia. Therefore, the company is facing a significant decision problem: where to establish this international branch? China and Thailand are two alternatives chosen by the top management of the company. But limited by funding and guided by strategic rationality the top management believes that for the first step only one can be decided from these two countries.

Now four reasons made this decision problem become the most important and most difficult decisions that confront top management. First, it involves enormous amounts of money — the company hope to start small; even so an amount of $2 million seems to be a bottom line so as to satisfy an annual demand of 80,000 pairs with a growth rate of 15% in 3 years.

Second, this decision will have long-lasting effects on the company. It is a starting point of the company's global strategy implementation. Once the decision is made, the possible mistake involved cannot be worked off in a short period of time. Also, it is one of the most important tools by which the top management controls the direction of the company.

Finally and perhaps most important, this decision is characterized by a high degree of uncertainty. Even the most recent economic crisis in South Asia added a lot of complexity into this problem. However, positioning itself as an ambitiously progressing organization, the company believes high degree danger might be another name of high degree opportunity. So the company assigned us to conduct such a preliminary feasibility study for a new adventure in Asia to find:

- What is the likely profitability of this new oversea branch, in terms of a period of 3 years?
- Which country is more suitable to open the new production branch in? China or Thailand?

4. Literature Search

There are a number of methods dealing with investment decision problems. The analytical methods that take into account the time value of money are a main body of those methods.[4][5] Net Present Value method is one of the powerful tools among them. Complementary to these time-oriented methods, a number of sophisticated accounting techniques have been developed for considering the tax implications of various investment proposals and the impacts of investments on cash and capital position. [6][7][8] There is another important branch of method handling the uncertainty that exists in all investment decisions, named risk analysis.[9][10][11] The decision tree approach is a convenient technique for representing and analyzing a series of investment decisions to be made.[12][13][14].

This work is trying to use a simplified combination of NPV method and decision tree technique to solve a single criteria investment decision problem. Then for comparison, we apply utility theory and multi criteria decision model [15] to solve the same problem.

5. Decision Process and Selection of Decision Model

A proposed full-sized decision process for this problem could be:

a) The top management of the company defines the objectives and constraints for the decision process;

b) A task team is formed to implement the decision process;

c) The task team designs the appropriate decision models and decision process for this problem with respect to the company's objectives and constraints;

d) The task team draft a proposal(including budgeting and scheduling) for the proposed process, submit it to the top management and request approval and support;

e) When approved, the task team starts to collect data objectively and/or subjectively for the proposed model. The adopted methods may be:

- Literature search
- Interviews
- Delphi
- AHP

The possible sources include literature, publicly available documents, and experts in the apparel industry. Especially importantly, the top management must be involved into the step of obtaining subjective judgements;

a) Quantify and collate all objective and subjective data;

b) Solve the model;

c) Verify the model and data;

d) Do sensitivity analysis/risk analysis;

e) Report to the top management and make recommendations;

f) The top management makes decisions.

However in this project, limited by time and resources, we played a role as the task team in the above process and just partially undertook the whole decision process.

We adopted two models in this work. First we use decision tree and NPV to compare the profitability of the two alternatives (A new footwear plant in China and a new footwear plant in Thailand) based on financial forecasting. NPV is obtained based on

calculating the expected cash flow in recent 3 years for each alternative. This model is a single criteria decision model. However, in the real world, a single criteria model addressing such an important decision problem will not work well. So in another way, we use multi-criteria decision model to solve this problem again. The utility functions are determined by our team together.

DATA GATHERING –Scenario I

To avoid the risk and an uncertainty of the overseas investment, the relevant information had been researched to support our company's objective. Thailand and China are attractive countries for manufacturing investment because of the economic crisis in Southeast Asian, and the new aspect of China. Due to the attraction of investment in Asian, three primary factors are being concerned for planning in manufacturing investment. These factors comprise of the cost analysis, the U.S. footwear market analysis and the financial forecast analysis.

Benchmarking cost analysis (China & Thailand)

Footwear companies are generally affected by the fluctuations in the cost of labor wages, raw materials needed as well as land & construction of both China and Thailand. The benchmarking cost analysis is used for a primary investment plan.

TABLE 1 (Background Information)

Cost Description	Thailand	China
Labor Wages ($/worker/year)	1350	1200
Raw Materials ($/footwear pair)	10	9
Land ($/m²)	500	300
Constructions ($/m²)	55	50

Note: *1). Labor Wages are computed from the GDP and population of Thailand and China.[16].*
     2). Land and Construction cost is approximately calculated from data available in Webs.
     3). Raw material cost is based upon the cost ratio of both countries.

U.S. footwear market analysis

From the statistical record in the Apparel & Footwear Industry Survey [17], the footwear manufacturers recorded moderately improved. The well-known footwear brands are Nike, Reebok, Fila and Adidas. These four companies hold the market share more than fifty percents of the U.S. market share.

The competition among these biggest footwear companies has grown more rapidly. Likewise, the overall sales of the entire footwear market have grown modestly. In other words, the power consuming in U.S. market has been increasing.

For new brand companies like "WestPa", the best strategy to share the U.S. footwear market is to offer the lower price to customers. According to the apparel & footwear industry survey, West Pacific Apparel Inc. plans to sell the product to the market in a lower price than the average price of the U.S. footwear market, $25 per pair, rather $33 per pair.

Consumer's Behavior

Billions of Dollars

| Year | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |

☐ Men's ■ Women's ☐ Boys' ☐ Girls' ■ Infants'
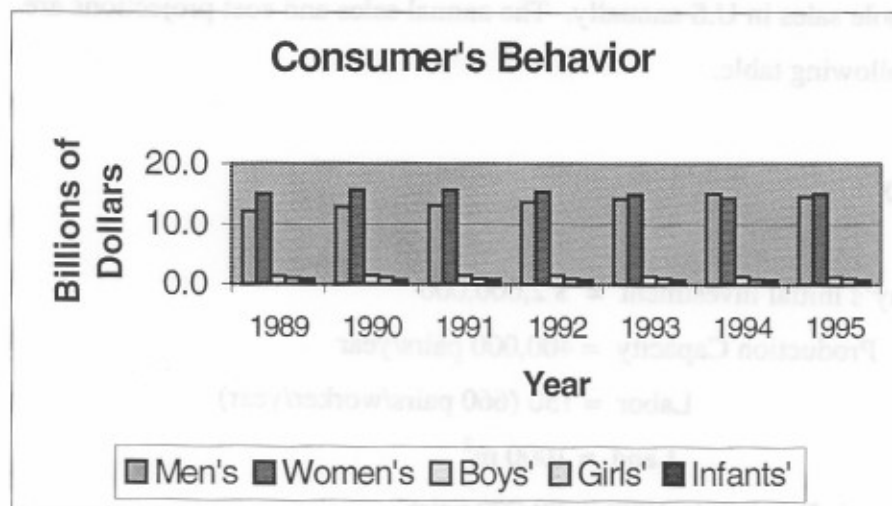
Figure-1: U.S. Consumer's Behavior

U.S. Footwear Sales

Billions of Dollars

—◆— Total Cost

Year
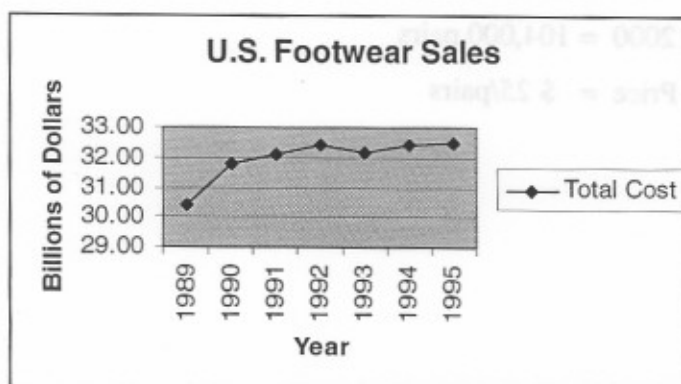
Figure-2: The total sales of U.S. footwear market
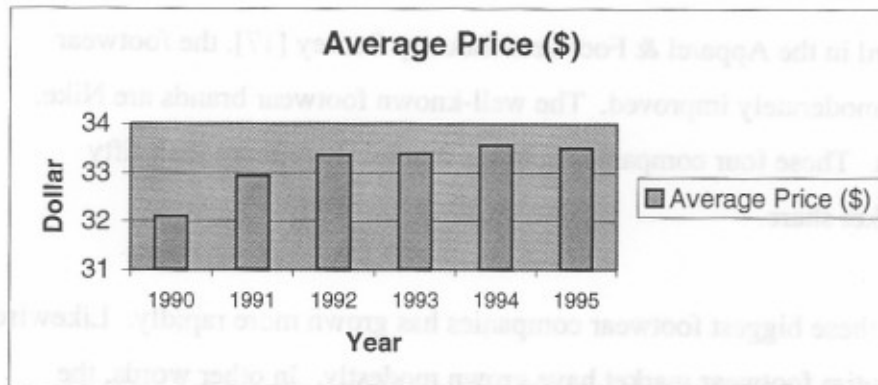
Figure-3: The average prices of the U.S. footwear market

Financial Forecast

After getting a grasp on the company's competitive position in the marketplace and the behavior of U.S. consumers, the next step is to analyze its financial standing. As indicated by the figure 1 illustrations, the growth of U.S. footwear market approximately increased by 5-20 percents annually. West Pacific Apparel Inc. desires to share the U.S. footwear market for 0.01 percent of the whole sales in U.S annually. The annual sales and cost projections are included here in the following table.

