

**JATROPHA OIL BASED BIO-ADHESIVE FOR
PLYWOOD APPLICATION**



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**MASTER IN CHEMICAL ENGINEERING WITH
ENTREPRENEURSHIP**

UNIVERSITI MALAYSIA PAHANG

JATROPHA OIL BASED BIO-ADHESIVE FOR PLYWOOD
APPLICATION

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NUR FARAHAIN BINTI KHUSNUN

A dissertation submitted in fulfilment
Of the requirements for the award of the degree of
Master of Chemical Engineering with Entrepreneurship

UMP

Faculty of Chemical & Natural Resources Engineering
UNIVERSITI MALAYSIA PAHANG

SEPTEMBER 2013

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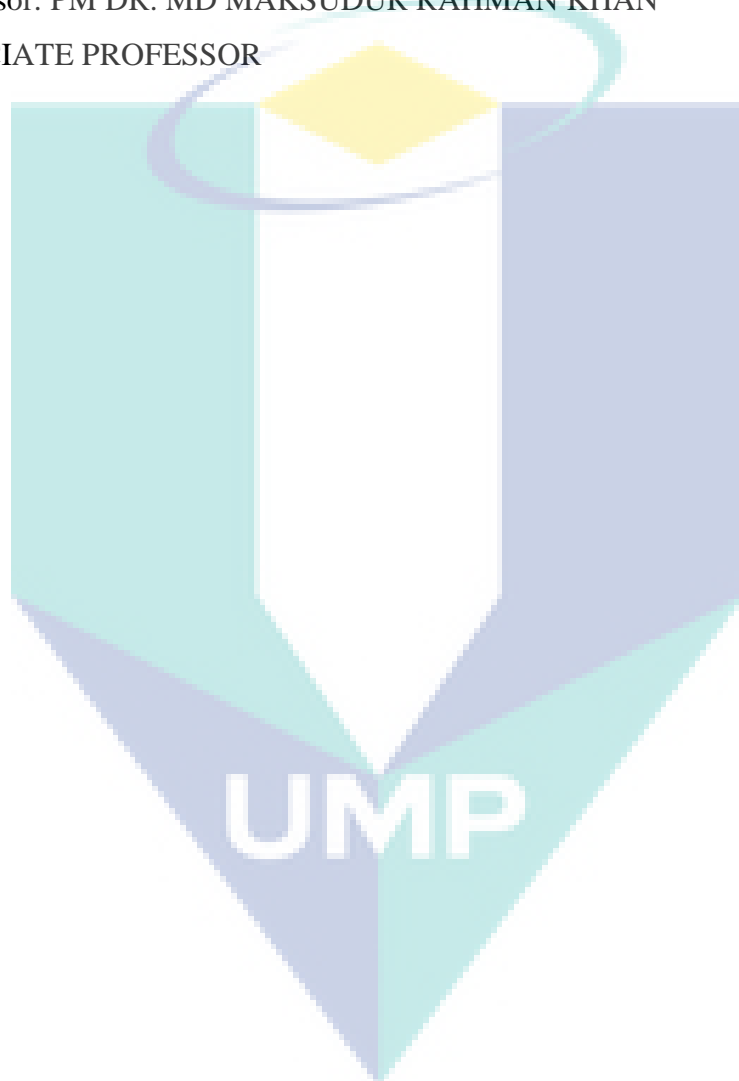
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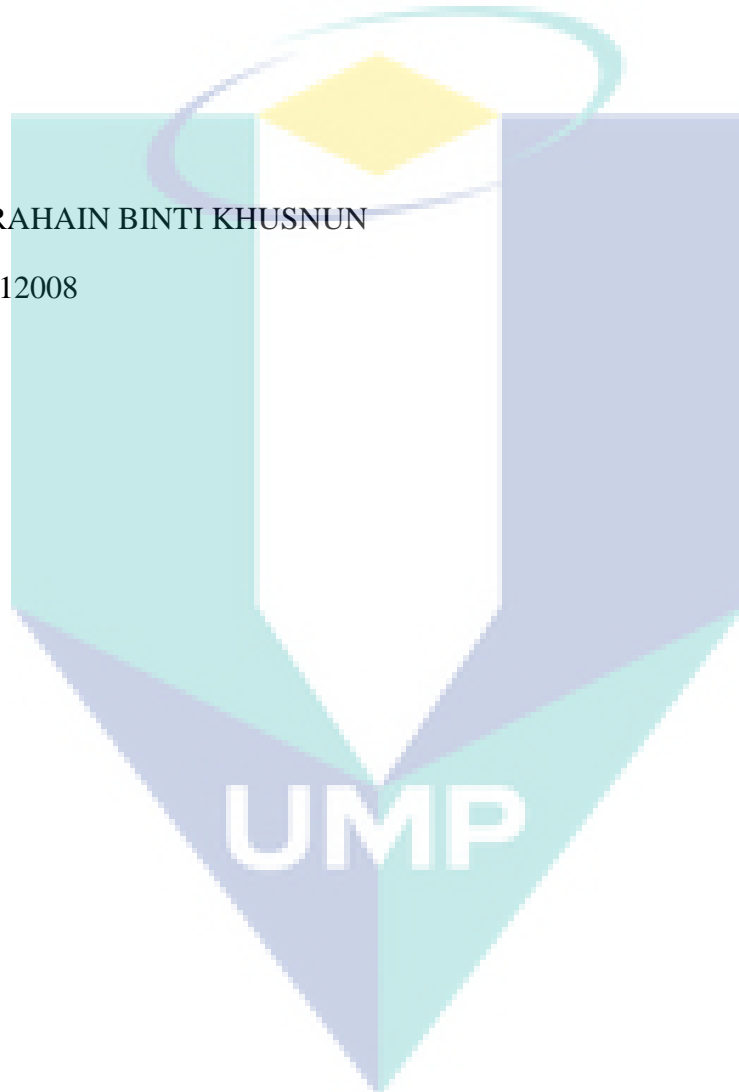
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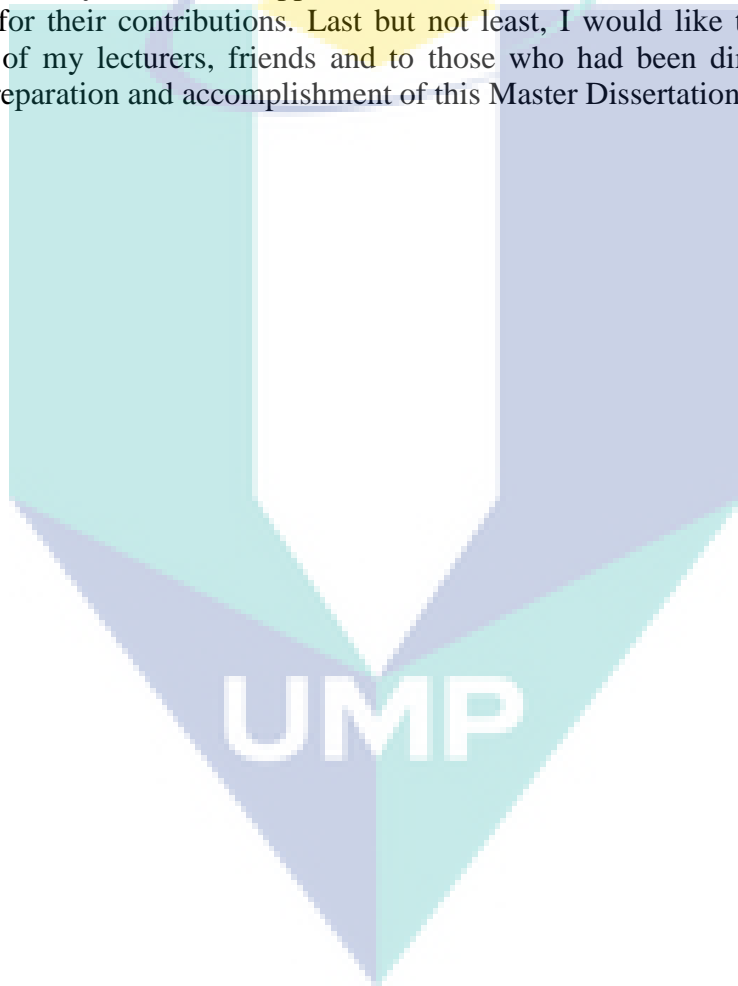
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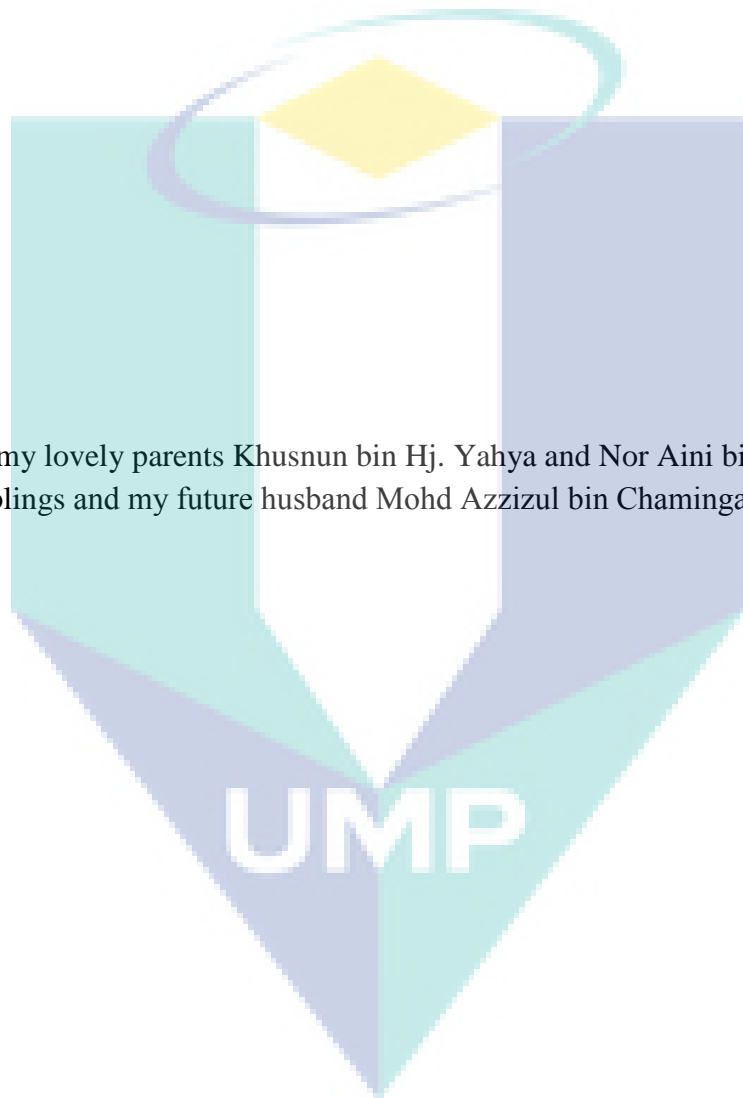
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PREFACE

Alhamdulillah, I was very grateful to Allah S.W.T for His grace and mercy for giving me strengths and opportunities to complete this master dissertation. This dissertation would not be completed without the never-ending support, guidance and contribution from the persons encountered by me during the evaluation of this project. Firstly, I would like to take this opportunity to give our millions of thank to my supervisor PM Dr. Md. Maksudur Rahman Khan for his continuous encouragement, guidance, comments and fruitful ideas from the beginning until the end of the preparation of this dissertation. My next appreciation goes to the Head of Master Chemical Engineering with Entrepreneurship. I would also like to thank my beloved family, who have supported and motivated me; no words can best describe my appreciation for their contributions. Last but not least, I would like to give a great big thank you to all of my lecturers, friends and to those who had been directly or indirectly involved in the preparation and accomplishment of this Master Dissertation.





Dedicated to my lovely parents Khusnun bin Hj. Yahya and Nor Aini binti Hj. Bahran,
siblings and my future husband Mohd Azzizul bin Chamingan...

EXECUTIVE SUMMARY

Type of Business

BAFP Sdn. Bhd. is a bio-adhesive manufacturer company with a focus on wood industries especially in plywood application.

Company Summary

BAFP Sdn. Bhd. produces jatropha oil based bio-adhesive for plywood application. It is made from natural resources which are from jatropha oil and (Jatropha Oil Seed Cake) JOSK that obtained from jatropha tree and also glycerol that obtained from biodiesel by product.

Business Opportunity

Malaysia is the top ten wood suppliers of wood based products in the world, especially export to Europe, Japan, Taiwan, Singapore and Middle East. Total exports of plywood-based products from Malaysia was RM4.71 billion in 2012 (MTIB, 2012) and this industry based exports in Malaysia rises nearly 40% compared to the past ten years. This opportunity can take to produce bio-adhesive.

