

CHAPTER X

CONCLUSION AND RECOMMENDATION

This chapter presents the conclusion and recommendation of the thesis. It summarizes the findings of both the first and the second part of the thesis; the analysis of Thai biodiesel critical success factors, and the project planning for setting up a biodiesel factory correspondingly. In addition, some recommendations would also be stated in this final section of the thesis.

10.1 Conclusion

Biodiesel industry is one of the important emerging industries in Thailand. Hence, Thai government is at the moment trying vigorous in developing this industry. Not only that Thai government has requested a financial institution to conduct a feasibility study in setting up a biodiesel factory, but also in the latest Energy Policy and Development Plan biodiesel has been identified as one of the alternative energies that Thai government would be supported. As a result, to advance the development of the Thai biodiesel industry by encouraging in the set-up of more biodiesel plants, the critical success factors are studied.

According to the Porter's five forces analysis, the biodiesel industry is one of the emerging industries in Thailand; whereby the demand from this industry is extremely high. With the current biodiesel production level, the demand of biodiesel is much exceeding the supplies available. Two factors revealed by Porter's five forces that act as the industry's barriers are the shortage of biodiesel raw material (crude palm oil) and the high set-up cost. Hence, it could be concluded that despite the high demand of biodiesel exists in the Thai market, the relatively high bargaining power of suppliers and the new entrants' barriers hinder the attractiveness of this industry.

From SWOT Analysis, the study uncovered that there are altogether nineteen points revealing as Thai's biodiesel industry strengths, weaknesses, opportunities, and threats; as shown in Table 5.1. With the construction of TOWS Matrix upon these identified nineteen points, nine strategic objectives were revealed (Table 5.2). To

accomplish these nine strategic objectives, five potential key success factors were discovered. These five potential key success factors include the government policy, the technology development, the raw material upsurge, the production process development, and human resource development. Additionally after the obtained of the five potential key success factors, they would be weighted for their importance through questionnaires' surveying. The outcome of the questionnaires' surveying turned out that the top three most significant critical success factors of the Thai's biodiesel industry are the raw material, the technology, and the human resource correspondingly.

For the raw material, the result of the study indicates that it is the most important critical success factor of all. It is evident from the critical success factors weighting as raw material gained the highest and second-highest scores in the critical success factors weighting. However, Thailand is now encountering with two major raw material challenges; which have turned out into two subsidiary key success factors of biodiesel industry. One of the challenges is the escalating price of raw material. This factor has enormously affected the set-up of biodiesel factory in term of increased in the production cost and lengthening of the payback time. Another challenge is the availability of raw material. Similarly, this factor has huge impacts on profit margin, payback time, and constant operation. Hence, to expand the Thai biodiesel industry, Thai government must first help to stabilize the price of raw material and also increase palm fresh fruit production to resolve the raw material problems.

For the technology, it is as important factor as the raw material. Technology could be subdivided into two subsidiary key success factors of technology know-how and technology development. According to critical success factors weighting, the technology know-how is very important for the set-up of a biodiesel factory as it showed significant impacts on the product quality and biodiesel constant operation. Moreover, for the technology development, it concerns with the set-up investment needed to acquire the technology for the production which at the moment is enormous – affecting the payback time and financial success of a newly set-up plant. Hence, for

Thai biodiesel industry to grow firmly and speedily, these technological concerns must be take care of.

Moreover from the study, it also revealed that human resource is another key success factor for biodiesel industry. At the moment, there is insufficient number of biodiesel specialists and skilled personnel available in the Thai biodiesel industry. With reference to the critical success factors weighting, the result indicates that lacking of biodiesel specialists and skilled personnel has the impact upon the quality of the produced biodiesel; gaining a relatively high scores. Consequently, with a shortage of the biodiesel specialists and skilled personnel, it seems that small biodiesel producers would be at very high risk in the confrontation of the inconsistency of product quality and the inefficiency of biodiesel manufacturing process. As a result, the problem of the deficient supplies of biodiesel specialists is another issue that must be address in the Thai biodiesel arena.

In this research seeking for Thailand's critical success factors in setting up of a biodiesel factory, many obstacles have been confronted; especially in the questionnaires' surveying section. One of the major obstacles encountered in this section is the limited numbers of biodiesel manufacturing factories in Thailand as Thai biodiesel industry is still very new. With reference to Department of Energy Business, Ministry of Energy, Thailand has only eight biodiesel manufacturing factories that could sell biodiesel commercially as vehicle fuel that could be incorporated into diesel fuel as B5. As a result, this affects to some extent on the results obtained. Furthermore, another obstacle faced is that at the time of conducting this study, many biodiesel producers have ceased their biodiesel production due to high production cost exceeding the diesel selling price – causes the biodiesel production to be shut down.

For the next part; after the critical success factors have been verified, the sensitivity analysis is studied to determine both the appropriate production capacity for the second part of this thesis which is to plan a project for setting up a biodiesel factory and the project's feasible indicator of the three identified critical success

factors on the selected production capacity. The study reveals that; from five comparing factors of limited availability of the raw material, increasing price of raw material, capital required for setting up biodiesel factory to the profit yield, additional earning from declining price of glycerin, and the effect upon increasing of the interest rate, the operational capacity of 10,000 litres per day biodiesel endures the fluctuation three out of five of these factors considerably well. Moreover, from the most-suited biodiesel production capacities weighting, the 10,000 litres per day biodiesel production capacity has turned out with the highest scores of 11 points. Therefore, for the furtherance to the second part of this thesis, it has been concluded that the project planning for setting up a biodiesel factory would be to set-up a biodiesel factory with the operational capacity of 10,000 litres per day.

