



CHAPTER 2

LITERATURE REVIEW AND THEORETICAL CONSIDERATION

This chapter presents the literature review and the theoretical consideration will be illustrated. The theoretical considerations compose of External and Internal Analysis, which covers of PEST Analysis, Competitive Force, and SWOT Analysis. A feasibility analysis will be came out a will cover areas, such as marketing, engineering, and financial feasibility.

2.1 Literature Reviews

“Infectious waste” is a waste that carries a probable risk of transmitting disease or illness to humans and a waste capable of producing an infectious disease. According to Oregon law "infectious waste" and divides it into four categories - biological waste; cultures and stocks; pathological waste; and sharps.



Figure 2.1: Infectious wastes

Source: Department of Pollution Control

There are many types of infectious wastes, including;

- ❑ Human blood, blood products and other potentially infectious body fluids
- ❑ All needles

- Sharp objects contaminated with potentially infectious agents (needles, razor blades scalpel blades, syringes, pasteur pipettes, broken glass and devices used to transfer inoculate and mix cultures)
- Biological laboratory wastes containing potentially infectious wastes: including cultures, stocks, culture dishes
- Pathological wastes: human or animal tissues, organs or body parts
- Animal carcasses, body parts and bedding containing potentially infectious agents
- Disposable equipment, utensils and instruments containing potentially infectious agents.

Infectious waste can be a threat to human health and the environment. Because so many people can come into contact with infectious wastes, it is very important that these be properly collected, handled, stored, treated, hauled and disposed.

On that account, every hospital tries to incinerate infectious wastes with incinerators, which do not generate air pollution. However, purchasing infectious waste incinerator from foreign country is quite expensive; therefore, many hospitals always convey their infective wastes to incinerate at infective waste incinerating service business. For this reason, investment in infectious waste incinerating service business is responsive.

In general, the project feasibility study in investment in infectious wastes incinerating service business by using controlled Air Incinerator is attentive project by virtue of Environment Standard of incinerators that should not produce large amounts of emission. There are several literatures that present information involving infective waste incinerating service business such as, in 1999 Incinerator Technology Institute of Thailand studied concerning controlled Air Incinerator research and development that research presented systematic of Air Controlled Incinerator and it's drawing.

The Environment Institute of Thailand presented infectious rubbish destroying method, gathering, and transferring. Moreover, in 2000, Trend Intertrade Company researched concerning controlled Air Incinerator for 100-200 Kg./hr. which presented design of Controlled Air Incinerator of 100-200 Kg/hr. included of testing, data collecting and

controlling air quality in closing area. In addition, Somrat Kerdsuwan study to design a hospital waste incinerator to meet Thai hospital requirements. The working principal of the designed incinerator is a controlled-air incinerator where the combustion is divided in two parts. The first part is an intake primary chamber where the waste is feed in and the combustion air is controlled at sub-stoichiometric conditions. The gas and the volatile matter then, will be reburned in the secondary combustion chamber with excess-air for completed combustion, before going through the stack. The temperature in the two chambers is measured through a monitoring system, which controls the amount of combustion air need to attain the desired temperature in each chamber. The temperature in the primary chamber is designed to run at 760 C, which is adequate to ensure the thermal cracking of waste. The designed temperature for secondary chamber is at 1,000 C and the residence time for the gas is about 1 seconds which is enough for destruction of this kind of waste. The design criteria must also take into account of the real characteristics of the waste. The design includes the calculation of mass balance, heat balance, and the capacity of primary and secondary chambers. The refractory and the insulation materials are chosen on the basis of local availability. The incinerator is designed to be used in conjunction with the automatic feeder machine and the air pollution control equipment. The result of this research can be used to build a pilot hospital waste incinerator for performance testing.

In the same year, the Ministry of Public Health presented situation of destroying of infectious wastes in Thailand Furthermore, Administration and Public Health's Law Institute of Thailand presented laws of destroying of infectious wastes in Thailand. Besides, Sansunthikul and Sriprasert (1997) presented a study of the optimum operating parameters for the combustion of infectious wastes in a Rotary Kiln Incinerator.

In general, before investment in this project, the firm should contemplate on project feasibility study in order to support accuracy decision-making. Consequently, they must consider of marketing, manufacturing/engineering, management, environment, and financial analysis. Moreover, investigating previous project feasibility is absorbing way as long as the company will obtain the alternative conception and methodology for making decision on other projects, which can apply, for this project.