Market analysis

The market for bio-adhesive is clearly having a big size. Formulated adhesive consumption in 2009 was 16.6 billion lbs. (worth USD20.6 billion). Volume is forecast to expand at a 4.5% annual rate through 2014.

Competitive advantage

Bio-adhesive has an advantage over less formaldehyde emission. Formaldehyde based adhesive can harm people. This bio-adhesive is completely free of formaldehyde, which uses renewable plant resources, through the green, no industrial waste emission, low-power processing preparation, to be excellent performances and affordable.

Competitor Analysis

Two possible competitors are identified:

- a) Other formaldehyde based adhesive producer that use Melamine Urea Formaldehyde and Urea formaldehyde resin
- b) Natural based adhesive producer that use soy bean as the raw material.

Intellectual Property Rights

The idea and the novelty of the product have been patented to avoid any vulnerable act.

Financials

The following are the estimated revenue for bio-adhesive which priced USD400/unit. For year 1 the revenue was USD 621, 727 and increased to USD920, 384 in year 2. It continuous increase to USD 960,794 on year 3 and USD 1,017,161 and USD 1,074,979 for year 4 and year 5 respectively.

Funding Requirement

Funding is required to lease building and purchase equipment and location and administration for start-up purpose. The amount is \$2.5million.

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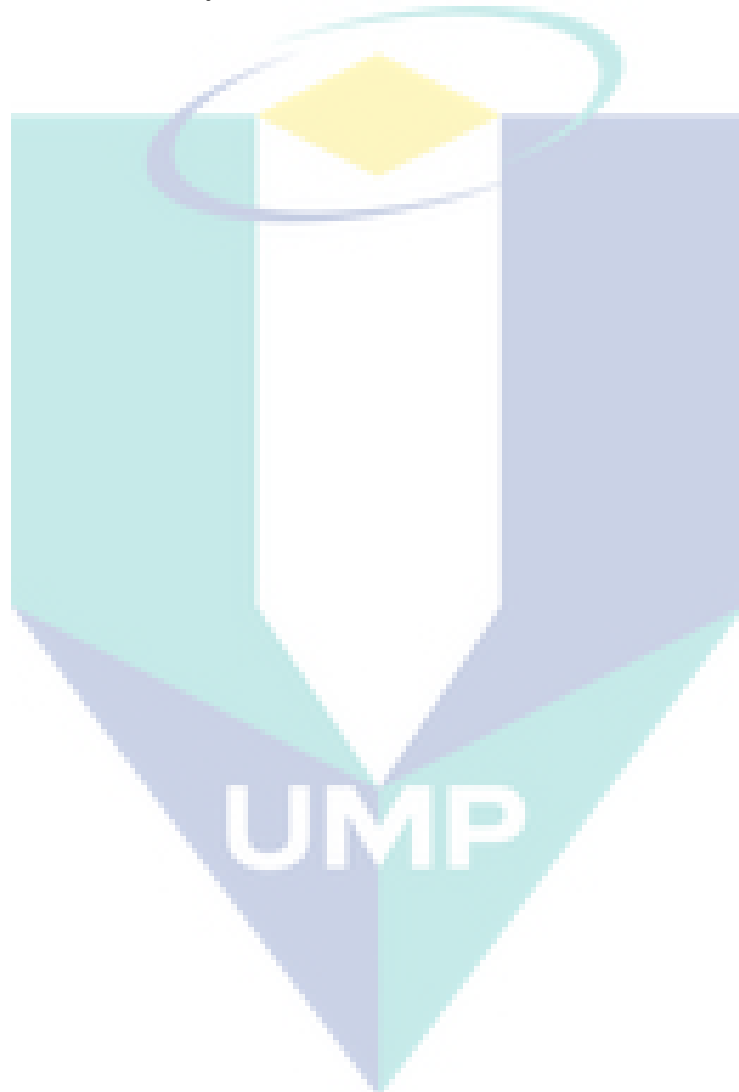
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LIST OF ABBREVIATIONS

| | |
|--------|--|
| BAFP | Bio-adhesive foe Plywood |
| BS | British Standard |
| CEO | Chief Executive Officer |
| CRDF | Commercialization of Research and Development Fund |
| EN | Harmonized European Standard |
| EPF | Employment Provident Fund |
| GHG | Green House Gas |
| GTFS | Green Technology Financing schemes |
| IARC | Institute Association of Research Cancer |
| IHPA | International hardwood Products Association |
| JAS | Japan Agriculture Standard |
| JBA | Jabatan Bekalan Air |
| JOSC | Jatropha Oil Seed Cake |
| LPT | Lebuhraya Pantai Timur |
| MDV | Malaysia Debt Venture |
| MF | Melamine Formaldehyde |
| MTDC | Malaysian Technology Development Cooperation |
| MTIB | Malaysia Timber Industry Board |
| MUF | Melamine Urea Formaldehyde |
| PF | Phenol Formaldehyde |
| PLUS | Perhubungan Lebuhraya Utara Selatan |
| RM | Ringgit Malaysia |
| SAJ | Syarikat Air Johor |
| SATU | Syarikat Air Terengganu |
| SOCSSO | Social Security Organization |
| TNB | Tenaga Nasional Berhad |
| UF | Urea Formaldehyde |
| UIA | Universiti Islam Antarabangsa |
| UMP | Universiti Malaysia Pahang |
| USD | United State Dollar |
| UTM | Universiti Teknologi Malaysia |

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Malaysia is the top ten wood suppliers of wood based products in the world, especially export to Europe, Japan, Taiwan, Singapore and Middle East. Total exports of wood-based products from Malaysia was RM18.52 billion in 2012 (MTIB, 2012) and this industry based exports in Malaysia rises nearly 40% compared to the past ten years. Specifically, export value for plywood was RM4.71 billion. This production of plywood has opened an opportunity to manufacturer produces an adhesive. At present, conventional adhesive cause formaldehyde emission. The wood based product export market was limited especially to United States and Europe due to formaldehyde emission issue. Therefore, formaldehyde free adhesive is important in order to export plywood-based to those country. Thus, several efforts have been made to reduce or replace formaldehyde contents in adhesive formulations or to develop adhesives from natural materials.

1.2 PRODUCT OVERVIEW

This product is bio-based adhesive. It used for plywood application. It is made from natural resources which are from jatropha oil and JOSOC that obtained from jatropha tree and

also glycerol that obtained from biodiesel by product. At present, formaldehyde based adhesives such as phenol formaldehyde (PF), urea formaldehyde (UF) and melamine urea formaldehyde (MUF) resin are predominantly used. These adhesives are synthetically produced from non-renewable resources such as petroleum and natural gas. Formaldehyde based adhesive was not environmental friendly because formaldehyde gas was releases from the wood panel which was carcinogenic to humans (IARC, 2004). Thus, bio-based adhesive product produces without using formaldehyde which yields comparable mechanical properties for the plywood to pass the international standard specifications and it is environmental friendly since it's made of natural resources instead of non-renewable sources. This product also promotes green technology to the world.

1.3 MARKET OVERVIEW

Adhesive is a 30 million ton global industry with a sales value of over USD 20 billion. For plywood application, adhesive consumption was USD1.245 million. From this market, BAFP Sdn. Bhd. will produce bio-based adhesive to replace the conventional adhesive. The bio-adhesive is completely free of formaldehyde, which uses renewable plant resources, through the green, no industrial waste emission, low-power processing preparation, to be excellent performances and affordable.

1.4 RESOURCES AND RAW MATERIALS

Recently, jatropha plantation starts in Malaysia especially at Sabah and Terengganu. Approximately 0.60 million acres plantation is available in Malaysia (Bionas Group) and 0.85 million tons of jatropha oil and 1.7 million tons of by-products, jatropha seed oil cake (JOSC) were produced yearly. Biodiesel plant sustained by oil palm is plenty in Malaysia. The by-product of biodiesel plant such as glycerol is also abundance. In this context, bio-adhesive was developed by using jatropha oil, glycerol and JOSC for plywood application.

CHAPTER 2

MARKET ANALYSIS

2.1 INTERNATIONAL/ REGIONAL/ LOCAL INDUSTRY DESCRIPTION

The market for bio-adhesive is clearly having a big size. Formulated adhesive consumption in 2009 was 16.6 billion lbs (worth USD20.6 billion). Volume is forecast to expand at a 4.5% annual rate through 2014. The Asia Pacific region is the largest consumer of formulated adhesives; it is consumed 40% of the 2009 volume and 34% of the dollars. Regional volume was up slightly in 2009 compared to prior year. Europe is the second largest regional consumer of formulated adhesives, with 30% of the world's volume and 32% of value in 2009. Europe had been the leader in adhesive dollars prior to 2009. The sharp decline in European consumption allowed Asia Pacific region to capture the lead which is projected to widen in future years. Forecasted figure consumption in Asia Pacific region is USD9.8 billion in 2014 Figure 2.1 shows adhesive dollar consumption by region in 2008, 2009, as well as the 2014 forecast.

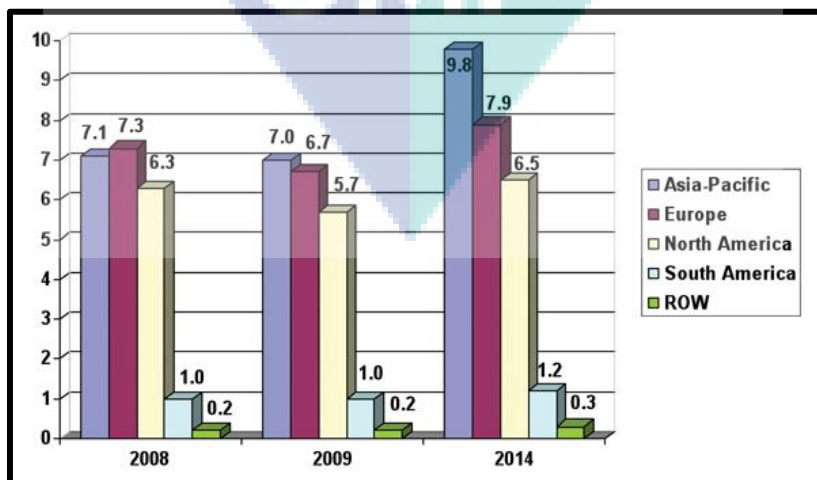


Figure 2.1: Adhesive Consumption by region (USD billion)

Source: The Global Adhesive Market (M.Kusumgar,2011)

BAFP Sdn. Bhd enters the target market by end use of the adhesive. Figure 2.2 shows the adhesive consumption by End Use, 2009 (USD20.6 billion total). Pressure sensitive products are the largest adhesive end use, representing 28% of the global volume in 2009 and 24.75% of the value. Packaging was the second largest end use, with 22% of the volume and 17.96% of dollars in 2009.

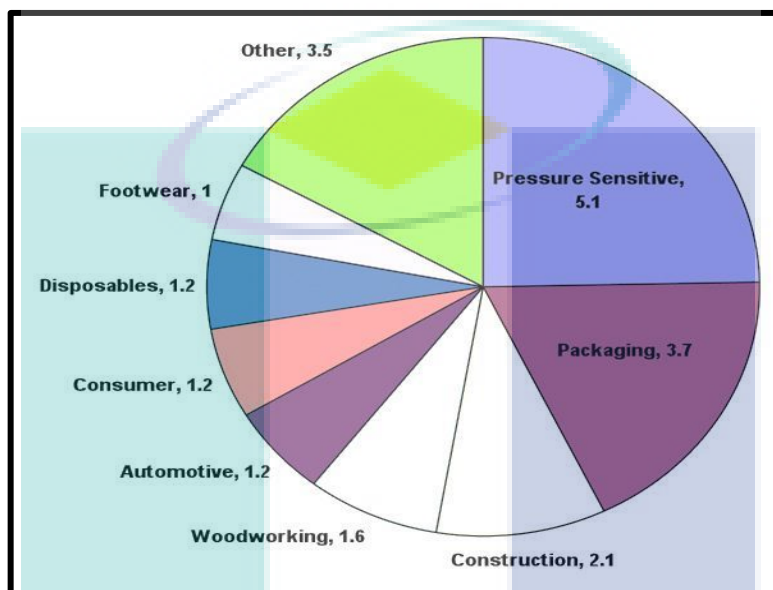


Figure 2.2: Adhesive consumption by End Use, 2009 (USD20.6 billion total)

Source: The Global Adhesive Market (M.Kusumgar, 2011)

Table 2.1: The Percentage of Consumption by End Use in 2009

| Application | Percentage, % |
|--------------------|---------------|
| Pressure sensitive | 24.75 |
| Packaging | 17.96 |
| Construction | 10.19 |
| Woodworking | 7.80 |
| Automotive | 5.82 |
| Consumer | 5.82 |
| Disposable | 5.82 |
| Footwear | 5.82 |
| Others | 16.99 |

As BAFP Sdn. Bhd produces bio-adhesive for plywood application, it penetrates into woodworking end use market. Woodworking is the fourth largest end use, taking 11% of the 2009 volume and 7.8% of the dollars. The consumption value was 7.8% of USD20.6million which give \$1.6 million. Table 2.1 shows the percentage of consumption by end use in 2009.