- **Startup Summary**

Company's initial investment = $ 2,000,000

Production Capacity = 400,000 pairs/year

Labor = 150 (660 pairs/worker/year)

Land = 1000 m^2

Demands Forecast in 1998 = 80,000 pairs

Demands Forecast in 1999 = 92,000 pairs

Demands Forecast in 2000 = 104,000 pairs

Sales Price = $ 25/pairs

TABLE 2 (Financial Forecast)

	Thailand			China		
	1999	2000	2001	1999	2000	2001
COST						
Labors (150)	202,500	202,500	202,500	180,000	180,000	180,000
Raw Materials	800,000	920,000	1,040,000	720,000	828,000	936,000
Land (1000 m^2)	500,000	-	-	300,000	-	-
Constructions (1000 m^2)	55,000	-	-	50,000	-	-
Miscellaneous Costs	50,000	57,500	66,125	45,000	51,750	59,512
TOTAL	**1,607,500**	**1,180,000**	**1,308,625**	**1,295,000**	**1,059,750**	**1,175,512**
SALES						
Men's Footwear (30%)	600,000	690,000	780,000	600,000	690,000	780,000
Women's Footwear (40%)	800,000	920,000	1,040,000	800,000	920,000	1,040,000
Boy's Footwear (10%)	200,000	230,000	260,000	200,000	230,000	260,000
Girls' Footwear (10%)	200,000	230,000	260,000	200,000	230,000	260,000
Infants' Footwear (10%)	200,000	230,000	260,000	200,000	230,000	260,000
TOTAL	**2,000,000**	**2,300,000**	**2,600,000**	**2,000,000**	**2,300,000**	**2,600,000**
REVENUE	392,500	1,120,000	1,291,375	705,000	1,240,250	1,424,488

Why are you limiting your economic analysis to a 3-year horizon?

DATA ANALYSIS

<u>YEAR 1999</u>

	OUTCOME		INCOME	PROFIT

448,983

Thailand

0.30 — $1 = 50 Baht -1,286,000 — **781,200**
- 0.46 — High ($28/pair) 2.240.000 — + 954,000
- 0.36 — Medium ($25/pair) 2.000.000 — + 714,000
- 0.18 — Low ($22/pair) 1.760.000 — + 474,000

0.50 — $1 = 40 Baht -1,607,500 — **459,700**
- 0.46 — High ($28/pair) 2.240.000 — + 632,500
- 0.36 — Medium ($25/pair) 2.000.000 — + 392,500
- 0.18 — Low ($22/pair) 1.760.000 — + 152,500

0.20 — $1 = 30 Baht -2,143,333 — **-76,133**
- 0.46 — High ($28/pair) 2.240.000 — + 96,667
- 0.36 — Medium ($25/pair) 2.000.000 — - 143,333
- 0.18 — Low ($22/pair) 1.760.000 — -383,333

763,647

China

0.20 — $1 = 8.5 Yuan -1,218,824 — **848,376**
- 0.46 — High ($28/pair) 2.240.000 — + 1,021,176
- 0.36 — Medium ($25/pair) 2.000.000 — + 781,176
- 0.18 — Low ($22/pair) 1.760.000 — + 541,176

0.59 — $1 = 8 Yuan -1,295,000 — **772,220**
- 0.46 — High ($28/pair) 2.240.000 — + 945,000
- 0.36 — Medium ($25/pair) 2.000.000 — + 705,000
- 0.18 — Low ($22/pair) 1.760.000 — + 465,000

0.21 — $1 = 7.5 Yuan -1,381,333 — **658,867**
- 0.46 — High ($28/pair) 2.240.000 — + 858,667
- 0.36 — Medium ($25/pair) 2.000.000 — + 618,667
- 0.18 — Low ($22/pair) 1.760.000 — + 378,667

YEAR 2000

		OUTCOME		INCOME		PROFIT

Thailand branch:

1,189,413 (value box)

- 0.30 → 1,433,280 ($1 = 50 Baht, -944,000)
  - 0.46 High ($28/pair) 2.576.000 → + 1,632,000
  - 0.36 Medium ($25/pair) 2.300.000 → + 1,356,000
  - 0.18 Low ($22/pair) 2.024.000 → + 1,080,000
- 0.50 → 1,197,280 ($1 = 40 Baht, -1,180,000)
  - 0.46 High ($28/pair) 2.576.000 → + 1,396,000
  - 0.36 Medium ($25/pair) 2.300.000 → + 1,120,000
  - 0.18 Low ($22/pair) 2.024.000 → + 844,000
- 0.20 → 803,947 ($1 = 30 Baht, -1,573,333)
  - 0.46 High ($28/pair) 2.576.000 → + 1,002,667
  - 0.36 Medium ($25/pair) 2.300.000 → + 726,667
  - 0.18 Low ($22/pair) 2.024.000 → + 450,667

China branch:

1,315,161 (value box)

- 0.20 → 1,379,868 ($1 = 8.5 Yuan, -997,412)
  - 0.46 High ($28/pair) 2.576.000 → + 1,578,588
  - 0.36 Medium ($25/pair) 2.300.000 → + 1,302,588
  - 0.18 Low ($22/pair) 2.024.000 → + 1,026,588
- 0.59 → 1,317,530 ($1 = 8 Yuan, -1,059,750)
  - 0.46 High ($28/pair) 2.576.000 → + 1,516,250
  - 0.36 Medium ($25/pair) 2.300.000 → + 1,240,250
  - 0.18 Low ($22/pair) 2.024.000 → + 964,250
- 0.21 → 1,246,880 ($1 = 7.5 Yuan, -1,130,400)
  - 0.46 High ($28/pair) 2.576.000 → + 1,445,600
  - 0.36 Medium ($25/pair) 2.300.000 → + 1,169,600
  - 0.18 Low ($22/pair) 2.024.000 → + 893,600

YEAR 2001

		OUTCOME		INCOME		PROFIT

Thailand — 1,370,012

$1,640,462$

- 0.46 — High ($28/pair) 2.912.000 — + 1,865,100
- 0.36 — Medium ($25/pair) 2.600.000 — + 1,553,100
- 0.18 — Low ($22/pair) 2.288.000 — + 1,241,110

$1 = 50\ Baht$ — -1,046,900 — **0.30**

$1,378735$

- 0.46 — High ($28/pair) 2.912.000 — + 1,603,375
- 0.36 — Medium ($25/pair) 2.600.000 — + 1,291,375
- 0.18 — Low ($22/pair) 2.288.000 — + 979,375

$1 = 40\ Baht$ — -1,308,625 — **0.50**

$1 = 30\ Baht$ — -1,744,833 — **0.20**

$942,527$

- 0.46 — High ($28/pair) 2.912.000 — + 1,167,167
- 0.36 — Medium ($25/pair) 2.600.000 — + 855,167
- 0.18 — Low ($22/pair) 2.288.000 — + 543,167

China — 1,509,214

$1,580,996$

- 0.46 — High ($28/pair) 2.912.000 — + 1,805,636
- 0.36 — Medium ($25/pair) 2.600.000 — + 1,493,636
- 0.18 — Low ($22/pair) 2.288.000 — + 1,181,636

$1 = 8.5\ Yuan$ — -1,106,364 — **0.20**

$1,511,848$

- 0.46 — High ($28/pair) 2.912.000 — + 1,736,488
- 0.36 — Medium ($25/pair) 2.600.000 — + 1,424,488
- 0.18 — Low ($22/pair) 2.288.000 — + 1,112,488