In addition, there is much research about project feasibility study such as in 1997, Chullavullibha studied project feasibility study on Setting –Up of a medium – Density Rubberwood Fiberboard Plant that concerned with application, production, marketing and investment setting up factory to produce the MDF board. Furthermore, it presented total investment of Rubberwood MDF board plant, capacity of 500 m³ /day, is 1,380 million baht. In analysis of 10 year project, the results are as follow, net present value of 245.7 million baht at cost capital of 15%, internal rate of return of 20%, payback period of 4.3 years. This project is possible for investment with profitable rate of return.

Two years later, Charoenwarat, rescanned a feasibility study on Setting-up a Photo Frame Factory Using Scrapped Banknote from the Bank of Thailand. This research studied demand for the frame per year, the location of this factory, plant design, production layout and financial analysis. This research insisted that pay back period is 2 years and 2 months, the rate of return on total investment is 61 %. In summary, this research is feasible in both economic and engineering. Furthermore, Aunkaw presented feasibility study of Radial Rubber Plant. This research including of marketing, engineering, financial, and environment analysis. The result of this research was investing 2,050 million baht, pay back period 5 years and 5 months.

2.2 Theoretical Consideration

Theoretical considering compose of PEST Analysis, Competitive Force, SWOT Analysis and feasibility analyses are explained in the following topics.

2.2.1 PEST Analysis

It is useful to consider what environmental influence have been particularly important in the past by using PEST Analysis which is identify a key environment drivers of change of the external factor influence a firm's choice of direction and action and ultimately it's organisational structure and internal processes. In this analysis, the external factor that we concern is remote environment. In addition, remote environment comprises factors that originate beyond, and usually irrespective of, any single firm's operating situation:

1) Political Factors

The political arena has a huge influence upon the regulation of businesses, and the spending power of consumers and other businesses which should be considering issues such as:

- How stable is the political environment?
- Will government policy influence laws that regulate or tax your business?
- What is the government's position on marketing ethics?
- What is the government's policy on the economy?
- Does the government have a view on culture and religion?
- Is the government involved in trading agreements such as EU, NAFTA, ASEAN, or others?

2) Economic Factors

Marketers need to consider the state of a trading economy in the short and long-terms. This is especially true when planning for international marketing. The issues are as low.

- Interest rates
- The level of inflation Employment level per capita
- Long-term prospects for the economy Gross Domestic Product (GDP) per capita, and so on

3) Sociocultural Factors

The social and cultural influences on business vary from country to country. It is very important that such factors are considered factor as following items.

- What is the dominant religion?
- What are attitudes to foreign products and services?
- Does language impact upon the diffusion of products onto markets?
- How much time do consumers have for leisure?
- What are the roles of men and women within society?
- How long are the population living? Are the older generations wealthy?
- Do the population have a strong/weak opinion on green issues?

4) Technological Factors

Technology is vital for competitive advantage, and is a major driver of globalization. Consider the following points:

- Does technology allow for products and services to be made more cheaply and to a better standard of quality?
- Do the technologies offer consumers and businesses more innovative products and services such as Internet banking, new generation mobile telephones, etc?
- How is distribution changed by new technologies e.g. books via the

Internet, flight tickets, auctions, etc?

- Does technology offer companies a new way to communicate with consumers e.g. banners, Customer Relationship Management (CRM), etc?

2.2.2 Analysis of Competitive Forces

Michael Porter (2000: 218) identified five forces that determine the intrinsic long-run profit attractiveness of a market or market segment: industry competitors, potential entrants, substitutes, buyer, and suppliers.

1) The Rivalry Among Existing Competitors (Industry competitors)

Threat of competitor is very considerable. A segment is unattractive if;

- It already contains numerous, strong, or aggressive competitors.
- The segment is stable or declining.
- Plant capacity additions are done in large increments.
- Fix costs are high.
- Exit barriers are high.
- Competitors have high stake in staying in the segment.

2) Threat of New Entrants (Potential Entrant or Threat of Mobility)

A segment's attractiveness varies with the height of its entry and exit barriers. Anyway, the majors of barriers to entry are as below;

- Economic scale
- Product differentiate
- Capital requirements
- Switching costs
- Access to distribution channels
- Cost disadvantages
- Government policy

In addition, the most attractive segment is one in which entry barriers are high and exit barriers are low as shown in the following figure. In addition, few new firms can enter the industry, and poor-performing firms can easily exit. When both and exit barriers are high, profit potential is high, but firms face more risk because poorer-performing firms stay in and fight it out. When entry and exit barriers are both low, firms easily enter and leave the industry, and the returns are stable and low. The worst case is when entry barriers are low and exit barriers are high: Here firms enter during good times but find it hard to leave during bad times. The result is chronic overcapacity and depressed earnings for all.