China is the largest consumer in Asia Pacific with 53 % of the volume and 50% of the value. Figure 2.3 shows adhesive consumption by region in Asia Pacific in 2009. Japan, the second largest market for adhesive in the region took 16% of the 2009 volume and 24% of the value. BAFP Sdn. Bhd. captured the market in rest of Asia region which is 15% of the market size (USD1.6million) which gives USD0.241 billion.

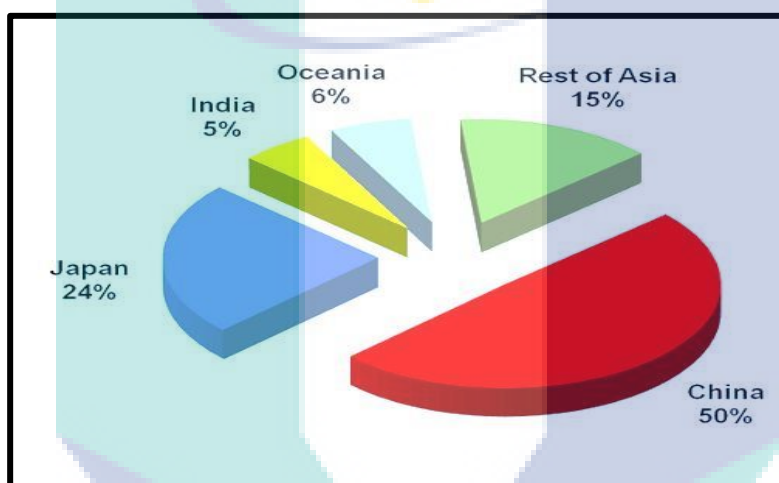


Figure 2.3: Adhesive Consumption by region in Asia Pacific in 2009

Sources: ASC Asia Pacific Market Study/DPNA

There is various type of woodworking in Malaysia Wood Industries. The percentage of them is show in Figure 2.4.

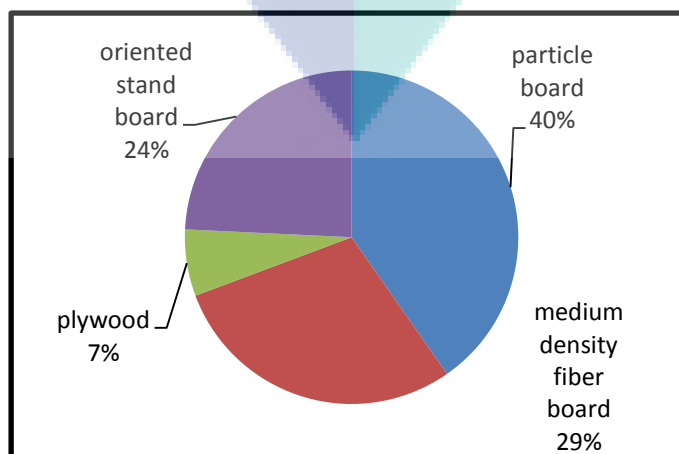


Figure 2.4: Percentage of woodworking type.

BAFP Sdn. Bhd. narrow down into market segment which is 7% from 0.241 billion and give the USD 1.245million. 1MT of adhesive was worth USD275. Thus USD1.245 is equal to 4522MT/year. BAFP Sdn. Bhd. will produce 4500MT/year adhesive which equal to377MT/month. BAFP Sdn. Bhd will sell 500kg/drum packaging which give 750unit/month. Sales projection is projected at 4.5% annual growth. Figure 2.5 shows the sales projection in 5 years' time. The details projection is in Appendix A.

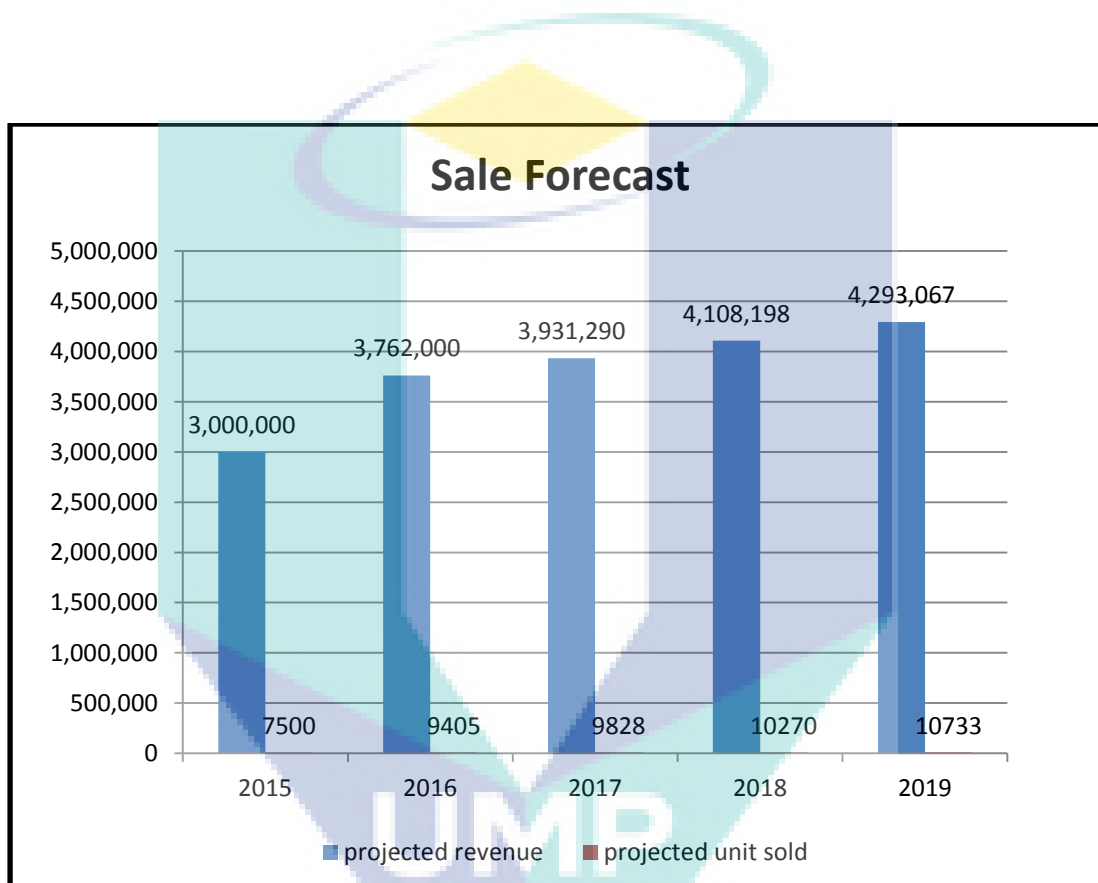


Figure 2.5: Sales Forecast

2.2 TARGET MARKET

Wood Industries especially in veneer and panel product sector that produce plywood-based product. Currently, there were 125 mills in operation in Malaysia. In 2012, the plywood produced was 180milions pieces per year and it needs 80950MT per year of adhesive. The plywood-based products will be exports to other countries such as Thailand, Europe, Middle East, Japan, United States and Taiwan.

2.3 COMPETITORS EVALUATION

2.3.1 POTENTIAL COMPANY

In the adhesive, sealant and coating field, adhesive-producing companies have relatively long track records. Most woods industries use the adhesive instead of bio-adhesive and it is very hard to encourage wood industries to switch mode from using adhesive to bio-adhesive. The adhesive producers are a direct competitor for BAFP Sdn. Bhd. Examples of competitive companies are listed in Table 2.2. The level of competition is indicated in the last row, scaled as follows:

- *** = Competition with substitute technology and strong financial backing
- ** = Competitor in non-target market, can become competitor when focus is shifted towards plywood application.
- * = Not a current threat, but has technology with promising future of that could become a substitute technology



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Table 2.2: Potential Competitors

| Company name | GRP Sdn. Bhd. | Lexis Internazionale Sdn. Bhd. | Bonding Technology Resources Sdn. Bhd. | Treezo Group |
|---------------------|-------------------------------------|---|--|---|
| Focus | Furniture, automotive, construction | Wood adhesive, plywood, | Automotive, flooring, | Plywood, fancy plywood, wood flooring |
| Mechanical strength | High performance | High Performance | High Performance | Excellent performance |
| Type of adhesive | Adhesive | Adhesive | Adhesive | Bio-adhesive |
| Environmental issue | Formaldehyde emission | Formaldehyde emission | Formaldehyde emission | Environmental friendly |
| Raw material | Chemical | Chemical | Chemical | Natural- Soy bean |
| Target Market | - | South America, Eastern Europe, Southeast Asia, Africa, Oceania, Middle East, Eastern Asia | North America, South America, Europe, Southern Asia, Oceania, Mid East, Eastern Asia, Western Europe, Central America, | North America, South America, Southeast Asia, Mid East, Eastern Asia, Western Europe, Northern Europe |
| Price | \$1000/tonne | \$1230/tonne | \$1050/tonne | \$900/tonne |
| Scale | * | *** | ** | *** |

2.3.2 POTENTIAL ADHESIVE

At present, synthetic-based adhesive such as Melamine Urea Formaldehyde (MUF), Urea Formaldehyde (UF), Melamine Formaldehyde (MF), Epoxy, Phenol Formaldehyde, and Unsaturated Polyester were used in market. These conventional adhesives have their own price as stated in Table 2.3. The data shows those conventional adhesives are more expensive than the bio-adhesive. Thus this conventional adhesive can be replace with this new adhesive which is bio-based adhesive.

Table 2.3: Pricing for adhesive

| Num. | Adhesive type | Price (USD)/ton |
|------|----------------------------------|-----------------|
| 1 | Melamine Urea Formaldehyde Resin | \$1400 |
| 2 | Urea Formaldehyde Resin | \$1200 |
| 3 | Melamine Formaldehyde Resin | \$1500 |
| 4 | Epoxy Resin | \$2600 |
| 5 | Phenol Formaldehyde Resin | \$1500 |
| 6 | Unsaturated Polyester Resin | \$2200 |
| 8 | Soybean-based bio-adhesive | \$900 |

2.4 MARKET APPROACH

Jatropha Oil Based bio-adhesive will have to fit in with existing adhesive to enter such market effectively. To achieve the success and gain more profit some approach are taken. The first approach is to obtain or to get accredited from any international standard such as Japan Agriculture Standard (JAS), British Standard (BS), International Hardwood Products Association Standard (IHPA), and Harmonized European Standard (EN). By having these standard our product will go far thus gain high profit. Second approach is by obeying some policy such as policy formaldehyde issue. There have some country have been banned to import formaldehyde emission product. The products that harm the environment are prohibited to enter the country. So, bio-adhesive produced by BAFP Sdn. Bhd. is free-formaldehyde and it will fulfill the criteria to enter other country that use this kind of policy. The last approach is by patent the property to protect from vulnerable act.

CHAPTER 3

COMPANY DESCRIPTION

3.1 NATURE OF BUSINESS

Bio-adhesive for Plywood as known as **BAFP Sdn. Bhd.** is a manufacturer of jatropa oil based bio-adhesive for plywood application. It is a new venture based at Gebeng Industrial Area.

- Missions Statement:

“BAFP Sdn. Bhd will provide best quality of bio-adhesive for plywood application whose performance and appearance are in accordance with our tradition of high manufacturing standards”

- Goals and Objectives:

To be a healthy and successful company that is a leader in bio-adhesive producer in Asia Pacific and that has a loyal customer following.

To achieve annual sales target every year.

To produce the best quality of bio-adhesive for fulfills customer satisfaction.

Main customer for BAFP Sdn Bhd is wood industries especially plywood manufacturer in Malaysia. Malaysia is the top ten wood suppliers of wood based products in the world, especially export to Europe, Japan, Taiwan, Singapore and Middle East. Total exports of plywood-based products from Malaysia was RM4.71 billion in 2012 (MTIB, 2012) and this industry based exports in Malaysia rises nearly 40% compared to the past ten years.

This novel jatropha oil based bio-adhesive is formaldehyde free adhesive which can reopen Malaysia wood export market especially to Europe and United states. While, Europe and United states were banned product manufactured using formaldehyde based adhesive.