$1 = 8.0\ Yuan$ — -1,175,512 — **0.59**

$1 = 7.5\ Yuan$ — -1,253,880 — **0.21**

$1,433,480$

- 0.46 — High ($28/pair) 2.912.000 — + 1,658,120
- 0.36 — Medium ($25/pair) 2.600.000 — + 1,346,120
- 0.18 — Low ($22/pair) 2.288.000 — + 1,034,120
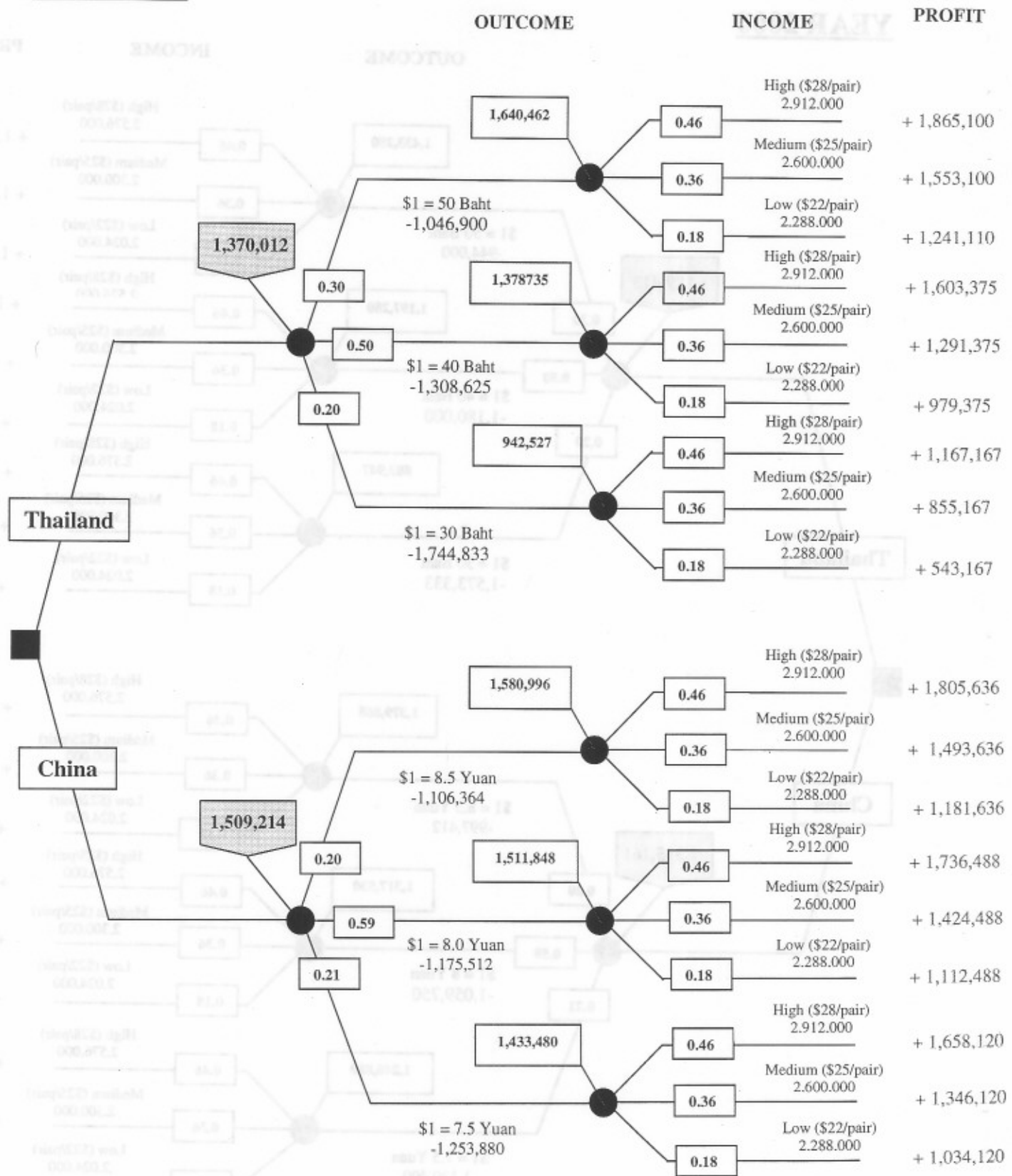
Pairwise Comparison (See Appendix A. – weighed by team members)

Thailand economic and exchange rate in 1999 –2001
- S1 = Exchange rate is subsided into 50 Baht/Dollar
- S2 = Exchange rate is stable at 40 Baht/Dollar
- S3 = Exchange rate is retrieved at 30 Baht/Dollar

China economic and exchange rate in 1999 – 2001
- S1 = Exchange rate is subsided into 8.5 Yuan/Dollar
- S2 = Exchange rate is stable at 8.0 Yuan/Dollar
- S3 = Exchange rate is retrieved at 7.5 Yuan/Dollar

U.S. footwear market in 1999 –2001
- Consuming power is high.
- Consuming power is medium.
- Consuming power is low.

Net Present Value Comparison

$$NPV = A_0 + \sum_{t=1}^{n} \frac{F^t}{(1+k)^t}$$

NPV - Net Present Value
A_0 - Initial Investment = 2,000,000
F_t - Net Cash Flow in time t
k - Rate of Return = 15%

$$NPV_{Thailand} = -2,000,000 + \frac{392,500}{(1+0.15)^1} + \frac{1,120,000}{(1+0.15)^2} + \frac{1,291,375}{(1+0.15)^3} = 37,285$$

$$NPV_{China} = -2,000,000 + \frac{705,000}{(1+0.15)^1} + \frac{1,240,250}{(1+0.15)^2} + \frac{1,424,488}{(1+0.15)^3} = 423,891$$

[Handwritten margin note:] You are assuming discrete values for Baht/Dollar & Yuan/Dollar exchange rates, but those discrete values are not collective exhaustive. Justify the selection of these representative values. A sensitivity analysis is needed to see the impact of variations in the exchange rate beyond the assumed values.

7. Multi Criteria Decision Model and Its Solution

Scenario II

To invest in the oversea countries, many aspects affecting foreign investment were considered in the Scenario II. We apply assessment of priority weight in order to perceive the importance of each aspect. To compare in which countries our company should invest, our team members apply the Utility method for each criterion and then we combine the results of each member to come up with our team's utility. After that, we apply the weight of the criterion and team's utility to judge which country we would locate our business.

There are three phases in the scenario II

- Phase I: Criterion Selection
- Phase II: Criterion Analysis
- Phase III: Judgement

Phase I: Criteria Selection

1. Each member brainstorms and lists about the criteria affecting manufacturing investments in overseas countries.

2. We come up with the following the criteria of manufacturing investments in overseas countries.

   - NPV (Net Present Value) see more information in the Scenario I.

   - Future Market Share. We forecast our chance in the future market around our new country that our company would like to invest.

   - Infrastructure Availability. We consider in terms of transportation and communication. Transportation determines how and when goods or raw materials will be received or sent to other places. We also included both internal and external transportation and communication. In addition, availability of methods of transportation needed such as ocean or airfreight [18].

- Economic Stability. We consider the economic stability history of the countries where we would like to do our business. We also forecast the countries' economy where we will be doing business in. If we do business in oversea countries, we have to deal with the currency exchange, which depend of their economy.

- Foreign investment Regulation. A firm must deal with law and regulation of the overseas country whenever the company exports and imports goods and raw materials from other countries. Foreign investment regulation is different in each country. If some countries are open trade and investment, they might not have a lot of regulation of import and export goods.

- Government Support. In some countries, they would like to have investment from other countries, their government might offer a lot of good documents and information for doing business. These are very helpful for foreigners when they have some problem with their business. Some countries might offer free land in some business in some area of the countries. Those might reduce some production cost.

3. Each member weights each of the criteria by using pairwise comparison method. (See the detail in Appendix A)

4. We bring the weight scores showing in the Appendix A, and then we calculate the weight of each criterion by using pairwise comparison method. The weight of the criterion of our member shows in Table 3. To find the weight of our team, we use the mean of our team weight.

Setting

      c1 = NPV (Net Present Value).
      c2 = Future Market Share
      c3 = Infrastructure Availability
      c4 = Government Support
      c5 = Economic Stability
      c6 = Foreigner investment Regulation

      W1 = the weight of NPV (Net Present Value).
      W2 = the weight of Future Market Share
      W3 = the weight of Infrastructure Availability
      W4 = the weight of Government Support
      W5 = the weight of Economic Stability
      W6 = the weight of Foreigner investment Regulation

Table 3: The criterion weight of each member

Decision makers	W1	W2	W3	W4	W5	W6	Inconsistency
Person 1	0.182	0.121	0.142	0.143	0.241	0.170	0.001
Person 2	0.152	0.143	0.168	0.150	0.216	0.170	0.022
Person 3	0.165	0.129	0.197	0.143	0.208	0.159	0.009
Person 4	0.143	0.137	0.188	0.162	0.205	0.165	0.009
Person 5	0.198	0.126	0.158	0.130	0.242	0.146	0.007
Mean	**0.168**	**0.131**	**0.171**	**0.146**	**0.222**	**0.162**	

Disagreement for all users = 0.017

When we come to the end of the step number four of Phase I, we reach our team weight of the criterion.

W1 (NPV)	**0.168**
W2 (Future Market Share)	**0.131**
W3 (Infrastructure Availability)	**0.171**
W4 (Government Support)	**0.146**
W5 (Economic Stability)	**0.222**
W6 (Foreigner Investment Regulation)	**0.162**

Phase II: Criteria Analysis

1. Each team member applies his/her own utility function for the criterion, which are preferentially independent. (shown in Appendix B)

2. We bright the utility of each member in order to meet with our team utility. It is shown in the table 4.

Setting

U(c1) = Utility function for NPV (Net Present Value).
U(c2) = Utility function for Future Market Share
U(c3) = Utility function for Infrastructure Availability
U(c4) = Utility function for Government Support
U(c5) = Utility function for Economic Stability
U(c6) = Utility function for Foreigner investment Regulation

Table 4: Utility function of the criteria

Table 4.1   **Utility Function (China)**

Decision makers	U(c1)	U(c2)	U(c3)	U(c4)	U(c5)	U(c6)
Person 1	0.92	0.8	0.5	0.8	0.8	0.5
Person 2	0.92	0.8	0.3	0.5	0.5	0.5
Person 3	0.93	0.8	0.5	0.5	0.8	0.5
Person 4	0.95	1	0.3	0.5	0.5	0.5
Person 5	0.78	0.5	0.5	0.8	0.8	0.5
Mean(team)	0.90	0.78	0.42	0.62	0.68	0.5

Table 4.2   **Utility Function (Thailand)**

Decision makers	U(c1)	U(c2)	U(c3)	U(c4)	U(c5)	U(c6)
Person 1	0.14	0.8	0.8	1	0.5	0.8
Person 2	0.18	1	0.8	0.8	0.3	1
Person 3	0.21	0.8	0.8	1	0.5	1
Person 4	0.28	0.8	0.8	0.8	0.3	0.8
Person 5	0.19	0.8	1	1	0.5	0.8
Mean(team)	0.20	0.84	0.84	0.92	0.42	0.88

1. Each team member applies his/her own utility function for the criteria, which are preferentially independent. (shown in Appendix B)

2. We bought the utility of each team member in order to meet with our team utility. It is shown in the table 4.

Setting
U(c1) = Utility function for NPV (Net Present Value)
U(c2) = Utility function for Future Market Share
U(c3) = Utility function for Infrastructure Availability
U(c4) = Utility function for Government Support
U(c5) = Utility function for Economic Stability
U(c6) = Utility function for Foreigner Investment Regulation

Table 4: Utility function of the criteria

Table 4.1   Utility Function (China)

0.91	0.8	0.2	0.8	0.8	0.5
0.92	0.8	0.5	0.5	0.5	0.5
0.93	0.8	0.5	0.5	0.8	0.5
0.96	1	0.5	0.5	0.5	0.5
0.79	0.5	0.5	0.4	0.8	0.5
0.90	0.75	0.42	0.42	0.48	0.5

Table 4.2   Utility Function (Thailand)

0.14	0.2	0.8	1	0.5	0.8
0.15	1	0.5	0.8	0.4	1
0.17	0.8	0.8	1	0.5	1
0.2	0.8	0.5	0.8	0.5	0.8
0.19	0.8	1	1	0.5	0.8
0.20	0.84	0.24	0.92	0.42	0.52

When we come to the end of the last step of Phase II, we reach our team utility of the criterion.