		Exit Barriers	
		Low	High
Entry Barriers	Low	Low, stable returns	Low, risky returns
	High	High, stable returns	High, risky returns

Figure 2.2: Barrier and Profitability

Source: Phillip Kotler (2000: 219)

3) Threat of Substitutes (New Products or Services)

Segmentation is unattractive when there are actual or potential substitutes for the product. Substitutes place a limit on prices and on the profits that a segment can earn. The key items that should be analyzed are as;

- Ability of customers to switch to the substitute.
- Monitor the price trends in the substitutes
- The possible threat of obsolescence
- The likely reduction in profit margin if price down or are held.

4) The Bargaining Power of Suppliers

A segment is unattractive if the company's suppliers are able to raise prices or reduce quantity supplied. Suppliers tend to be powerful if;

- They are concentrated or organized
- There are few substitutes
- The supplied product is an important input
- The cost switching suppliers are high
- The suppliers can integrate down stream

5) The Bargaining Power of Buyers

The bargaining power of buyers can have a similar effect on profitability as suppliers, just in the other direction. A strong buyer can force prices down, reducing those profit margins, while weak buyers can be exploited. The concentration issues are as bellow;

- The firm has only a very limited number of customers they are likely to wield more power than the customers in, say, a retail environment.
- If buyers are buying a large proportion of the firm's output they will have more say than a group that only wants to purchase a couple of units.
- Repeated interactions also favour buyers who then have the chance to go elsewhere if they feel unfairly exploited on a transaction.

2.2.3 SWOT Analysis

Situation analysis is the process of collecting and analyzing information about a company's strength, weakness, opportunity and threat to help determine a company strategy. The acronym SWOT is often used for these four components of situation analysis. Strengths and weaknesses are internal characteristics of the organization that enhance and impede its ability to compete. Opportunities and threats are external or environmental factors that might help an organization to meet or hinder it from meeting its strategic goals.(Judith R. Gordon, Steven R. Gordon : 1999,63).

According to http://www.mindtools.com/pages/article/newTMC_05.htm. "Carrying out an analysis using the SWOT framework will help company to focus the activities into areas where it is strong, and where the greatest opportunities lie". To carry out a SWOT Analysis write down answers to the following questions. Where appropriate, use similar questions:

Strengths:

- What are the company advantages?
- What does the company do well?
- What do a competitors see as your strengths?
- Is acknowledged as market leader?
- Is the technology proprietary grown?
- Is there a cost advantage?
- Is there a quality advantage?

It is important to consider this from the company's point of view as well as the companies it deals with.

Weaknesses:

- What can the company improve?
- What does the company do badly?

- What should the company avoid?
- Does the company have no strategic direction?
- Does the competition all access to same technology?
- Is the management poor/inexperience?
- Are facilities obsolete?

This should be considered from an internal and external basis for example are the company's competitors doing anything better.

Opportunities:

- Where are have opportunities?
 - Are there any interesting trends?
 - Useful opportunities can come from such things as: Changes in technology and markets on both a broad and narrow scale. Changes in government policy related to your field. Changes in social patterns, population profiles, lifestyle changes, etc.
- Local Events

Threats:

- What obstacles does the company face?
- What is the competition doing?
- Are the required for the company's products or services changing?
- Is changing technology threatening the company position?
- Does the company have bad debt or cash-flow problems?

Carrying out this analysis will often be illuminating - both in terms of pointing out what needs to be done, and in putting problems into perspective. SWOT analysis can be applied to the competitors - this may produce some interesting insights. (http://www.mindtools.com/pages/article/newTMC_05.htm: 2002)

2.2.4 Feasibility Study

The objective of the feasibility study is to provide the basic information for deciding whether to continue project or not. It also helps decision-makers to select the most desirable alternative among the others. In general, the project feasibility study of investment in a manufacturing facility is concerned with marketing, manufacturing, financial and other management implications.

1) Marketing Feasibility Study

Marketing feasibility study is the principal of the other studies because it presents the company's situation through SWOT Analysis, shows the Marco environment by the application of PEST Analysis, and uses Porter's Five-Force Analysis to analyze the competitive force. In addition, marketing analysis also presents market segmentation, market targeting including of demand and price estimation.