Table 10.1: Most-suited biodiesel production capacities weighting

Selected factors	Production capacity (litres/day)		
	200,000	100,000	10,000
Availability of raw material	1	2	3
Price of raw material	2	3	1
Capital required	2	1	3
Additional earning from selling glycerin	3	2	1
Effect upon increasing of the interest rate	2	1	3
Total scores	10	9	11

Moreover, the sensitivity analysis also investigates the project feasibility criteria for setting up a 10,000 litres per day biodiesel factory based on the three identified critical success factors. From the study, it resulted that for the project to be feasible with the Internal Rate of Return (IRR) more than 10%; the difference in price of raw material and biodiesel should be more than 7 Baht, the amount of raw material that needs to be secured should be of at least 255,000 kilograms per month, the

biodiesel selling price should be lower than the diesel price of more than 3.70 Baht to stimulate its usage, the set-up investment spent should be not more than 26,500,000 Baht despite the increasingly price of technology, the cost of human resource employ should be less than 207,000 Baht per month eventhough the company uses the experts from other country, and lastly, the biodiesel obtained from the set-up production process should be more than 247,500 litres per month with the input of 265,000 kilograms of crude palm oil (CPO) per month. These are the project's feasible indicators in setting up a biodiesel factory with the production capacity of 10,000 litres per day biodiesel production.

Table 10.2: Summary of Project feasibility factors

Summary of Project feasibility factors:
– Difference in price of raw material & biodiesel: ≥ 7 Baht
– Amount of raw material: $\geq 255,000$ kilograms per month
– Biodiesel & diesel selling price: ≥ 3.70 Baht
– Set-up capital: $\leq 26,500,000$ Baht
– Human resource employ: $\leq 207,000$ Baht per month
– Biodiesel production: $\geq 247,500$ litres per month

Lastly, for the project planning for setting up a biodiesel factory with the operational capacity of 10,000 litres per day, the result of the analysis turns out that this project would require a total of 128 days to complete the whole project. With the employment of the Microsoft Project program, it reveals that if the project starting date is scheduled to be on January 1, 2008, this project would expect to be completed on July 7, 2008. Moreover, it also reveals that that there are in total 13 critical tasks. These 13 critical tasks include A – C – D – E – F – H – I – K – L – P – Q – T – V.

For the human resource, this project would be required in all eight project members. These eight project members would be filling up the following positions of project manager, process engineer, mechanical engineer, industrial engineer, quality

assurance officer, accountant and financial officer, human resource officer, and purchasing officer. The proposed project structure for setting up a small biodiesel factory is a functional structure.

Finally, for the cost calculation of this project, the study uncovers that the total project capital requirement is 18,455,917 Baht in all. The project cost has been broken down into five categories of human resources, plant construction, plant utilities, equipments and machineries, and miscellaneous expenses. In addition, the project cost has also been calculated using bottom-up cost estimating method. The result reveals likewise that the project required a total of 18,455,913 Baht to complete this biodiesel set-up project.

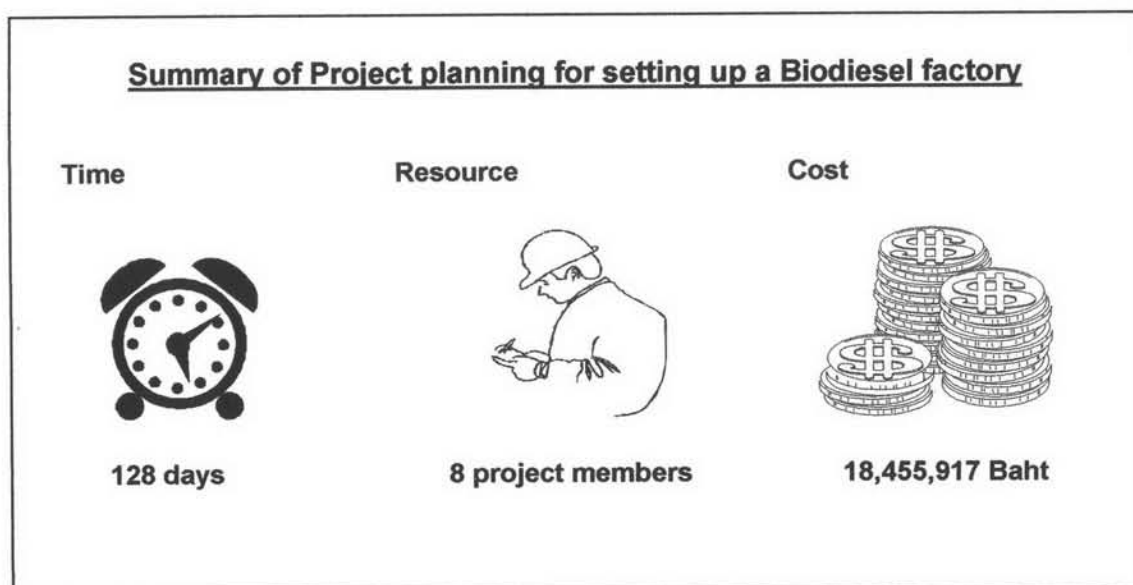


Figure 10.1: Summary of Project planning for setting up a biodiesel factory

10.2 Thesis Recommendation

With the presentation of the critical success factors analysis and the project planning for setting up a biodiesel factory, there are some recommendations about this research as followed:

- For the critical success factors determination; in term of information collection, to obtain more accurate and more details of the industry insight information, a face-to-face interview might be a better tool to employ instead of the questionnaires.

- As this study focuses in evaluating an overview of the Thai biodiesel industry for any biodiesel interested parties; does not specify on a company, thus the attained result would be only a general overview rather than a tailored-made solution to a particular organization.

- The next research should be a continual research on efficiency improvement of biodiesel manufacturing process and/or the capital requirement reduction in setting up a biodiesel factory in order to strengthen the Thai biodiesel industry.