Utility function	China	Thailand
U(c1)	0.90	0.20
U(c2)	0.78	0.84
U(c3)	0.42	0.84
U(c4)	0.62	0.92
U(c5)	0.68	0.42
U(c6)	0.50	0.88

Phase III: Judgement

The results of Phase I and Phase II are use in the Phase III.

To make decision in phase III, we apply *the expected value of utility function*. If which country has the highest of the value of utility function, we prefer to chose to invest our business there.

Expected value of utility function

$$E(U(A)) = W1*U(c1)_A + W2*U(c2)_A + W3*U(c3)_A + W4*U(c4)_A + W5*U(c5)_A + W6*U(c6)_A$$

$$
\begin{aligned}
E(U(China)) &= (0.168)(0.9) + (0.131)(0.78) + (0.171)(0.42) + (0.146)(0.62) \\
&\quad + (0.222)(0.68) + (0.162)(0.50) \\
&= \mathbf{0.648}
\end{aligned}
$$

$$
\begin{aligned}
E(U(Thailand)) &= (0.168)(0.2) + (0.131)(0.84) + (0.171)(0.84) + (0.146)(0.92) \\
&\quad + (0.222)(0.42) + (0.162)(0.88) \\
&= \mathbf{0.657}
\end{aligned}
$$

Thus, $E(U(China)) < E(U(Thailand))$

financial forecasting part, which could be detrimental to the reliability of the results we obtained.

The data came from literature, Internet, and judgement made by our team members. Still a small part of data came from the knowledge of our team members; e.g. the currency exchange rate of China's Yuan versus Dollar and Thailand's Baht versus Dollar. We didn't verify each objective data very strictly. In the real decision process, the analysts should get the objective data needed by decision model as much as possible and as precise as possible. The analysts should work closely with the decision-makers (in this problem the top management) to ensure the decision process is involved with them as deep as possible. The key subjective data should come from the decision-makers themselves instead of the analysts even though the analysts can help the decision-makers quantify their judgements and help them smooth the inconsistency in their judgements.

9. Recommendations

This work shows that it is more profitable to open a new footwear plant in China than in Thailand, due to China's lower cost of labor, land and raw materials, based on a 3 years' forecasting. However, the top management of West Pacific Apparel Inc. still might decide to choose Thailand when completely evaluating all investment decision criteria by using utility theory and multi criteria decision model. An explanation of this result could be that at an overall level the top management believes Thailand alternative is more strategically important than China alternative. However in this project, the judgement came from our team instead of the top management of West Pacific Apparel Inc.

8. Results and Discussions

By solving the first model, the results show that the profitability of "opening a new plant in China" is greater than "opening a new plant in Thailand". When the discount rate is set at 0.15, the difference between NPVs of the two alternatives is as high as ~~near~~ $40,000. Obviously, if we adopt different discount rates to compute the two NPVs, the values will vary but the result ($NPV_{China} > NPV_{Thailand}$) will hold.

It's interesting that when we apply multi-criteria decision model to solve this problem we get a different result with the above result obtained from solving the single criteria model. The subjective judgements made by our team members demonstrate an overall preference of Thailand alternative to China alternative. "No man does anything from a single motive."[3] This is saying that multi criteria decision process is much more common than single criteria especially in important decision domain. Meanwhile, even in the same decision situation and conducted by the same people, the results coming from the two different models can significantly vary.

In solving the second model, Thailand alternative wins the benchmarking.

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However, there are some aspects about the results of this work that should be noted.

The first model we applied is a new attempt to solve investment decision problems. NPV is a widely used method in selecting investment alternatives. But the method we used, in which we compute the expected profits based on financial forecasting for each alternative in each year considered and then use the expected profit to calculate NPV, is not seen in literature. The validity of this method needs to be verified by theory analysis and practice.

Also in solving the first model, due to lack the skill of business planning and accounting/budgeting skill, there could be significant weakness in our work in terms of

APPENDIX A

10. Conclusions

This project is a simple application of the theory that we have learned from decision making class. Due to the limited time available, lack of skills for business planning (especially accounting/budgeting), the results obtained may be not reliable. However, we have gained some valuable learning experience from this project. First, we realized that both the NPV method and decision tree technique is useful tools in investment decision problem. And we have tried applying a combination of these two on a simplified application. One drawback of the decision tree approach is that computations can quickly become unwieldy. To make this approach practical, it is necessary to limit the number of branches emanating from chance event nodes to a very small number. This means that the probability distribution of chance events at each node must be represented by a very few point estimates. As a result, the answers obtained from a decision tree analysis are often inadequate. To address this, risk analysis seems to be a good supplement.

Second, we realized that budgeting process is essential to an investment decision problem. A reliable budgeting process will be a great help to an investment decision process.

Finally, multi criteria decision problems are more common in the real world strategic decision processes than single criteria problem. To address this, a multi criteria decision model is an answer.

Person 4: China currency

$1 = 8.5 yuan	25	$1 = 8 yuan	75
$1 = 8.5 yuan	35	$1 = 7.5 yuan	65
$1 = 8 yuan	80	$1 = 7.5 yuan	20

Person 4: Thai currency

$1 = 50 Baht	70	$1 = 40 Baht	30
$1 = 50 Baht	80	$1 = 30 Baht	20
$1 = 40 Baht	60	$1 = 30 Baht	40

Person 5: China currency

$1 = 8.5 yuan	25	$1 = 8 yuan	75
$1 = 8.5 yuan	45	$1 = 7.5 yuan	55
$1 = 8 yuan	90	$1 = 7.5 yuan	10

Person 5: Thai currency

$1 = 50 Baht	30	$1 = 40 Baht	70
$1 = 50 Baht	60	$1 = 30 Baht	40
$1 = 40 Baht	60	$1 = 30 Baht	40

USA –China
S1 = 0.20
S2 = 0.59
S3 = 0.21
Inc = 0.109

USA – Thai
S1 = 0.30
S2 = 0.50
S3 = 0.20
Inc = 0.179

Scenario I
Weight exchange rate by using pairwise comparisons.

USA - China

    S1 : $1 = 8.5 yuan
    S2 : $1 = 8 yuan
    S3 : $1 = 7.5 yuan

USA - Thai

    S1: $1 = 50 Baht
    S2: $1 = 40 Baht
    S3: $1 = 30 Baht

We would like to know the probability of each currency exchange rate while we are doing business in China and Thailand.

Note: The total score is 100 of each pair. We do not except ZERO.
The score should be in between 1-99.

Person 1: China currency

$1 = 8.5 yuan	10	$1 = 8 yuan	90
$1 = 8.5 yuan	20	$1 = 7.5 yuan	80
$1 = 8 yuan	80	$1 = 7.5 yuan	20

Person 1: Thai currency

$1 = 50 Baht	20	$1 = 40 Baht	80
$1 = 50 Baht	50	$1 = 30 Baht	50
$1 = 40 Baht	90	$1 = 30 Baht	10

Person 2: China currency

$1 = 8.5 yuan	35	$1 = 8 yuan	65
$1 = 8.5 yuan	65	$1 = 7.5 yuan	35
$1 = 8 yuan	65	$1 = 7.5 yuan	35

Person 2: Thai currency

$1 = 50 Baht	25	$1 = 40 Baht	75
$1 = 50 Baht	45	$1 = 30 Baht	55
$1 = 40 Baht	90	$1 = 30 Baht	10

Person 3: China currency

$1 = 8.5 yuan	45	$1 = 8 yuan	55
$1 = 8.5 yuan	50	$1 = 7.5 yuan	50
$1 = 8 yuan	60	$1 = 7.5 yuan	40

Person 3: Thai currency

$1 = 50 Baht	40	$1 = 40 Baht	60
$1 = 50 Baht	50	$1 = 30 Baht	50
$1 = 40 Baht	40	$1 = 30 Baht	60

Person 1
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Support
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion on which criteria affect our investment from most to less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

Note: The total score is 100 of each pair. We do not except ZERO.
The score should be in between 1-99.

Economic Stability	57	NPV	43
Infrastructure Availability	38	Economic Stability	62
Government Support	55	Future Market share	45
Government Support	45	Foreigner investment Regulation	55
Government Support	50	Infrastructure Availability	50
Future Market share	40	Foreigner investment Regulation	60
Economic Stability	60	Foreigner investment Regulation	40
NPV	57	Future Market share	43
Government Support	38	Economic Stability	62
Infrastructure Availability	43	NPV	57
Government Support	43	NPV	57
Economic Stability	67	Future Market share	33
Infrastructure Availability	54	Future Market share	46
NPV	53	Foreigner investment Regulation	47
Foreigner investment Regulation	55	Infrastructure Availability	45

Person 1
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

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Economic Stability	60	Foreigner investment Regulation	40
NPV	57	Future Market share	43
Government Support	38	Economic Stability	62
Infrastructure Availability	43	NPV	57
Government Support	43	NPV	57
Economic Stability	67	Future Market share	33
Infrastructure Availability	54	Future Market share	46
NPV	53	Foreigner investment Regulation	47
Foreigner investment Regulation	55	Infrastructure Availability	45

Person 3
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Supports
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion on which criteria affect our investment from most to less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

Note: The total score is 100 of each pair. We do not except ZERO. The score should be in between 1-99.