Product

This product is bio-based adhesive. It used for plywood application. It is made from natural resources which are from jatropha oil and Jatropha Oil Seed Cake JOSK that obtained from jatropha tree and also glycerol that obtained from biodiesel by product. At present, formaldehyde based adhesives such as phenol formaldehyde (PF), urea formaldehyde (UF) and melamine urea formaldehyde (MUF) resin are predominantly used. These adhesives are synthetically produced from non-renewable resources such as petroleum and natural gas. Formaldehyde based adhesive was not environmental friendly because formaldehyde gas was releases from the wood panel which was carcinogenic to humans. (IARC, 2004). Thus, this bio-based adhesive product prepared without using formaldehyde which yield comparable mechanical properties and having better performance for the plywood to pass the international standard specifications and it is environmental friendly since it's made of natural resources instead of non-renewable sources.

Price

The price for 1 unit finished end (500kg) is calculated based on the cost of goods sold to produce a unit. The price for each unit is the sum up of total cost of goods sold for a unit, 100 percent markup for a profit, 10% for manufacturing cost including labor cost and 5% service charge. The price for 1 unit product is \$400. The details calculation of the price and cost of goods sold are stated in the Appendix B

Promotion

There are several significant ways to promote and sold the product. The main route is by using direct sale. The finished end products are direct sell to plywood manufacturer. In addition, it supports by internet networking. The promotion will be done using famous and known website, Twitter and Facebook. All the article and advertisement are release in the internet. Other than that, the advertisement and promotion also will be done by having a grand opening ceremony, launching, and sales. The sharing moment also will be done by having a business talk or conferences with our target customer. The demonstrations on how effective of our product also will be done to attract target market well-known to the product. Other that, BAFP Sdn. Bhd. also join and business expo or business showcase to do a network and find strategy to enhanced our business skills.

3.2 MANAGEMENT TEAM AND ORGANIZATION

3.2.1 Organization Structure

BAFP Sdn. Bhd has constructed the organization structure in order to organize the company. The company led by the CEO. Two main areas which are operation and management and support are under the CEO supervision. For operation part, it head by General Manager and for management and support are head by Commercial Manager. Under the operation there are engineer, chemist, technicians and assistants to run the operation. Under the management and support there are Marketing Sales executive, Office manager and administrator. Each of the position in the organization has their own responsibility and role. Figure 3.1 shows the organization structure for BAFP Sdn. Bhd.

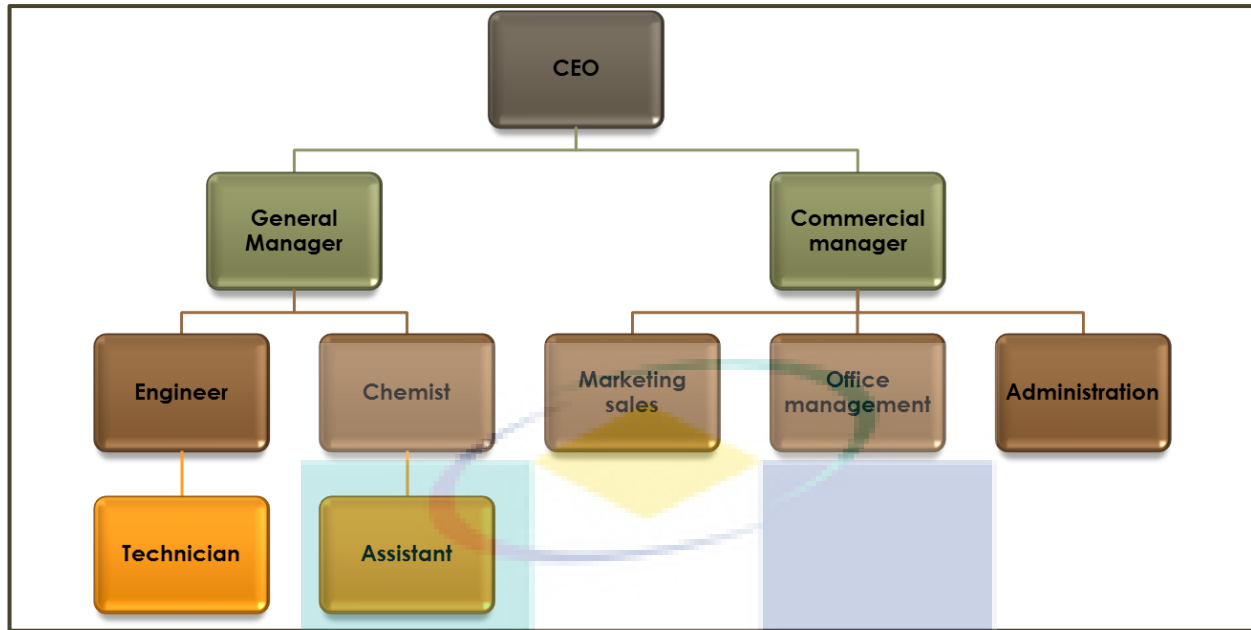


Figure 3.1: Organization Structure of BAFP Sdn. Bhd.

3.2.2 Key Individual Role

In order to have a healthy business, each management team should have their own focusing area. Thus each position has their own job specification. Figure 3.2 shows the key role for each position in the company.

CEO

- understand the every-day activities of the organization and how all the parts fit together to move the company forward.
- maintain a highly trained management team that is fully capable of handling tasks.
- remain focused on the primary duties of increasing revenues, and meeting the goals identified in the vision.

GENERAL MANAGER

- develop a strategic plan for the approval of the Board and once it is approved, is responsible for the operational planning to successfully execute.
- effectively lead people, delegate, manage time & resources and communicate.
- responsible for the overall performance of the entire business

COMMERCIAL MANAGER

- In charge in marketing and handle daily business issues, manage company associations, and recognize business opportunities
- constantly communicating and negotiating with clients or business associates
- continuously working to strategically expand, preserve or improve the company's procedures, standards or policies while sticking to business edicts and regulatory guidelines



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Engineer

- Develop safety procedures to be employed by workers operating equipment or working in close proximity to on-going chemical reactions.
- Determine most effective arrangement of operations, such as mixing, reaction, and heat transfer.
- Prepare estimate of production costs and progress reports for management.

Technician

- Trouble shoots and repair complex mechanical and electrical assemblies used in equipment to the component level.
- Performs routine equipment maintenance and limited troubleshooting activities as required
- Work with engineering on functionality issues and procedure updates

Chemist

- Prepare test solutions, compounds, and reagents for laboratory personnel to conduct test.
- Compile and analyse test information to determine process or equipment operating efficiency and to diagnose malfunctions.
- Direct, coordinate, and advise personnel in test procedures for analyzing components and physical properties of materials.



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Marketing and Sales

- managing organization's sales and marketing activities
- establishing and implementing a sales methodology, tracking the sales pipeline and measuring performance against sales quotas.
- planning, coordinating and implementing marketing programs to identify and acquire new customers
define their department's monthly, quarterly and annual goals and make sure that sales and marketing objectives align with overall company goals.

Office management

- Balancing office budgets, arranging travel, meetings and appointments
- Supervising and monitoring the work staff
- Reviewing and implementing the company's health and safety policy
- Arranging training for staff

Administration

- Sorting out the post
 - Ordering office stationery supplies
 - Typing
 - Managing diaries
- Answering the phones
Greeting clients
Filing

Figure 3.2: Key Individual Roles

3.3 LOCATION OF OPERATION

A preliminary feasibility study must be conducted before started the plant construction. That is important to determine whether our plant is sufficient to be built or not in term of economic aspect, safety, environmental impact controllability and the flexibility for our plant in short and long term period.

Location of a chemical plant is very important criterion that must be considered seriously. A good and suitable location of the plant can affect the plant success day to day and in the future operation. Considerable care must be exercised in the selecting the plant site, and many different

factors must be considered. Primarily, the plant should be located where the minimum cost of production and distribution can be obtained, but the other factor, such as space for expansion and safe living conditions for plant operation as well as the surrounding community are also important. The choice of the final site should be based on a complete survey of the advantages of availability industrial estates.

In Malaysia, there are three major petrochemical zones that governments have already setup for this industry which is at Kerteh, Terengganu; Gebeng, Pahang; and Pasir Gudang/Tanjung Langsat, Johor.

A proper selection must be done in order to obtain the most suitable and profitable of the location. The choice of the final site should first be based on a complete survey of the advantages and disadvantages of various geographical areas. There are several factors to be considered when selecting a suitable site, such as:

1. The type of industry allowed in the Industrial Park. Bio-adhesive plant is the must be built in designated area specially setup for chemical industries.
2. The availability of space area for building a plant.
3. The price of the land in the park. The price is a one-time pay out. Therefore, if the price range is acceptable, it could be recovered in the long run.
4. The availability of raw material. To make sure the plant can running day over day.
5. Utilities available, which are electricity and water supplies. Utilities rate are important as the cost is directly associated with the production cost.
6. Transportation system availability such as road, airport and port. The importing and exporting of raw materials and products will effect on the overall cost.
7. Availability of manpower.
8. Waste disposal. Ethical issues will emerge from the mismanagement of wastes and subsequently the fines will follow.
9. Research and development organization. R&D benefits could help reduce the cost of operation.
10. The government policies and incentives offered. Incentives such as tax reduction or exemption

There are three places in Malaysia, which are suitable for the location of this chemical plant. The manufacture of bio-adhesive is classified as a petrochemical project. The plant must be located in a specialized zone provided by government. Three main locations that have been short listed to setup the proposed methanol plant are:

1. Kerteh in Terengganu
2. Gebeng Industrial Park in Pahang
3. Pasir Gudang-Tanjung langsung in Johore

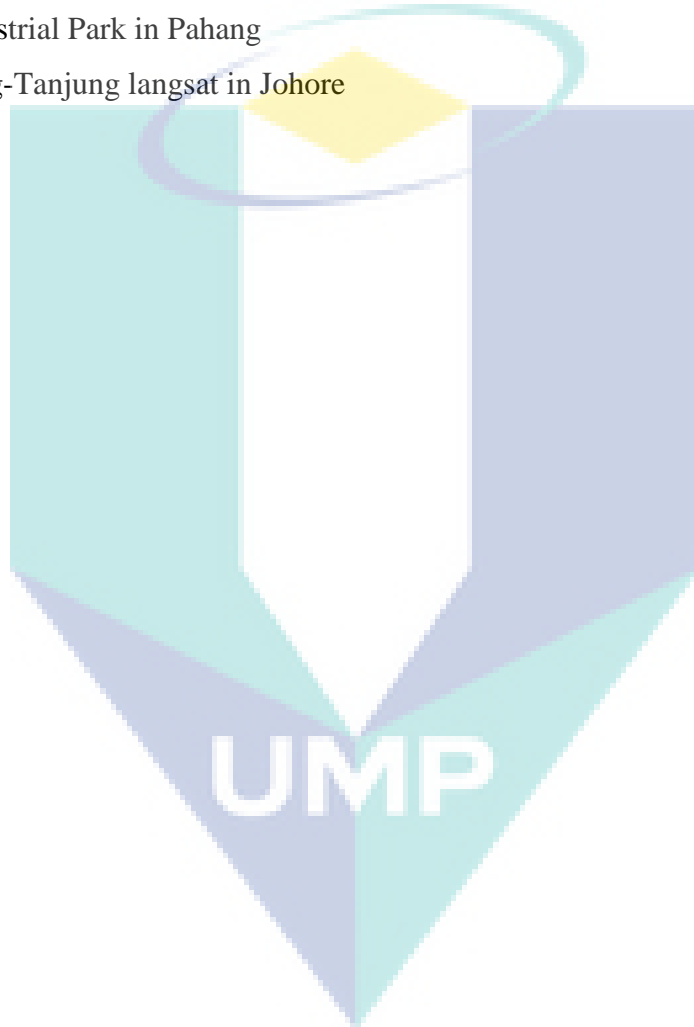


Table 3.1: Plant selection analysis

| Factors | Kerteh, Terengganu | Gebeng, Pahang | Tanjung langsung, Johore |
|--|--|--|--|
| (1) Location | -130km from Kuala Terengganu town 4 | -25km from Kuantan town 4 | -42km from Johor Bahru town -46km from Singapore 4 |
| (2) Type of Industry Preferred | Petrochemical & chemical industry 5 | Petrochemical & chemical industry 5 | Petrochemical & chemical industry 5 |
| (3) Area available | 516 hectares 3 | 1279 hectares 5 | 579.52 hectares 3 |
| (4) Land prices (per ft ²) | RM 4.18– RM 9.94 5 | RM 9.00 – RM 10.00 4 | RM 15.80 – RM 17.00 2 |
| (5) Availability of raw material | Terengganu 4 | Terengganu 3 | Terengganu 2 |