2) Engineering Analysis

Engineering analysis is to analyze the infectious waste incinerating process, production program, machine equipment; plant location and lay out include of raw material and the other management implications.

a) Incinerating Process

In order to select the most appropriate Infectious wasted incinerating process.

b) Plant Location

For select the most suitable location, the ABC Company should consider many important factors, then they should compare several locations together before make decision. In general, location decision-making procedure usually consists of 4 steps; these are determine the criteria of the company, identify the important factor that effect location decision. Then develop location alternative and evaluate the alternative that suitable for Infectious wastes incinerating plant. (Stevenson, 1990:232)

c) Plant Layout

According to Heizer and Render (1996 322) “ Lay out decision include the best placement of machine (in production settings), offices and desk (in office settings), or service enters (in setting such as hospitals or department stores. An effective layout facilitates the flow of materials, people, and information within and between areas.” In case of ABC Company, it needs to set the best placement of all machines such as Controlled Air Incinerator, and so on. For office and desk the company need to choose the best place for infectious wastes incinerating service’s officers.

d) Production Program

Production programmed dictates the level of production activities with respect to time scale. In consistency with sale projection and technical factors, production program will subsequently settled.

e) Material Technology

Raw materials, which are expected to be used in incinerating process, will be considered in term of availability, technical properties, price and so on.

f) Management Implication

Management study is also necessary because it helps ABC Company to select the appropriate organization and to structure lines of command, wage/ salary and fringe benefit.

3. Financial Analysis

For financial study, the important components are as below.

a) Total Investment Cost

Total investment cost comprises pre-operation capital expenditure, fixed asset capital expenditure, and net working capital.

- Fixed asset capital expenditure composes of fixed assets and land, road, building, reservoir, machine facility, vehicle.
- Pre-operation capital expenditure which are all expenses incurred during pre-operation and construction phase. These expenses involve wage/salary for project staff, traveling, office rental, training, and etc.
- Net working capital which is the expected amount of reserve for short term operation (within one year) such as raw material, salary/ wage, fringe benefit, administrative expense , and etc.

b) Production Cost

Production cost composes of fixed cost and variable cost. Total variable cost changes in direct proportion to a change in the level of production volume whereas total fixed cost remains unchanged in total as the level of product volume varies. Variable cost is such as raw material, direct labor, depreciation, sale administration expense and etc. Fixed costs are, for example, office building, interest expense, pre-operation expense and etc. (Ronald W. Hiltion: 1994).

c) Administration Cost

Administration cost involved of salary and wage, depreciation and amortization, insurance, transportation cost and etc.

d) Project income statement, cash flow statement, and balance sheet

According to Brigham and Gapenski(1994) “ Based upon all the above plans, income statement, cash flow statement, and balance sheet are to be created accordingly. These three statements basically picture the overview of projected project operation and financial position.” The balance sheet indicates a project financial status at a point in time whereas income statement presents the income for the period between two balance sheet dates. The statement cash flow depicts how cash flows through the project during a certain period of time.

e) Feasibility assessment

For project decision making, a couple of popular financial indicators have been employed in reality are as;

1) Payback Period

Payback period is the period in which net return or cash flow from the operation of a project is of the same values as an investment in the project. This method considers the number of years in which return will be even with investment funds. The method is a tool suitable for making a decision on a project with high risks or in a situation in which political fluctuation is prevalent. Thus, investors may have to consider making investment in a project, which yield return in a short time.

Payback period can calculate from the number of years in which the accumulated total of cash flow of benefits (Cash inflow) of the project is equal to the cash flow of expenses (cash outflow) or the number of years in which the total of net cash flow of the project is equal to zero. The formula for calculation can be shown as follows;

$$\sum_{t=0}^n \text{Cash Inflow} = \sum_{t=0}^n \text{Cash Outflow}$$

Or

$$\sum_{t=0}^n (\text{Cash Inflow} - \text{Cash Outflow}) = 0$$

Or
$$\sum_{t=0}^n (\text{Net Cash Flow}) = 0$$

Where $n = \text{Payback Period}$

When the project has very short payback period or if this value is the lowest, it may place the project in top rank. In other hand, when any payback period has high values, the project is placed in the next lower rank. In case of ABC Company, payback period is about 4 year so this project is also interesting.

2) Net Present Value (NPV)

Net Present Value is the total of net return for which time value has been adjusted in each year (Accumulated Present Value of Cash Flow) with an aim to measure worthwhile return of a project. In general, a principle for making a decision to choose a project among several ones is that the best project should be one that yields highest NPV or to use the principle of electing a project which provides highest profits in a short period with minus value is regarded as one not worth investing in. In the government sector, a decision for investment is not based always on the highest value of NPV as other factors also will have to be considered. Calculation to find Net Present Value (NPV) can be as follows;

- a. To make calculation to find present value of net return in each year (NPV of Cash Flow) and add up the said value of each year throughout the life of the project. Result is NPV of the project. The formula for calculation is as below;

$$\text{NPV} = \sum_{t=0}^n \frac{B_t}{(1+i)^t} - \sum_{t=0}^n \frac{C_t}{(1+i)^t}$$