Economic Stability	65	NPV	35
Infrastructure Availability	35	Economic Stability	65
Government Support	53	Future Market share	47
Government Support	45	Foreigner investment Regulation	55
Government Support	40	Infrastructure Availability	60
Future Market share	40	Foreigner investment Regulation	60
Economic Stability	60	Foreigner investment Regulation	40
NPV	53	Future Market share	47
Government Support	46	Economic Stability	54
Infrastructure Availability	47	NPV	57
Government Support	45	NPV	55
Economic Stability	60	Future Market share	40
Infrastructure Availability	60	Future Market share	40
NPV	55	Foreigner investment Regulation	45
Foreigner investment Regulation	45	Infrastructure Availability	55

Person 4
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Supports
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion on which criteria affect our investment from most to less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

Note: The total score is 100 of each pair. We do not except ZERO. The score should be in between 1-99.
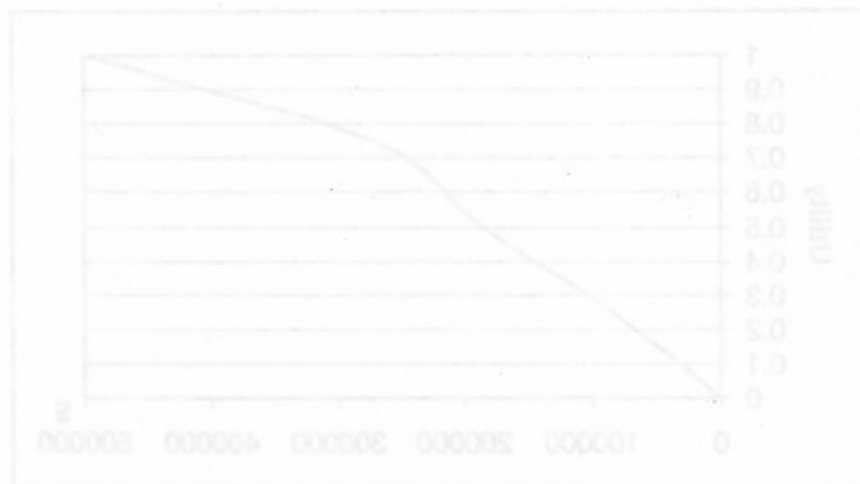
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Economic Stability	55	Foreigner investment Regulation	45
NPV	57	Future Market share	43
Government Support	43	Economic Stability	57
Infrastructure Availability	58	NPV	42
Government Support	52	NPV	48
Economic Stability	60	Future Market share	40
Infrastructure Availability	47	Future Market share	53
NPV	47	Foreigner investment Regulation	53
Foreigner investment Regulation	45	Infrastructure Availability	55

Person 5
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Supports
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion which criterion affect to our investment the most until the less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

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Economic Stability	63	NPV	37
Infrastructure Availability	40	Economic Stability	60
Government Support	53	Future Market share	47
Government Support	45	Foreigner investment Regulation	55
Government Support	47	Infrastructure Availability	53
Future Market share	43	Foreigner investment Regulation	57
Economic Stability	61	Foreigner investment Regulation	49
NPV	57	Future Market share	43
Government Support	38	Economic Stability	62
Infrastructure Availability	45	NPV	55
Government Support	35	NPV	65
Economic Stability	63	Future Market share	37
Infrastructure Availability	57	Future Market share	43
NPV	65	Foreigner investment Regulation	35
Foreigner investment Regulation	47	Infrastructure Availability	53

APPENDIX B

Person 1
Giving personal utility into the criteria by using the economy history of each country

Utility function for NPV of profit
Net Present Value of China and Thailand is presented in the Scenario I.
Net Present Value of China in three year is equal 423,891.00
Net Present Value of Thailand in three year is equal 37,285.00
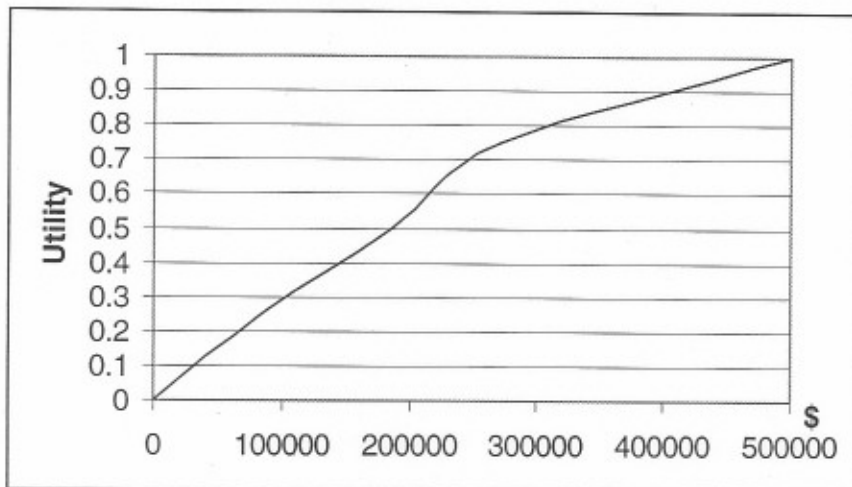To come up with the Utility curve, each person should answer the following question.

IF	What is your response?
Chance 50 % to get $500,000 and 50% to get $0	$X1 = 185,000$
Chance 50 % to get $ X1 and 50% to get $ 500,000	$X2 = 270,000$
Chance 50 % to get X1 and 50% to get 0	85,000

Note: we assume the probability.
Person 1's utility fuction

Utility scale For *Future market share*

Preference	China	Thailand
Very Good –1.0		
Good –0.8	√	√
Medium – 0.5		
Poor – 0.3		
Very Poor – 0		

Person 1 Con't

Utility scale For *Infrastructure Availability (transportation and communication)*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For *Government Support*

Preference	China	Thailand
Very Good –1.0		√
Good –0.8	√	
Medium – 0.5		
Poor – 0.3		
Very Poor – 0		

Utility scale For *Economic Stability*

Preference	China	Thailand
Very Good –1.0		
Good –0.8	√	
Medium – 0.5		√
Poor – 0.3		
Very Poor – 0		

Utility scale For *Foreigner investment Regulation*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For Infrastructure Availability (transportation and communication)

		Very Good – 1.1
	✓	Good – 0.8
	✓	Medium – 0.5
		Poor – 0.3
		Very Poor – 0

Utility scale For Government Support

	✓	Very Good – 1.0
	✓	Good – 0.8
		Medium – 0.5
		Poor – 0.3
		Very Poor – 0

Utility scale For Economic Stability

		Very Good – 1.0
	✓	Good – 0.8
	✓	Medium – 0.5
		Poor – 0.3
		Very Poor – 0

Utility scale For Foreign Investment Regulation

		Very Good – 1.0
	✓	Good – 0.8
	✓	Medium – 0.5
		Poor – 0.3
		Very Poor – 0

When we come to the end of the last step of Phase II, we reach our team utility of the criterion.

Utility function	China	Thailand
U(c1)	0.90	0.20
U(c2)	0.78	0.84
U(c3)	0.42	0.84
U(c4)	0.62	0.92
U(c5)	0.68	0.42
U(c6)	0.50	0.88

Phase III: Judgement

The results of Phase I and Phase II are use in the Phase III.

To make decision in phase III, we apply *the expected value of utility function*. If which country has the highest of the value of utility function, we prefer to chose to invest our business there.

Expected value of utility function

$$E(U(A)) = W1*U(c1)_A + W2*U(c2)_A + W3*U(c3)_A + W4*U(c4)_A + W5*U(c5)_A + W6*U(c6)_A$$

$$
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&= \mathbf{0.657}
\end{aligned}
$$