| Factors | Kerteh, Terengganu | Gebeng, Pahang | Tanjung langsung, Johore |
|------------------------|--|---|---|
| (6) Electricity supply | Paka Power Plant 4 | Tenaga Nasional Berhad (TNB) 4 | Sultan Iskandar Power Station(TNB) 4 |
| (7) Water supply | Terengganu Water Company (SATU) 4 | Semambu Water Treatment Plant (JBA) 4 | Sungai Layang Water Treatment (SAJ) 4 |
| (8) Transport system | Sultan Ismail International Airport, Kerteh Airport East coast highway (LPT) - Kuantan Port - Kemaman Port 4 | Sultan Ahmad Shah Airport, Kuantan East coast highway (LPT) - Kuantan Port - Kemaman Port 5 | - Sultan Ismail Airport, Senai -Changi Airport, Singapore North South Highway (PLUS) - Pasir Gudang Port - Tanjung Langsat Port - Tanjung Pelepas Port Rail to Singapore 5 |

| Factors | Kerteh, Terengganu | Gebeng, Pahang | Tanjung langsung, Johore |
|---|---|---|--|
| (9) Research & Development Organization | -Uni. Malaysia Terengganu -Uni. Darul Iman Malaysia -Institut Teknologi Petroleum -Petronas Terengganu -Pusat Latihan Keselamatan Terengganu (TESDEC) -Kolej Universiti TATI <div style="text-align: right; border: 1px solid black; width: 20px; height: 20px; display: inline-block; margin-top: 10px;">4</div> | -Universiti Malaysia Pahang(UMP) -International Islamic University Malaysia (UIA) -MARA Community College -Sultan Ahmad Shah Polytechnic -Pahang Skill Dev. Centre -Shahputra University College -Institut Kemajuan Ikhtisas Pahang <div style="text-align: right; border: 1px solid black; width: 20px; height: 20px; display: inline-block; margin-top: 10px;">5</div> | -Universiti Teknologi Malaysia (UTM) -Universiti Tun Hussein Onn (UTHM) Malaysia -Institut Latihan Perindustrian <div style="text-align: right; border: 1px solid black; width: 20px; height: 20px; display: inline-block; margin-top: 10px;">3</div> |
| (10) Added Value | East Coast Development Region <div style="text-align: right; border: 1px solid black; width: 20px; height: 20px; display: inline-block; margin-top: 10px;">5</div> | East Coast Development Region <div style="text-align: right; border: 1px solid black; width: 20px; height: 20px; display: inline-block; margin-top: 10px;">5</div> | Iskandar Development Region <div style="text-align: right; border: 1px solid black; width: 20px; height: 20px; display: inline-block; margin-top: 10px;">5</div> |
| Total | 42 | 44 | 37 |

Based on our evaluation and weightage study in Table 3.1, we can conclude that the best site for our plant is in Gebeng Industrial Park, which is located in Pahang Darul Makmur. Gebeng Industrial Park is located about 25km from the Kuantan Town. Gebeng Industrial Park lies at a strategic location of heavy industrial area and also petrochemical hub for multinational players like BASF, Amoco, Kaneka, Eastman and Polyplastics.

According to Pahang State Development Corporation, the state government has approved 1279 hectares of area for development. This industrial park which has ready-built industrial land and factories can allocate medium and heavy industries, chemical and petrochemical industries. The selling price of the land is reasonable which around RM 9.00 to RM 10.00 per sq ft.

Since Gebeng is situated in the East Coast, skilled labors are not of a problem. Research and development organization such as University Malaysia Pahang (UMP), International Islamic University Malaysia (UIA), Pahang Skill Development Centre, Institut Kemajuan Ikhtisas Pahang and so on will fulfill industrial requirement. Apart from that, jobs can be offered to the graduates that enable after finish their study.

With all the infrastructures available in the area, such as transportation facilities, utilities supply and telecommunication plus the government incentives, make Gebeng an attractive location to set up a methanol plant. About 800 MW power supply provided by Tenaga Nasional Berhad (TNB) and 64 MG/D water provided to support the development of this industrial area.

CHAPTER 4

OPERATION DESCRIPTION

4.1 OPERATING TIMELINE

BAFP Sdn. Bhd. proposed a timeline such in Figure 4.1. The first step in joining a new venture is to have a deeply understand of the business concept. It is includes build-up the strategy, do a research on marketing and financial plan. After thorough understanding, fund required are obtained to start-up the business. The installations of equipment are done and start to do the advertising and promotion. This step takes two month of period. After installation equipment, the initial operation phase is starts where the productions begin. When the finished end produced, grand opening ceremony and product launching are organized.

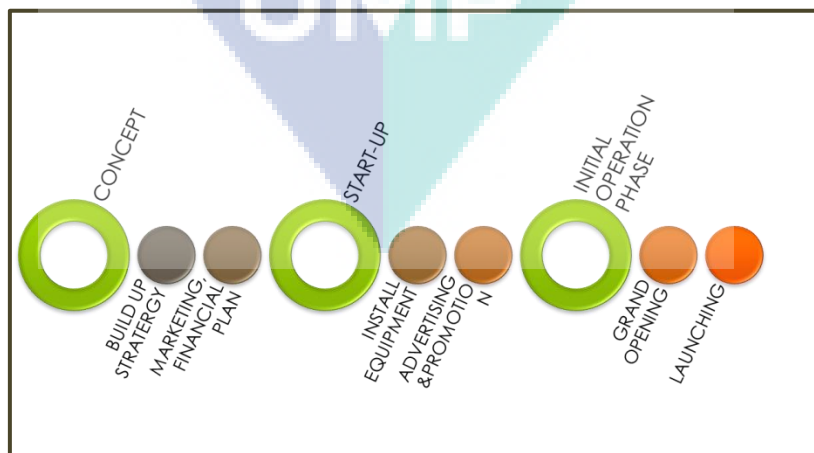


Figure 4.1: Proposed Business timeline

4.2 PROCESS DESCRIPTION

The process synthesis and flow sheeting play an important role in order to design the overall process plant. The enlargement of the overall design project involves many different design considerations. Failure to include these considerations in the overall design project may perhaps, in many instances, alter the entire economic situation so significantly as to make the project valuable. In order to ensure the quality of the product, to maintain the profitability, safety and the environment factors of the plant, the equipment is chosen cautiously and prudently.

Generally, our plant is producing 4522 MT/Annum of Bio-adhesive. Alcoholysis and esterification method is use to produce our preferred product. Our plant is operating for 330days per year excluding maintenance and upgrading works. This process is batch mode which runs 24 hour per day. The production management tool uses was lean production which uses resources more efficiently to lower costs and improve service.

When the raw materials were load, the production bio-resin is starts then follow by producing the adhesive. Lastly the line proceeds to packaging. After packaging, the product ready to shipping. The process of our plant can be categorized into 2 main process sections and a utility section, which are:

- i) Production of bio-resin
- ii) Production of bio-adhesive
- iii) Utilities

General Overview of production Bio-adhesive is shows in Figure 4.2.

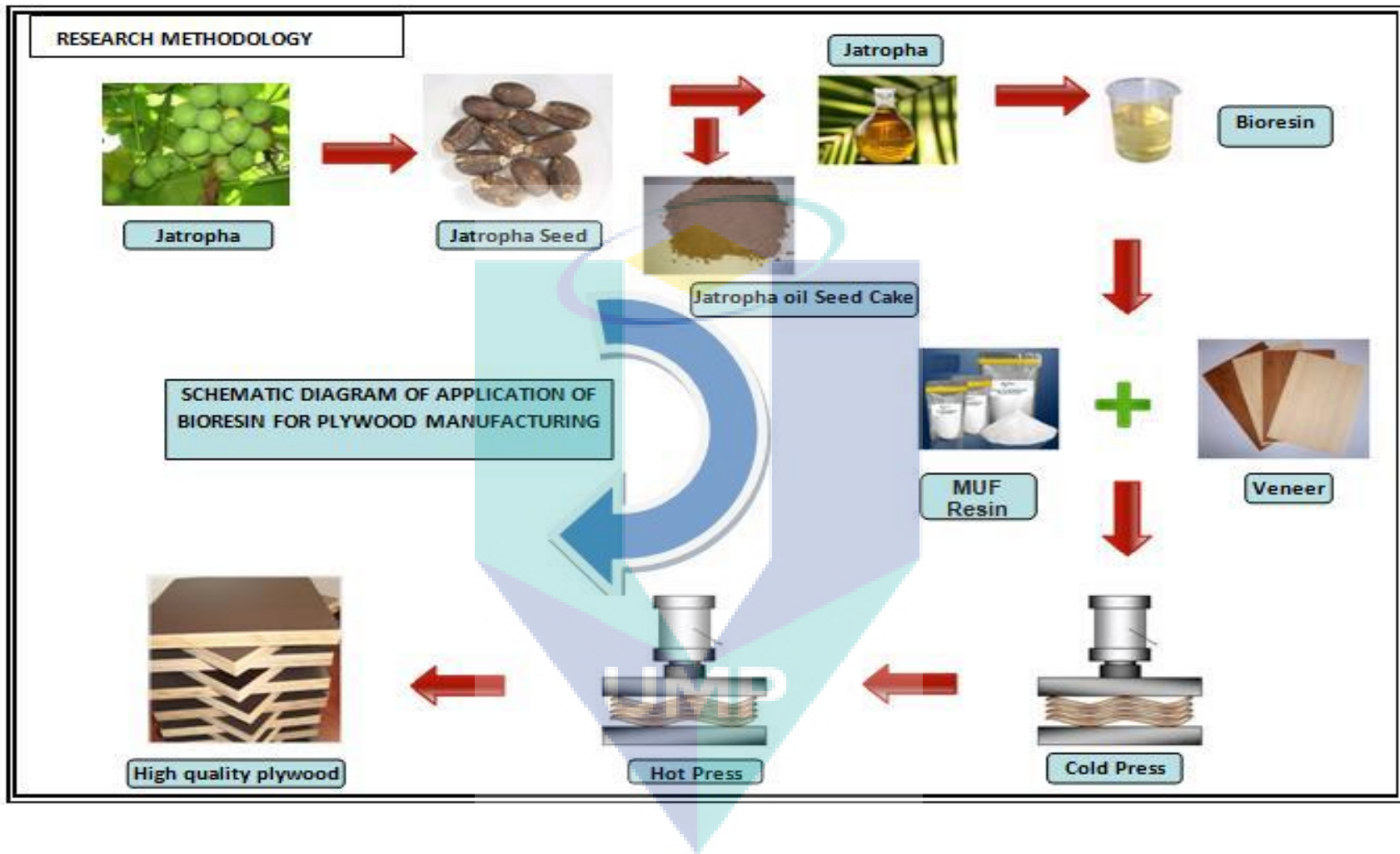


Figure 4.2: Schematic flow of production of bio-adhesive.

Location

Plant location is very important needed in a company. BAFP Sdn. Bhd has decided this plant layout as drafted in Figure 4.3. The plant layout is designed with consideration of safety issue.