- b. Calculation to determine total return in each year, deduct it with total expenditures in that year and the result is net return or net cash flow of each year. Then, use that value to adjust time value in each year throughout the life of the project. Next, the resultant values are added up to get NPV of the project.

$$NPV = \sum_{t=0}^n \frac{B_t - C_t}{(1+I)^t}$$

Where	NPV	=	Net Present Value of the project
	Bt	=	Benefits of the project in year "t"
	Ct	=	Costs of the project in year "t"
	I	=	Interest rate or Discount rate or opportunity Cost of Capital
	N	=	the life of the project
	1/(1+I)	=	Present Worth Factor (PWF)

When PWF or $1/(1+I)^t$ is multiplied by value of net monetary flow in the year "t", the result is present value of cash flow in that year. For PWF value, refer to the prepared table "Discount Factor Table". It is evident that calculation to determine NPV of the project be either a. or b. method will be produce the same result.

3) Internal Rate of Return (IRR)

Internal Rate of Return of project is discount rate that will make benefits and expenses equal after calculation of discount into present value. This rate is that of ability of investment funds to create sufficient income to cover investment funds. In other word, which discount rate that will make net value equal to zero. This criterion is similar to the determination of NPV. The difference is the changes of the value of "I" value (Interest rate) in NPV to "r" value (Discount rate) in IRR.

In the calculation to determine IRR value, it begins with the reduction or benefits by expenses in each year throughout the project so as to get net return or net cash flow in each year. Next, calculation is made to find a discount rate that will make the total of present value of net return give in zero.

Calculation to find IRR value is similar to the formula on finding NPV. The difference is to change “I” value to “r” and this “r” value will turn NPV into zero value. Formula for calculation is as follows;

$$\sum_{t=0}^n \frac{B_t - C_t}{(1+r)^t} = 0$$

Where r = IRR value of the project

This calculation of IRR is done gradually (Trial and Error). That is experiment has to be made to find r-value that will turn NPV into zero. One may have to waste time to make experiments of various values. In practice, interpolation method may be employed in determining IRR value that will turn into zero.

$$\text{IRR} = \text{DR}_L + (\text{DR}_{H} - \text{DR}_L) * \frac{(\text{NPV}_L)}{\text{NPV}_L - \text{NPV}_H}$$

Where

- DR_L = Lower bound discount rate
- DR_H = Higher bound discount rate
- NPV_L = Net present value of DR_L
- NPV_H = Net present value of DR_H
- IRR = Discount rate that will made NPV= 0

Thought it takes time to find this value in calculation, but it is a basic principal in making a decision to invest. At present, owing to advanced technology in finding IRR, it is possible to get IRR from computer application program, such a Excel or lotus.

4) Benefit –Cost Ratio(B/C Ratio)

Benefit /Cost Ratio refers to the ratio of present value of benefits to present value of costs throughout the life of a project. Costs here include costs of investment funds and expenses on operation and maintenance (O&M). Calculation of B/C ratio can be done as follows:

$$B/C = \frac{\text{Present Value of Benefits(PVB)}}{\text{Present Value of Cost (PVC)}}$$

$$B/C = \frac{\sum_{t=0}^n \frac{B_t}{(1+i)^t}}{\sum_{t=0}^n \frac{C_t}{(1+i)^t}}$$

Where	B _t	=	Benefits of the project in year “t”
	C _t	=	Costs of the project in year “t”
	I	=	Interest rate or Discount rate or Opportunity Cost of Capital
	T	=	Year of the project(-3,-2,-1,0,1,2,3...n)

Criteria for decision making are as follows.

- If $B/C = 1$, this means benefits and costs are of equal value. So, whether or not to choose the project depends on other supporting factors.
- If B/C less than 1, this means benefits are less value than costs. It is not advisable to invest in that project.
- If B/C more than 1, this means the benefits are higher than value of costs. Therefore, this project will provide benefit.

5) Sensitivity analysis

Sensitivity analysis is an approach to examining the effects of uncertainties in the forecasts on the viability of a project. According to, the economic analysis of a project can only be based on the best estimates that can be made of the investment required and the cash flow. The actual cash flows achieved in any year will be affected by any changes in such as raw material costs, and other operation & maintenance costs; and will be very dependent on the price and sales volume. To carry out the analysis the investment and cash flows are first calculated using what are considered the most probable values for the various factors; this establishes the base case for analysis. Whatever, the cash flows and criteria of performance are to be used, are then calculated assuming a range of error for each of parameter in turn; for instance, an error of ± 10 percent on the investment or O&M cost might be assumed.