Thus, $E(U(China)) < E(U(Thailand))$

Finally, we would decide to invest our company in Thailand, due to the expected value of utility function of Thailand more than that of China.
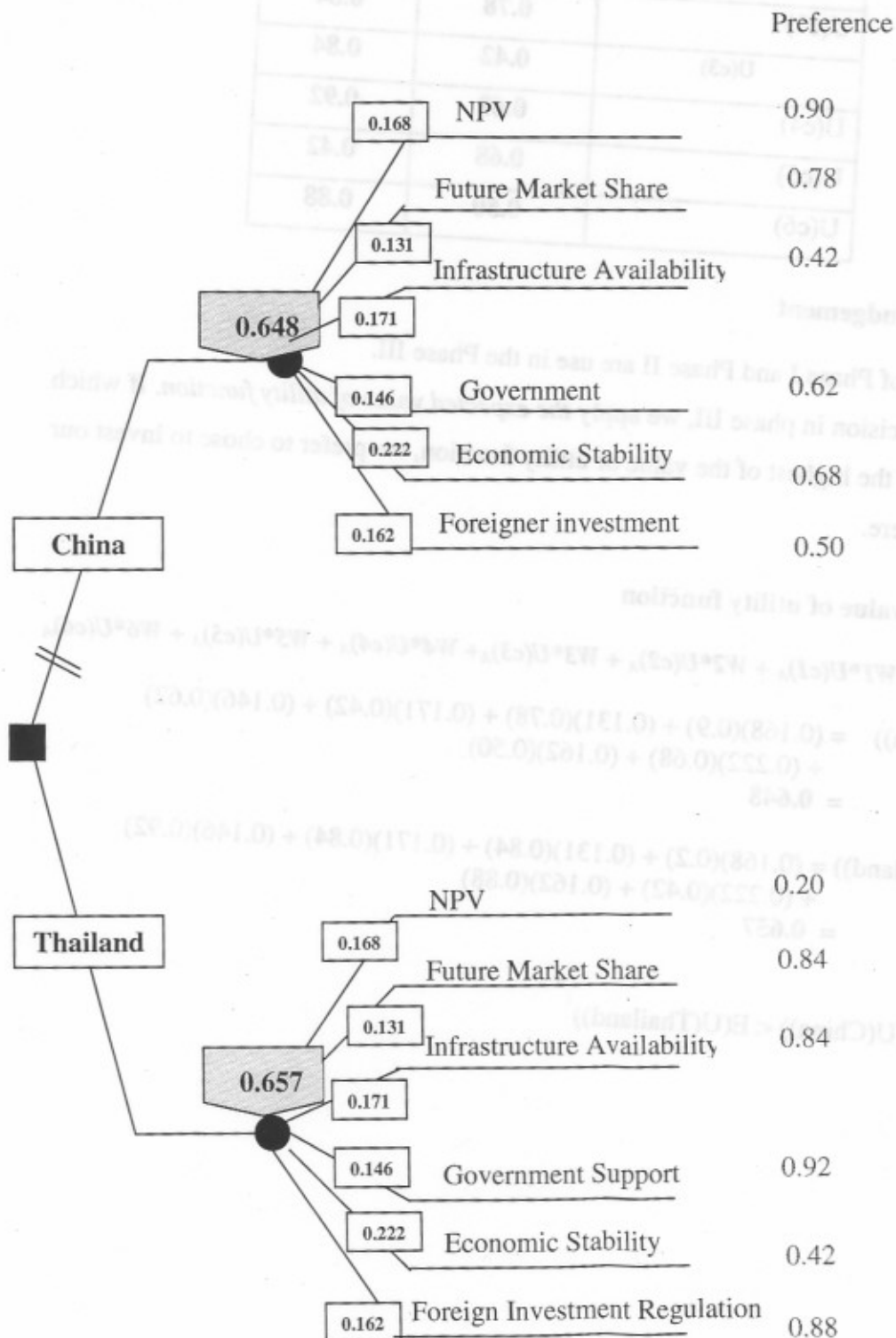
Preference

China

0.648		
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0.131	Future Market Share	0.78
0.171	Infrastructure Availability	0.42
0.146	Government	0.62
0.222	Economic Stability	0.68
0.162	Foreigner investment	0.50

Thailand

0.657		
0.168	NPV	0.20
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By solving the first model, the results show that the profitability of "opening a new plant in China" is greater than "opening a new plant in Thailand". When the discount rate is set at 0.15, the difference between NPVs of the two alternatives is as high as ~~near~~ $40,000. Obviously, if we adopt different discount rates to compute the two NPVs, the values will vary but the result ($NPV_{China} > NPV_{Thailand}$) will hold.

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Second, we realized that budgeting process is essential to an investment decision problem. A reliable budgeting process will be a great help to an investment decision process.

Finally, multi criteria decision problems are more common in the real world strategic decision processes than single criteria problem. To address this, a multi criteria decision model is an answer.

APPENDIX A

Scenario I
Weight exchange rate by using pairwise comparisons.

USA - China

S1 : $1 = 8.5 yuan
S2 : $1 = 8 yuan
S3 : $1 = 7.5 yuan

USA - Thai

S1: $1 = 50 Baht
S2: $1 = 40 Baht
S3: $1 = 30 Baht

We would like to know the probability of each currency exchange rate while we are doing business in China and Thailand.

Note: The total score is 100 of each pair. We do not except ZERO.
The score should be in between 1-99.

Person 1: China currency

$1 = 8.5 yuan	10	$1 = 8 yuan	90
$1 = 8.5 yuan	20	$1 = 7.5 yuan	80
$1 = 8 yuan	80	$1 = 7.5 yuan	20

Person 1: Thai currency

$1 = 50 Baht	20	$1 = 40 Baht	80
$1 = 50 Baht	50	$1 = 30 Baht	50
$1 = 40 Baht	90	$1 = 30 Baht	10

Person 2: China currency

$1 = 8.5 yuan	35	$1 = 8 yuan	65
$1 = 8.5 yuan	65	$1 = 7.5 yuan	35
$1 = 8 yuan	65	$1 = 7.5 yuan	35

Person 2: Thai currency

$1 = 50 Baht	25	$1 = 40 Baht	75
$1 = 50 Baht	45	$1 = 30 Baht	55
$1 = 40 Baht	90	$1 = 30 Baht	10

Person 3: China currency

$1 = 8.5 yuan	45	$1 = 8 yuan	55
$1 = 8.5 yuan	50	$1 = 7.5 yuan	50
$1 = 8 yuan	60	$1 = 7.5 yuan	40

Person 3: Thai currency

$1 = 50 Baht	40	$1 = 40 Baht	60
$1 = 50 Baht	50	$1 = 30 Baht	50
$1 = 40 Baht	40	$1 = 30 Baht	60

Person 4: China currency

$1 = 8.5 yuan	25	$1 = 8 yuan	75
$1 = 8.5 yuan	35	$1 = 7.5 yuan	65
$1 = 8 yuan	80	$1 = 7.5 yuan	20

Person 4: Thai currency

$1 = 50 Baht	70	$1 = 40 Baht	30
$1 = 50 Baht	80	$1 = 30 Baht	20
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Person 5: China currency

$1 = 8.5 yuan	25	$1 = 8 yuan	75
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$1 = 8 yuan	90	$1 = 7.5 yuan	10

Person 5: Thai currency

$1 = 50 Baht	30	$1 = 40 Baht	70
$1 = 50 Baht	60	$1 = 30 Baht	40
$1 = 40 Baht	60	$1 = 30 Baht	40

USA –China
S1 = 0.20
S2 = 0.59
S3 = 0.21
Inc = 0.109

USA – Thai
S1 = 0.30
S2 = 0.50
S3 = 0.20
Inc = 0.179

Scenario I
Weight consuming power between 1999 –2001 by using pairwise comparisons.

S1 : Consuming power is high.
S2 : Consuming power is medium.
S3 : Consuming power is low.

We would like to know the probability of variation of each comsuming power while we are doing business in China and Thailand.

Note: The total score is 100 of each pair. We do not except ZERO.
The score should be in between 1-99.

Person 1

Consuming power is high.	70	Consuming power is medium.	30
Consuming power is high.	80	Consuming power is low	20
Consuming power is medium.	90	Consuming power is low	10

Person 2

Consuming power is high.	80	Consuming power is medium.	20
Consuming power is high.	90	Consuming power is low	10
Consuming power is medium.	80	Consuming power is low	20

Person 3

Consuming power is high.	60	Consuming power is medium.	40
Consuming power is high.	70	Consuming power is low	30
Consuming power is medium.	80	Consuming power is low	20

Person 4

Consuming power is high.	55	Consuming power is medium.	45
Consuming power is high.	65	Consuming power is low	35
Consuming power is medium.	60	Consuming power is low	40

Person 5

Consuming power is high.	20	Consuming power is medium.	80
Consuming power is high.	40	Consuming power is low	60
Consuming power is medium.	40	Consuming power is low	60

S1 = 0.46
S2 = 0.36
S3 = 0.18
Inc = 0.147

Person 1
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Support
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion on which criteria affect our investment from most to less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

Note: The total score is 100 of each pair. We do not except ZERO.
The score should be in between 1-99.

Economic Stability	57	NPV	43
Infrastructure Availability	38	Economic Stability	62
Government Support	55	Future Market share	45
Government Support	45	Foreigner investment Regulation	55
Government Support	50	Infrastructure Availability	50
Future Market share	40	Foreigner investment Regulation	60
Economic Stability	60	Foreigner investment Regulation	40
NPV	57	Future Market share	43
Government Support	38	Economic Stability	62
Infrastructure Availability	43	NPV	57
Government Support	43	NPV	57
Economic Stability	67	Future Market share	33
Infrastructure Availability	54	Future Market share	46
NPV	53	Foreigner investment Regulation	47
Foreigner investment Regulation	55	Infrastructure Availability	45

Person 2
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Support
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion on which criteria affect our investment from most to less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

Note: The total score is 100 of each pair. We do not except ZERO. The score should be in between 1-99.

Economic Stability	60	NPV	40
Infrastructure Availability	40	Economic Stability	60
Government Support	65	Future Market share	35
Government Support	45	Foreigner investment Regulation	55
Government Support	40	Infrastructure Availability	60
Future Market share	55	Foreigner investment Regulation	45
Economic Stability	55	Foreigner investment Regulation	45
NPV	40	Future Market share	60
Government Support	45	Economic Stability	55
Infrastructure Availability	47	NPV	53
Government Support	40	NPV	60
Economic Stability	60	Future Market share	40
Infrastructure Availability	60	Future Market share	40
NPV	45	Foreigner investment Regulation	55
Foreigner investment Regulation	55	Infrastructure Availability	45

Person 3
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Supports
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion on which criteria affect our investment from most to less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

Note: The total score is 100 of each pair. We do not except ZERO. The score should be in between 1-99.