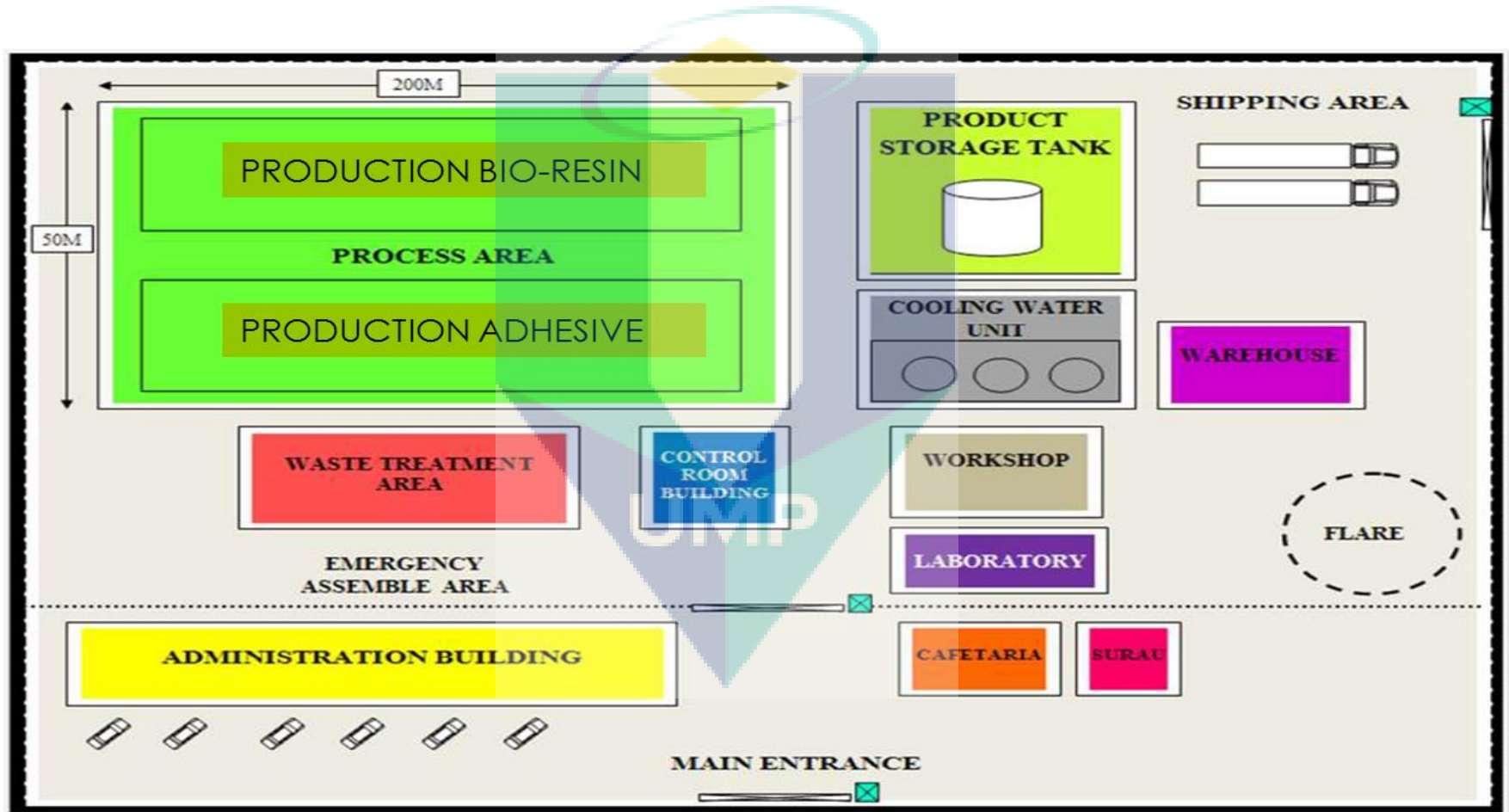
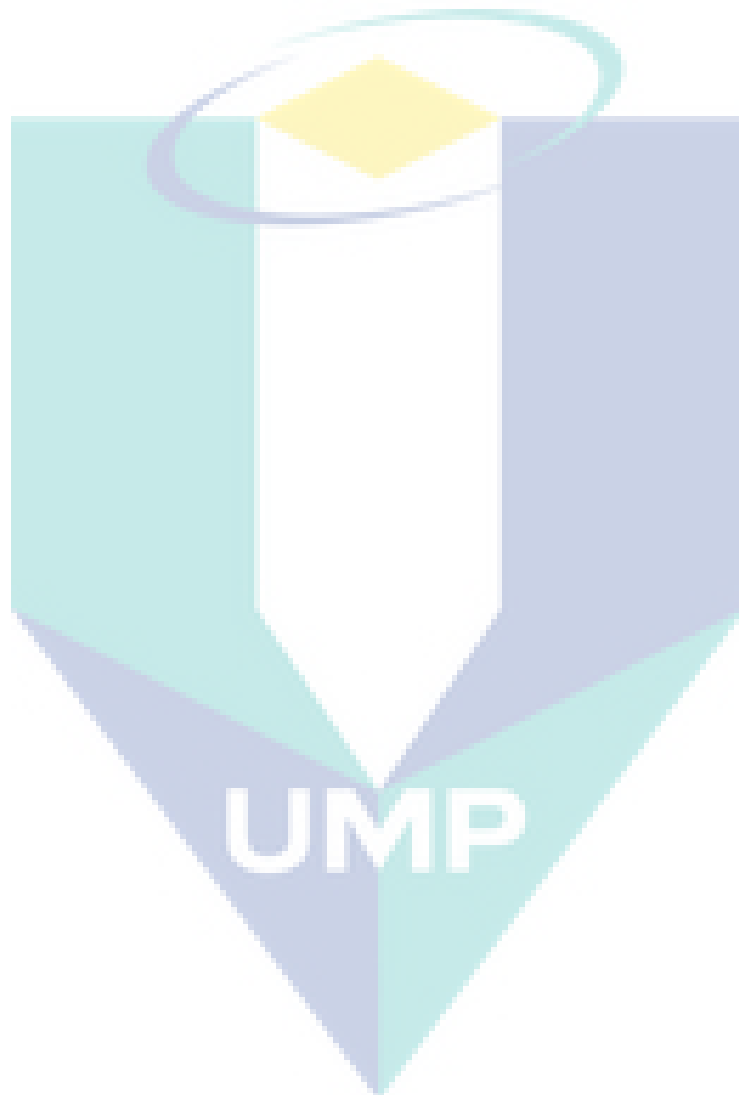


Figure 4.3: Bio-adhesive Plant Layout

BAFP Sdn. Bhd. needs two acres of land for the company. From the plant layout, administration areas are separated from process area. There also have three entrance which are main entrance where the workers enter from this entrance, production area entrance where person that have permit only can access to the area and shipping area entrance where applicable for shipping purpose only.



CHAPTER 5

FINANCIAL

5.1 START-UP AND CAPITALIZATION

From the financial projection, BAFP Sdn. Bhd. needs \$2,500,000 fund to start the business. Summary of Start-up expenses are as Figure 5.1.

| Summary Statement | |
|----------------------------------|---------------------|
| Sources of Capital | |
| Owners' and other investments | \$ 500,000 |
| Bank loans | 1,000,000 |
| Other loans | 1,000,000 |
| Total Source of Funds | \$ 2,500,000 |
| Startup Expenses | |
| Buildings/real estate | \$ 124,000 |
| Leasehold improvements | - |
| Capital equipment | 1,830,000 |
| Location/administration expenses | 25,216 |
| Opening inventory | - |
| Advertising/promotional expenses | - |
| Contingency fund | 520,784 |
| Working capital | - |
| Total Startup Expenses | \$ 2,500,000 |

Figure 5.1: Summary for Start-up Expenses

The required fund is to lease the buildings and purchase equipment. Other than that is for location and administration purposed. The balance of the fund is to use as a contingency fund. The detail on the start-up expenses are attached in Appendix B

5.2 FUNDING REQUEST

As the required funding amount \$2million, BAFP Sdn. Bhd. was requested 50% of the required fund at bank as a loan. The loan amount is \$1million. This 1 million is used to lease building and buying land for the company. Another 25%, BAFP Sdn. Bhd. was requested at Malaysia Debt Venture Berhad (MDV) under Green Technology Financing Scheme (GTFS). MDV is a Venture Financing Organization, providing contract/project financing facilities to early and growth stage companies within MDV's ICT and Biotechnology Technology Focus Areas. The GTFS introduced by the Government aims to promote green technology by availing loans of financing to companies that supply and utilize green technology. The objective of GTFS is to promote investments in Green Technology which:

- Minimizes the degradation of the environment;
- Has a zero or low greenhouse gas (GHG) emission;
- Safe for use and promotes healthy and improved environment for all forms of life;
- Conserves the use of energy and natural resources; or
- Promotes the use of renewable resources

As BAFP Sdn. Bhd. meets the requirement of funding, BAFP Sdn. Bhd. requests \$500,000 from MDV to start the business. The fund is used to purchase the equipments and to cover cost during the installation.

Another 25%, BAFP requested fund at Malaysian Technology Development Cooperation (MTDC) under Commercialization of R&D Fund (CRDF). The CRDF provides added stimuli for the right innovation among Malaysian-owned companies, by providing partial grants to qualified R&D projects. These grants will enable full commercialization of home-grown R&D, developed by local universities/ research institutions or the private sector. BAFP Sdn. Bhd. was requested \$500,000. The fund is to cover the costs of:

a) Equipment

- Cost of the purchase of equipments for Quality Control and Production
- Cost of maintenance of equipments

b) Technology

- Cost of technology/ consultation/ training

c) Administration and Overhead

- Cost of allowance for management and technical personnel
- Cost of rental at technology centre
- Cost of utilities

d) Services

- Cost of core raw materials
- Cost of advertisement and promotion
- Cost of certification and standard
- Cost of production out-sourcing

5.3 PROSPECTIVE FINANCIAL DATA

As the purpose of investing money in chemical plant is to earn money, some means of comparing the economic performance of projects is needed. The projection of income statement, Cash Flow statement and Balance Sheet Statement are projected for five years.

5.3.1 Profit and Loss Projection

Profit and Loss Projection will shows the total revenue that company generated, total expenses o the company and the net profit that company can obtain. BAFP have some assumption before the projection. The assumptions are as follow:

- The Salaries expenses is increased 8% per year
- Payroll Taxes (EPF and SOCSO) is 8% of total salaries.
- Insurance covers is 20% of the sales
- Utilities for electric consumption is 50000kW/hr per month
- Utilities for water consumption is 70 m³ per month
- Repair and maintenance is 0.1% of total equipment cost. (considered at the year 3 since for the first two years still under warranty)
- Depreciation of the equipment is 5 year life
- Car, Delivery and travel is \$1000/month for each year
- Accounting and Legal is \$700/month for each year
- Interest rate is 6% per year

- Advertising is 10% of revenue.
- Income taxes are 25% of net profit before taxes.

From the projected income statement figure 5.2, it shows BAFP Sdn. Bhd. started gain profit on the second year operation. On the first year, BAFP Sdn. Bhd. got loss because of the initial two month is no production and we have no sales. From the figure, we can see BAFP Sdn. Bhd. Profit is growth 43% in 5 year. The details Income Statement are attached in the Appendix C

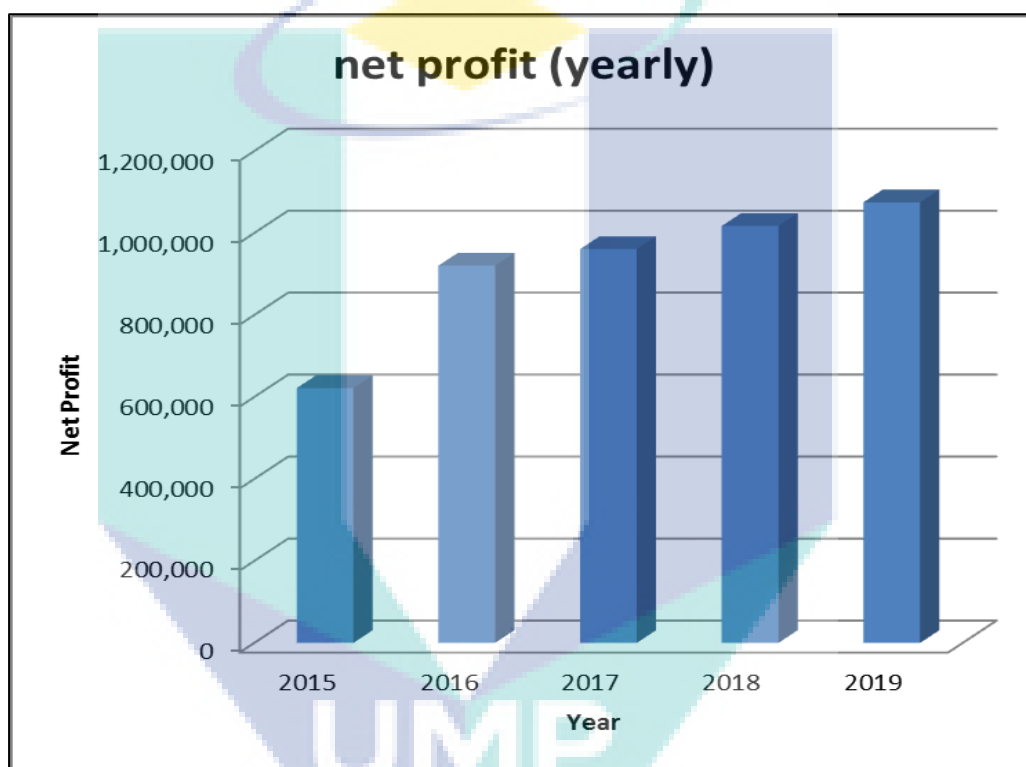


Figure 5.2: Yearly Net Profit

5.3.2 Cash Flow Projection

Cash Flow projection is to show the cash position of the company. In other word to show where the cash goes in and out. The following figures are the projected cash flow each year in 5 year time. BAFP Sdn. Bhd. sales 90% of the products to the customer and keeps another 10% as inventory every month. 60% from the sales are paid by cash and 30% goes to account receivable. The clients will pay the debt next month after buying and the cash are put into account at mid and end of the year. During first year USD250,000 was injected into account to cover the negative cash. This injection is a working capital for next production. All

the injections were paid on the second, third and fourth year. From the following figures, it shows the cash of company increase throughout the years. The details cash flow are attached in Appendix D

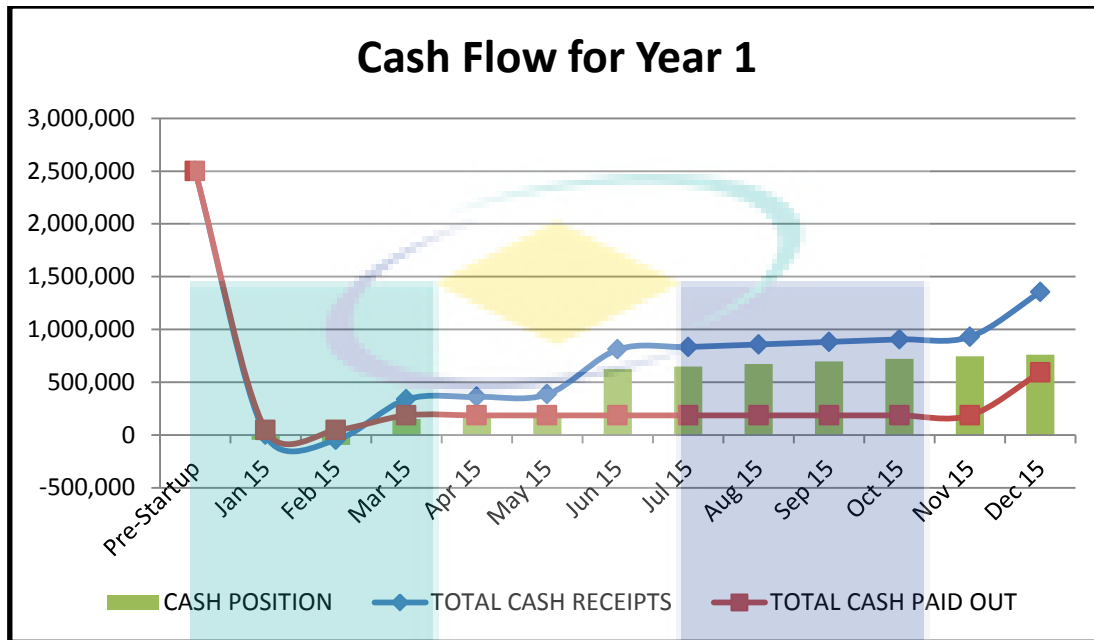


Figure 5.3: Cash Flow for Year 1

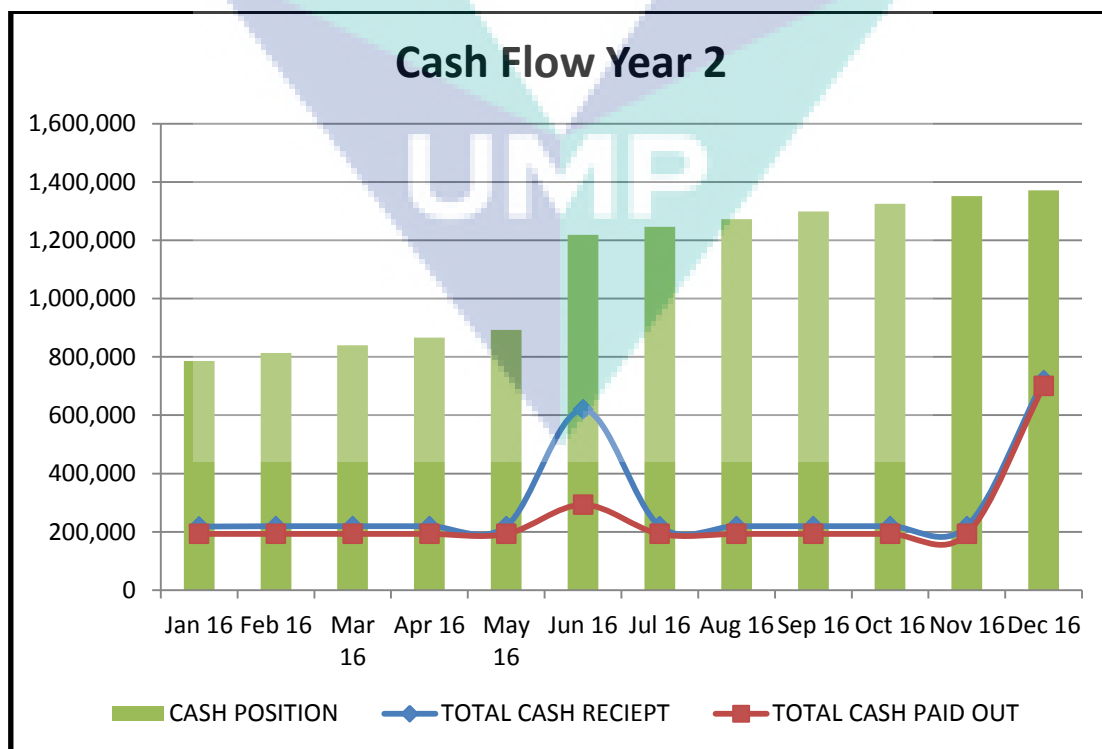


Figure 5.4: Cash Flow for Year 2

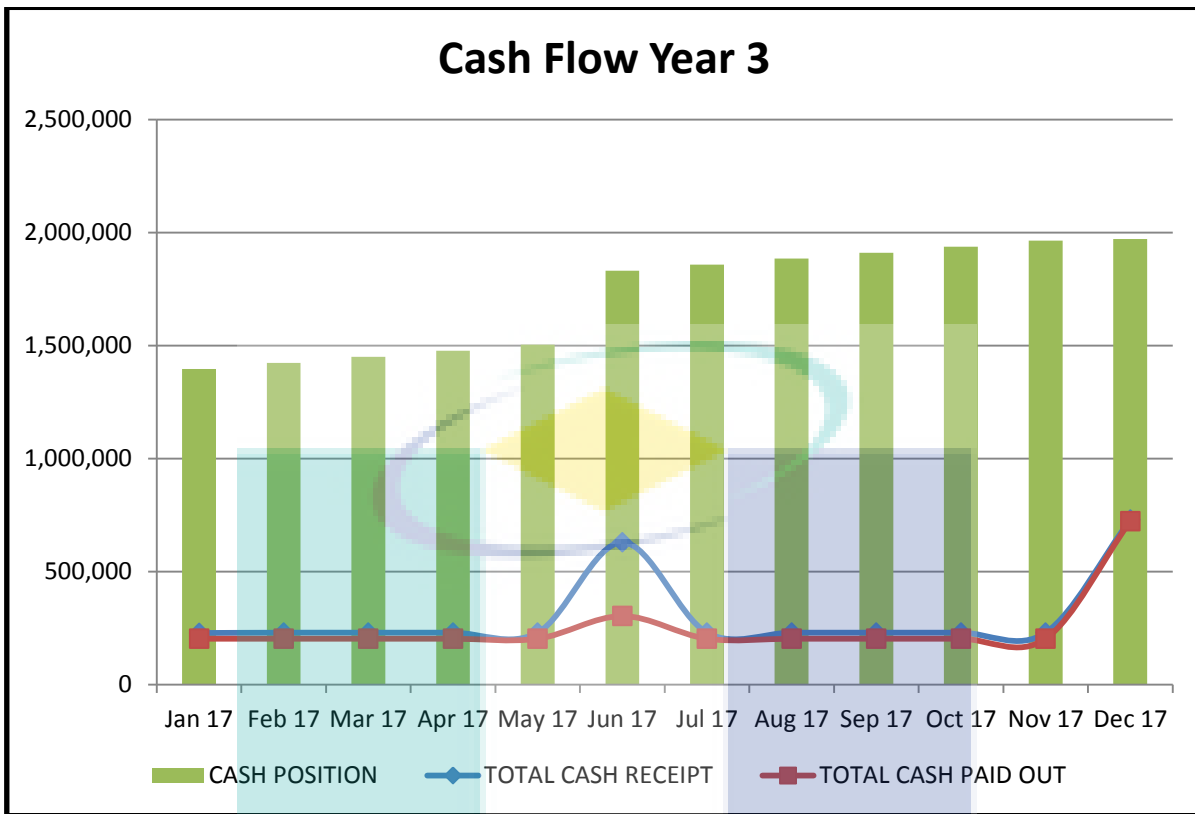


Figure 5.5: Cash Flow for Year 3

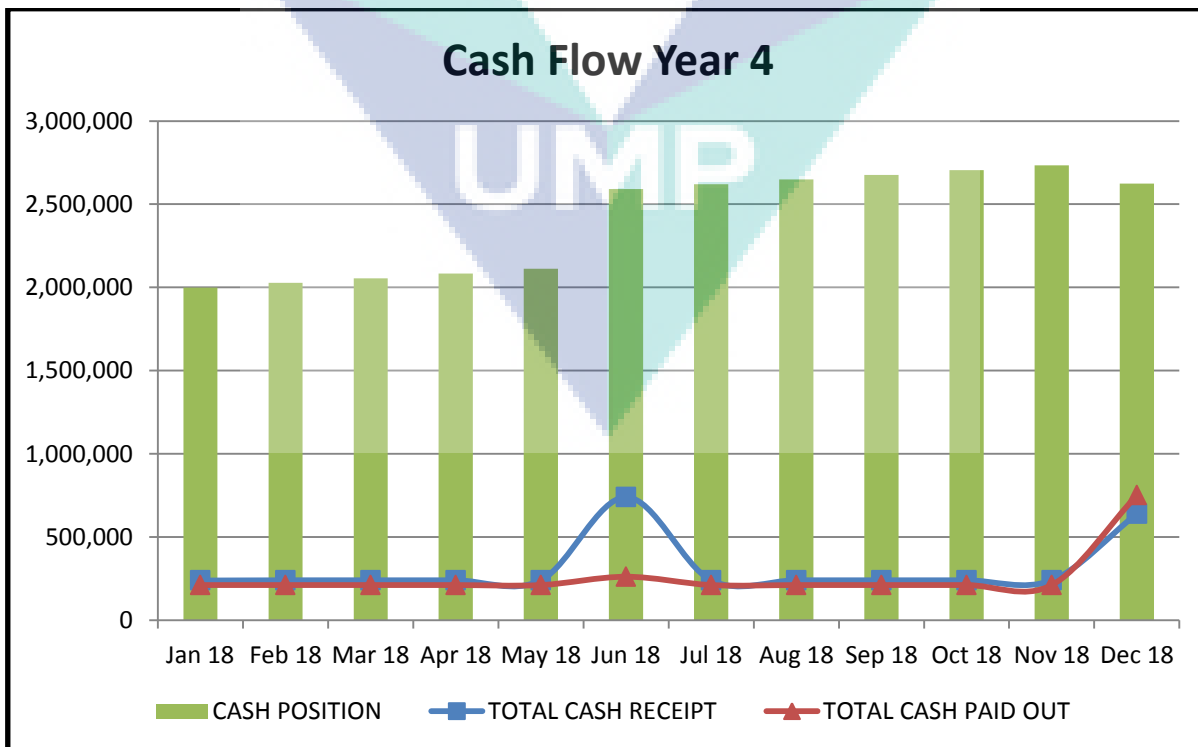


Figure 5.6: Cash Flow for Year 4

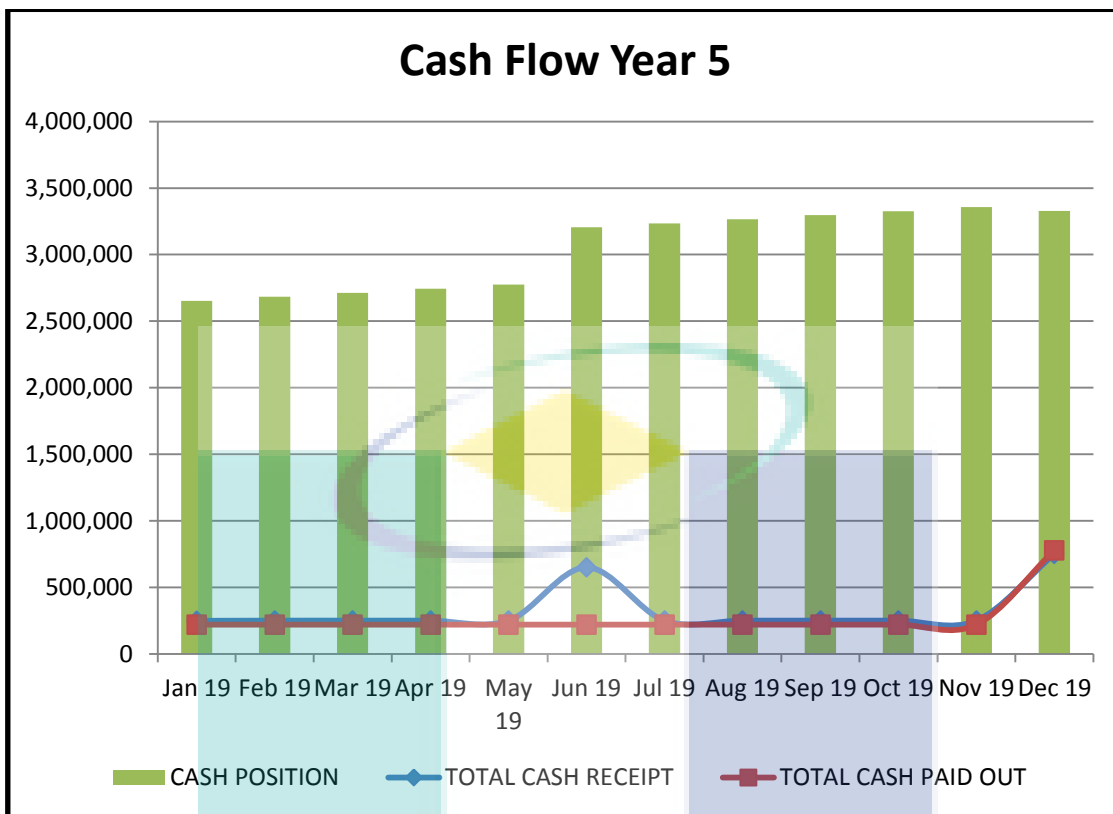


Figure 5.7: Cash Flow for Year 5

UMP

5.3.3 Balance Sheet Projection

Balance Sheet shows the total asset and the total liabilities that companies have. From balance sheet also we can find ratio analysis. Details of Balance Sheets are stated in Appendix E.