Economic Stability	65	NPV	35
Infrastructure Availability	35	Economic Stability	65
Government Support	53	Future Market share	47
Government Support	45	Foreigner investment Regulation	55
Government Support	40	Infrastructure Availability	60
Future Market share	40	Foreigner investment Regulation	60
Economic Stability	60	Foreigner investment Regulation	40
NPV	53	Future Market share	47
Government Support	46	Economic Stability	54
Infrastructure Availability	47	NPV	57
Government Support	45	NPV	55
Economic Stability	60	Future Market share	40
Infrastructure Availability	60	Future Market share	40
NPV	55	Foreigner investment Regulation	45
Foreigner investment Regulation	45	Infrastructure Availability	55

Person 4
Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Supports
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion on which criteria affect our investment from most to less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

Note: The total score is 100 of each pair. We do not except ZERO.
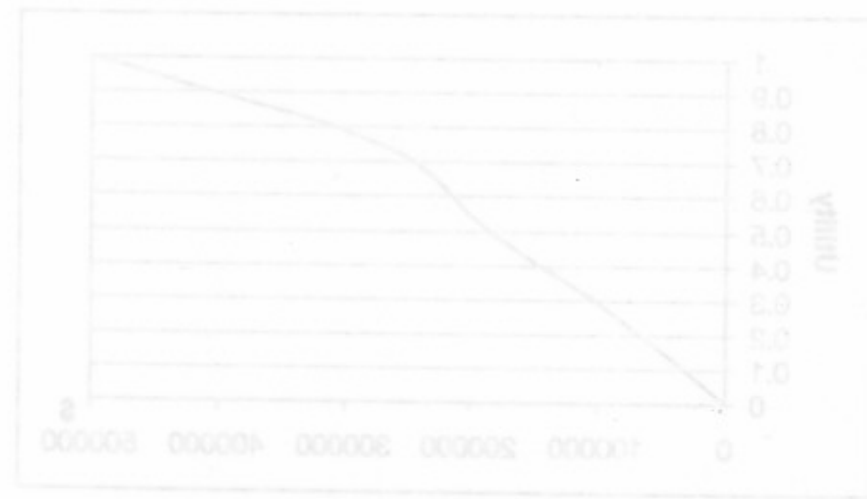The score should be in between 1-99.

Economic Stability	65	NPV	35
Infrastructure Availability	55	Economic Stability	45
Government Support	57	Future Market share	43
Government Support	50	Foreigner investment Regulation	50
Government Support	45	Infrastructure Availability	55
Future Market share	43	Foreigner investment Regulation	57
Economic Stability	55	Foreigner investment Regulation	45
NPV	57	Future Market share	43
Government Support	43	Economic Stability	57
Infrastructure Availability	58	NPV	42
Government Support	52	NPV	48
Economic Stability	60	Future Market share	40
Infrastructure Availability	47	Future Market share	53
NPV	47	Foreigner investment Regulation	53
Foreigner investment Regulation	45	Infrastructure Availability	55

Person 5

Scenario II: Phase I

Weight the criterion by using pairwise comparisons.

1. NPV (Net Present Value)
2. Future Market Share
3. Infrastructure Availability (transportation and communication)
4. Government Supports
5. Economic Stability
6. Foreigner investment Regulation

As decision-makers considering the criteria, each of us has its own opinion which criterion affect to our investment the most until the less. To apply pairwise comparisons of the criteria, each of us would consider the importance of each criterion comparing with others in pair.

Note: The total score is 100 of each pair. We do not except ZERO.
The score should be in between 1-99.

Economic Stability	63	NPV	37
Infrastructure Availability	40	Economic Stability	60
Government Support	53	Future Market share	47
Government Support	45	Foreigner investment Regulation	55
Government Support	47	Infrastructure Availability	53
Future Market share	43	Foreigner investment Regulation	57
Economic Stability	61	Foreigner investment Regulation	49
NPV	57	Future Market share	43
Government Support	38	Economic Stability	62
Infrastructure Availability	45	NPV	55
Government Support	35	NPV	65
Economic Stability	63	Future Market share	37
Infrastructure Availability	57	Future Market share	43
NPV	65	Foreigner investment Regulation	35
Foreigner investment Regulation	47	Infrastructure Availability	53

APPENDIX B

Person 1
Giving personal utility into the criteria by using the economy history of each country

Utility function for NPV of profit
Net Present Value of China and Thailand is presented in the Scenario I.
Net Present Value of China in three year is equal 423,891.00
Net Present Value of Thailand in three year is equal 37,285.00
 To come up with the Utility curve, each person should answer the following question.
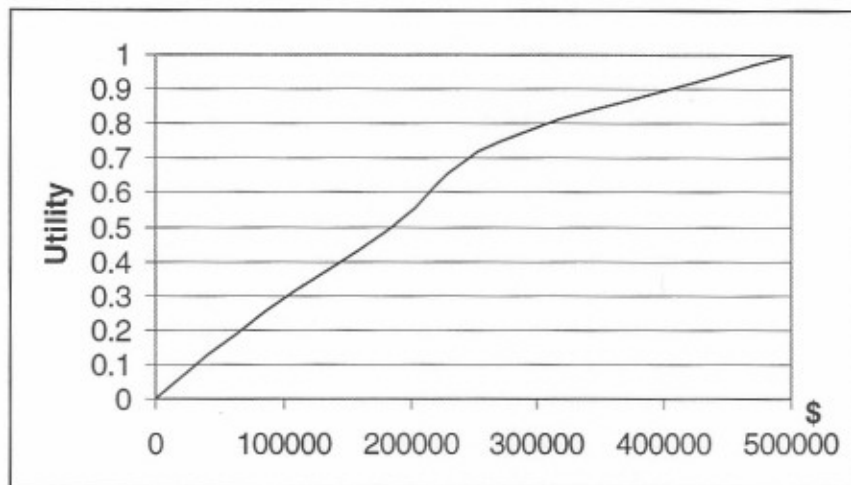
IF	What is your response?
Chance 50 % to get $500,000 and 50% to get $0	X1 = 185,000
Chance 50 % to get $ X1 and 50% to get $ 500,000	X2 = 270,000
Chance 50 % to get X1 and 50% to get 0	85,000

Note: we assume the probability.
Person 1's utility fuction

Utility scale For *Future market share*

Preference	China	Thailand
Very Good –1.0		
Good –0.8	√	√
Medium – 0.5		
Poor – 0.3		
Very Poor – 0		

Person 1 Con't

Utility scale For *Infrastructure Availability (transportation and communication)*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For *Government Support*

Preference	China	Thailand
Very Good –1.0		√
Good –0.8	√	
Medium – 0.5		
Poor – 0.3		
Very Poor – 0		

Utility scale For *Economic Stability*

Preference	China	Thailand
Very Good –1.0		
Good –0.8	√	
Medium – 0.5		√
Poor – 0.3		
Very Poor – 0		

Utility scale For *Foreigner investment Regulation*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For Infrastructure Availability (transportation and communication)

		Very Good – 1.0
	✓	Good – 0.8
	✓	Medium – 0.5
		Poor – 0.3
		Very Poor – 0

Utility scale For Government Support

✓		Very Good – 1.0
	✓	Good – 0.8
		Medium – 0.5
		Poor – 0.3
		Very Poor – 0

Utility scale For Economic Stability

		Very Good – 1.0
	✓	Good – 0.8
✓		Medium – 0.5
		Poor – 0.3
		Very Poor – 0

Utility scale For Foreign Investment Regulation

		Very Good – 1.0
✓		Good – 0.8
	✓	Medium – 0.5
		Poor – 0.3
		Very Poor – 0

Person 2

Giving personal utility into the criteria by using the economy history of each country

Utility function for NPV of profit
Net Present Value of China and Thailand is presented in the Scenario I.
Net Present Value of China in three year is equal 423,891.00
Net Present Value of Thailand in three year is equal 37,285.00
To come up with the Utility curve, each person should answer the following question.
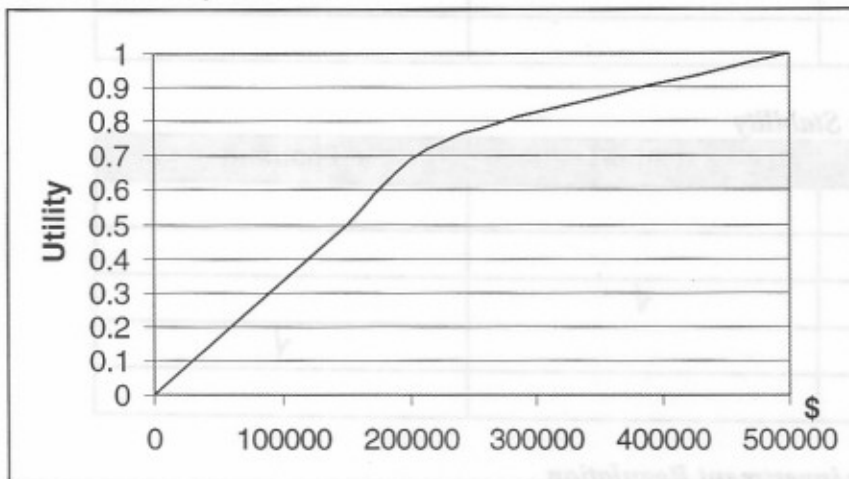
IF	What is your response?
Chance 50 % to get $500,000 and 50% to get $0	X1 = 150,000
Chance 50 % to get $ X1 and 50% to get $ 500,000	X2 = 230,000
Chance 50 % to get $X1 and 50% to get 0	75,000

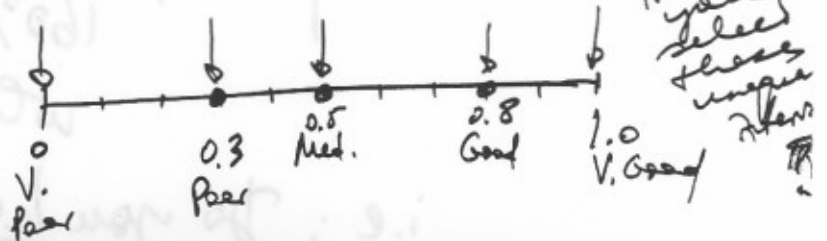Note: we assume the probability.
Person 2's utility function

Utility scale For *Future market share*

Preference	China	Thailand
Very Good –1.0		√
Good –0.8	√	
Medium – 0.5		
Poor – 0.3		
Very Poor – 0		

(Handwritten annotations:)
Did you use pairwise comparison?