| Assets | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|------------------|------------------|------------------|------------------|------------------|
| Current Assets | | | | | |
| Cash | 761,327 | 1,371,361 | 1,970,958 | 2,623,786 | 3,328,904 |
| Accounts receivable | 100,000 | 328,600 | 607,987 | 940,446 | 1,328,367 |
| Inventory | 30,000 | 31,350 | 32,761 | 34,235 | 35,776 |
| <i>Total current assets</i> | 891,327 | 1,731,311 | 2,611,706 | 3,598,467 | 4,693,046 |
| Fixed (Long-Term) Assets | | | | | |
| Property, plant, and equipment | 1,830,000 | 1,830,000 | \$ 1,830,000 | \$ 1,830,000 | \$ 1,830,000 |
| Land and building | 124,000 | 124,000 | \$ 124,000 | \$ 124,000 | \$ 124,000 |
| (Less accumulated depreciation) | (219,600) | (439,200) | (658,800) | (878,400) | (1,098,000) |
| <i>Total fixed assets</i> | 1,734,400 | 1,514,800 | 1295200 | 1075600 | 856000 |
| Other Assets | | | | | |
| Deposits | 25,216 | 25,216 | 25,216 | 25,216 | 25,216 |
| Contingency Fund other | 520,784 | 520,784 | 520,784 | 520,784 | 520,784 |
| <i>Total Other Assets</i> | 546,000 | 546,000 | 546000 | 546000 | 546000 |
| Total Assets | 3,171,727 | 3,792,111 | 4,452,906 | 5,220,067 | 6,095,046 |
| Liabilities and Owner's Equity | | | | | |
| Current Liabilities | | | | | |
| Short-term loans | 250,000 | 150,000 | 50,000 | | |
| <i>Total current liabilities</i> | 250,000 | 150,000 | 50,000 | - | - |
| Long-Term Liabilities | | | | | |
| Long-term debt | 1,800,000 | 1,600,000 | 1,400,000 | 1,200,000 | 1,000,000 |
| Other | | | | | |
| <i>Total long-term liabilities</i> | 1,800,000 | 1,600,000 | 1,400,000 | 1,200,000 | 1,000,000 |
| Owner's Equity | | | | | |
| Owner's investment | 500,000 | 500,000 | 500,000 | 500,000 | 500,000 |
| Retained earnings- current | 621,727 | 920,384 | 960,794 | 1,017,161 | 1,074,979 |
| Retained earning - beginning | - | 621,727 | 1,542,111 | 2,502,906 | 3,520,067 |
| <i>Total owner's equity</i> | 1,121,727 | 2,042,111 | 3,002,906 | 4,020,067 | 5,095,046 |
| Total Liabilities and Owner's Equity | 3,171,727 | 3,792,111 | 4,452,906 | 5,220,067 | 6,095,046 |

Figure 5.8: Balance Sheet Projection

5.3.4 Financial Analysis

The analysis is to show the health of the business. Figure 5.9 shows the financial analysis for BAFP Sdn. Bhd. for 5 years. All details calculation on Financial Analysis is in Appendix F.

| | Baseline | | | | |
|------------------------------|----------|---------|---------|---------|---------|
| | 2015 | 2016 | 2017 | 2018 | 2019 |
| Debt to equity | 2.83 | 1.86 | 1.48 | 1.30 | 1.20 |
| Assets to equity | 2.83 | 1.86 | 1.48 | 1.30 | 1.20 |
| Debt ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Times interest earned | 13.73 | 19.14 | 22.52 | 26.54 | 31.29 |
| Net wkg cap'l (,000 OMITTED) | 641.33 | 1581.31 | 2561.71 | 3598.47 | 4693.05 |
| Current ratio | 3.57 | 11.54 | 52.23 | #DIV/0! | #DIV/0! |
| Quick ratio | 3.45 | 11.33 | 51.58 | #DIV/0! | #DIV/0! |
| Days sales outstanding | 45.63 | 133.27 | 246.57 | 381.40 | 538.73 |
| Inventory turnover | 45.08 | 54.06 | 54.00 | 53.96 | 53.88 |
| Days sales in inventory | 8.10 | 6.75 | 6.76 | 6.76 | 6.77 |
| Asset turnover | 0.65 | 0.69 | 0.54 | 0.55 | 0.49 |
| Equity turnover | 1.85 | 1.29 | 0.80 | 0.71 | 0.59 |
| Working capital turnover | 3.23 | 1.66 | 0.93 | 0.80 | 0.64 |
| Return on sales | 0.30 | 0.35 | 0.40 | 0.35 | 0.36 |
| Return on total assets | 0.20 | 0.24 | 0.22 | 0.19 | 0.18 |
| Return on equity | 0.74 | 0.60 | 0.43 | 0.34 | 0.28 |
| Operating return | 0.26 | 0.32 | 0.29 | 0.26 | 0.24 |
| Gross margin | 0.35 | 0.36 | 0.26 | 0.36 | 0.36 |

Figure 5.9: BAFP Sdn. Bhd. financial analysis

CHAPTER 6

RISK ANALYSIS

6.1 INDUSTRIAL RISK

The global economic and financial crisis led to substantial falls in demand for adhesive. When the demand was dropped, BAFP will have a big problem on production and sales. As a reaction to the significant drop in demand, BAFP Sdn. Bhd. will initiated comprehensive measures to reduce and optimize the production.

6.2 MARKET RISK

The risk that might be face for this company is the insufficient source of capital from the shareholders or the bank loan. This will affect the start-up process of the company since the company need a sufficient amount for start-up and begin operation. To overcome this risk, BAFP Sdn. Bhd. tries to seek any other funds to gain more financial support. Other risk is on the capital obtained from the investor. The possible risk is where the investor stops investing to the company. As a contingency plan, BAFP Sdn. Bhd. makes a deal contract with the investor regarding the mature period policy.

6.3 OPERATIONAL RISK

The raw materials for producing bio-adhesive are available in Malaysia. The possible risk might be faces are the main suppliers suddenly cannot supply the raw materials. This case will affect the production line and reduce the sales thus the profit will loss. To overcome this problem, BAFP Sdn. Bhd. will make a contract with the supplier and action will be taken to

those not comply or breach the contract. Other than that BAFP Sdn Bhd. should prepare a backup list of supplier for raw materials.

Since current plywood manufacturer used conventional adhesive, BAFP Sdn. Bhd. might face the problem where the manufacturer do not want to switch from conventional adhesive to the new one which is our bio-adhesive. To convince them, BAFP Sdn Bhd. needs to have a day with the plywood manufacturer and others target customer to do a demonstration and testimony about product. Furthermore, BAFP Sdn. Bhd. needs to explain the benefit and advantage of switching from the conventional adhesive to the new one which is bio-adhesive.

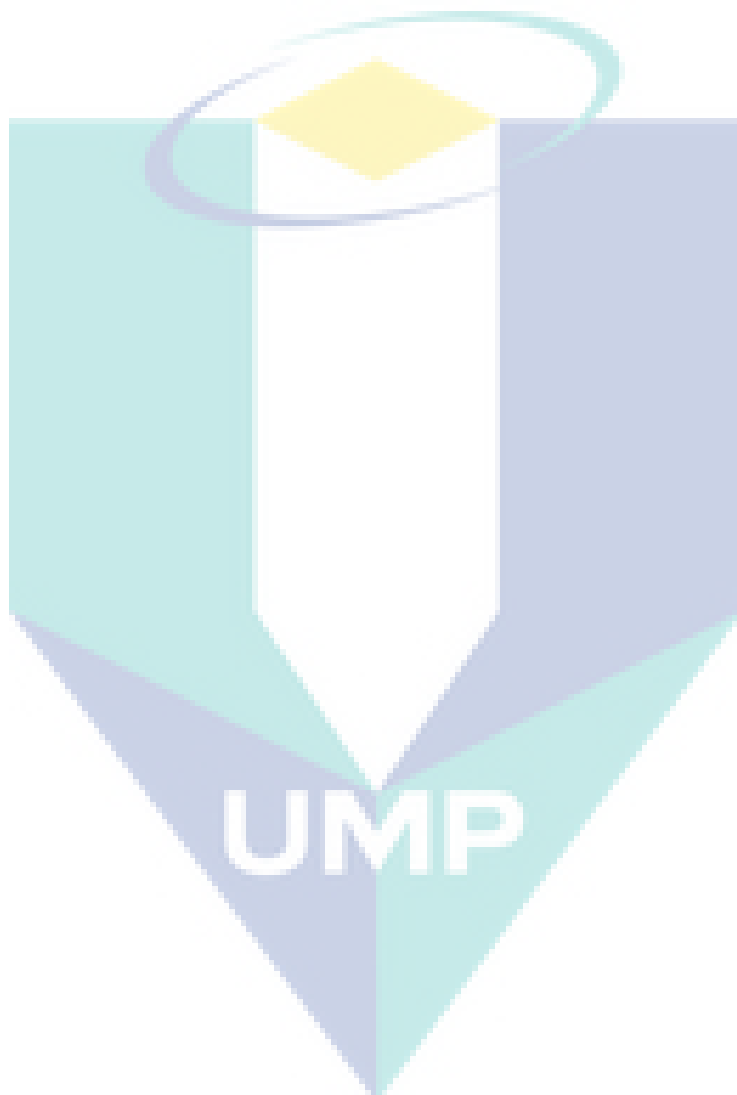
6.4 SOCIAL AND ECONOMIC RISK

In order to achieve the targeted levels of prices, factors such as brand image, design and product quality are becoming increasingly important, as well as additional technical features resulting from our innovative research and development. Convincing solutions, for example supporting go-green program or further improving our adhesive's specialty and mechanical properties as with as biotechnology, are of key importance for safe and sustainable mobility. Because these solutions generally require higher advance expenditure and greater technical complexity, there is an increasing challenge to realize efficiency improvements while simultaneously fulfilling BAFP's own quality standards. If we fail to perform this task optimally, this could negatively affect the future profitability. Product quality has a major influence on a customer's decision to buy formaldehyde-based adhesive or bio-based adhesive.

6.5 HEALTH AND SAFETY RISK

Industrial and commercial users of adhesives require special protection because they work on daily basis with adhesives, often for many hours a day. In addition to hazards associated with the physical properties of adhesives such as flammability, explosiveness and burns when using hot melts, it is in particular chemical effects such as toxicity, skin irritation, acid burns and allergies which have to be avoided. This is achieved by equipping the work-place with properly designed air replenishment and ventilation systems, providing workers

with personal protection equipment (e.g. work clothing, gloves, and safety glasses) and ensuring that hygiene regulations are adhered to (e.g. thorough washing of the skin before breaks and at the end of work; refraining from eating, drinking and smoking in the workplace). Safety officers monitor compliance with these safety measures. Personnel who work with adhesives undergo regular training on matters relating to work safety and environmental protection. If special risks are involved, then personnel undergo regular medical examinations.



CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

As a conclusion, by following this business plan, BAFP Sdn. Bhd. will meet its goals successfully. For funding purpose BAFP Sdn. Bhd. required \$0.5million from investor and \$2million bank loan to start the venture. As indicated in the forecasted financial statements, the loan to be paid in eight (5) years at an interest rate 6%.Lastly, based on the projection, BAFP Sdn. Bhd. will grow 43% over the first 5 years.

7.2 RECOMMENDATIONS

BAFP Sdn. Bhd. was recommended to start the business at 2015. This is to give time to technical department to design and evaluate the process needed to produce the jatropha oil based bio-adhesive. The rigorous design and analysis need to conduct to get the optimum condition of the production.

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A large, semi-transparent watermark logo for UMPA (Universiti Malaysia Perlis) is centered on the page. It features a stylized 'U' shape composed of teal and light blue segments, with a yellow diamond at the top. The letters 'UMP' are printed in white across the bottom of the 'U' shape.

UMP