Why not a scale? i.e., why a 5-point scale?

How did you select these unique items?

(Handwritten scale:) 0 V. Poor — 0.3 Poor — 0.5 Med. — 0.8 Good — 1.0 V. Good

Person 2 Con't

Utility scale For *Infrastructure Availability (transportation and communication)*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5		
Poor – 0.3	√	
Very Poor – 0		

Utility scale For *Government Support*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For *Economic Stability*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		
Medium – 0.5	√	
Poor – 0.3		√
Very Poor – 0		

Utility scale For *Foreigner investment Regulation*

Preference	China	Thailand
Very Good –1.0		√
Good –0.8		
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Is good meant to be ^ 80% of very good, and 160% of Medium? If so, why?

i.e ; Do you have rati scale measurements?

Person 3

Giving personal utility into the criteria by using the economy history of each country

Utility function for NPV of profit
Net Present Value of China and Thailand is presented in the Scenario I.
Net Present Value of China in three year is equal 423,891.00
Net Present Value of Thailand in three year is equal 37,285.00
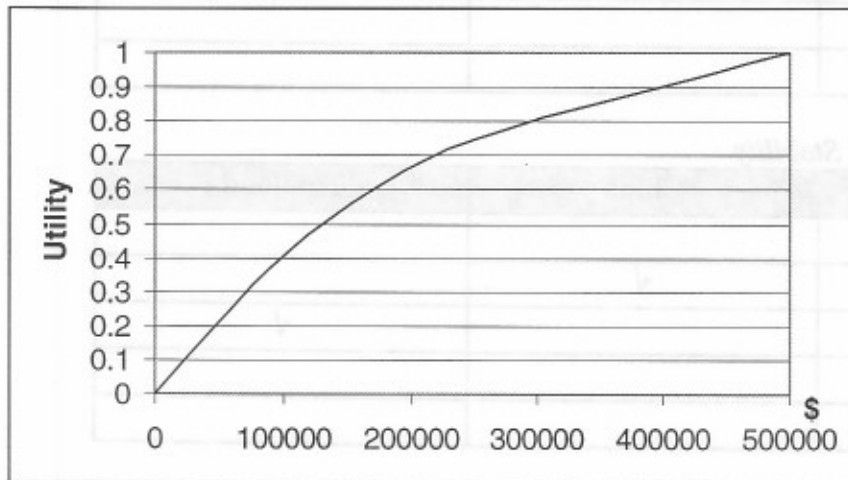To come up with the Utility curve, each person should answer the following question.

IF	What is your response?
Chance 50 % to get $500,000 and 50% to get $0	X1 = 130000
Chance 50 % to get $ X1 and 50% to get $ 500,000	X2 = 250000
Chance 50 % to get $X1 and 50% to get 0	60,000

Note: we assume the probability.
Person 3's utility function

Utility scale For *Future market share*

Preference	China	Thailand
Very Good –1.0		
Good –0.8	√	√
Medium – 0.5		
Poor – 0.3		
Very Poor – 0		

Utility scale For *Infrastructure Availability (transportation and communication)*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For *Government Support*

Preference	China	Thailand
Very Good –1.0		√
Good –0.8		
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For *Economic Stability*

Preference	China	Thailand
Very Good –1.0		
Good –0.8	√	
Medium – 0.5		√
Poor – 0.3		
Very Poor – 0		

Utility scale For *Foreigner investment Regulation*

Preference	China	Thailand
Very Good –1.0		√
Good –0.8		
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Person 4

Giving personal utility into the criteria by using the economy history of each country

Utility function for NPV of profit
Net Present Value of China and Thailand is presented in the Scenario I.
Net Present Value of China in three year is equal 423,891.00
Net Present Value of Thailand in three year is equal 37,285.00
To come up with the Utility curve, each person should answer the following question.
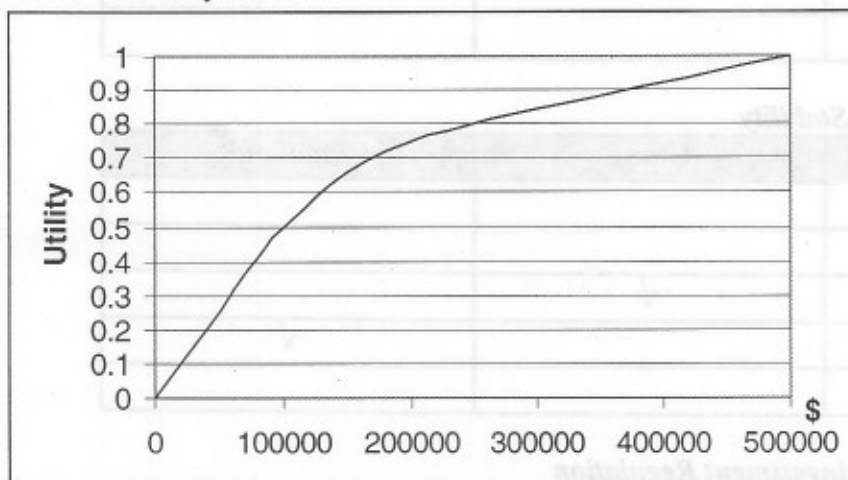
IF	What is your response?
Chance 50 % to get $500,000 and 50% to get $0	X1 = 100000
Chance 50 % to get $ X1 and 50% to get $ 500,000	X2 = 200000
Chance 50 % to get $X1 and 50% to get 0	50,000

Note: we assume the probability.
Person 4's utility function

Utility scale For *Future market share*

Preference	China	Thailand
Very Good –1.0	√	
Good –0.8		√
Medium – 0.5		
Poor – 0.3		
Very Poor – 0		

Person 4 Con't

Utility scale For *Infrastructure Availability (transportation and communication)*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5		
Poor – 0.3	√	
Very Poor – 0		

Utility scale For *Government Support*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For *Economic Stability*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		
Medium – 0.5	√	
Poor – 0.3		√
Very Poor – 0		

Utility scale For *Foreigner investment Regulation*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Person 5

Giving personal utility into the criteria by using the economy history of each country

Utility function for NPV of profit
Net Present Value of China and Thailand is presented in the Scenario I.
Net Present Value of China in three year is equal 423,891.00
Net Present Value of Thailand in three year is equal 37,285.00
To come up with the Utility curve, each person should answer the following question.
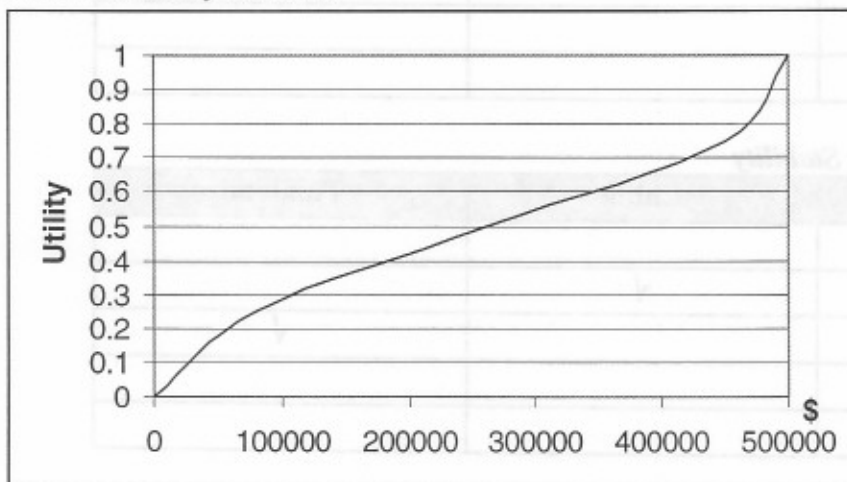
IF	What is your response?
Chance 50 % to get $500,000 and 50% to get $0	X1 = 260000
Chance 50 % to get $ X1 and 50% to get $ 500,000	X2 = 450000
Chance 50 % to get $X1 and 50% to get 0	80,000

Note: we assume the probability.
Person 5's utility function

Utility scale For *Future market share*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For *Infrastructure Availability (transportation and communication)*

Preference	China	Thailand
Very Good –1.0		√
Good –0.8		
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

Utility scale For *Government Support*

Preference	China	Thailand
Very Good –1.0		√
Good –0.8	√	
Medium – 0.5		
Poor – 0.3		
Very Poor – 0		

Utility scale For *Economic Stability*

Preference	China	Thailand
Very Good –1.0		
Good –0.8	√	
Medium – 0.5		√
Poor – 0.3		
Very Poor – 0		

Utility scale For *Foreigner investment Regulation*

Preference	China	Thailand
Very Good –1.0		
Good –0.8		√
Medium – 0.5	√	
Poor – 0.3		
Very Poor – 0		

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