An Economic Study for Rattan Industry from Raw Materials to an Enhancement of Products Development

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Abstract. As a cellulosic non-wood material, rattan is commonly associated with luxury items and used as a material for wicker, craft, and furniture manufacturing. During the processing of rattan for furniture and related products, these activities generated approximately 40-50% of waste. For sustainability development in this industry, the stages of the rattan processing were investigated for small and medium enterprises' marketing setup. This study conducts an exploratory on three primary stages in the rattan industry in order to reduce waste and at the same time created another industry for rattan itself. The waste can be repurposed and converted into other products, generating additional revenue for the industry. Forecasted monthly profits for the three major rattan industries were 18.0%, 23.0%, and 16.5%, respectively, for raw rattan processing, rattan core and skin industry, and rattan furniture industry.

Keywords: Sustainability of rattan, SME's rattan industry, Malaysian economic, Rattan furniture, Income generation

Introduction

Tropical forests are rich with sources like dipterocarp species (Shorea species, Hopea species, Dipterocarpus species, Tectona grandis, and others) (Sulaiman et al., 2022a), fast-growing (Acacia species, Eucalyptus species, and others) (Wahab et al., 2020; Sulaiman et al., 2022b), also palm and bamboo species (Bambusa species, Gigantochloa species, Elaeis guineensis, and others) (Wahab et al., 2018 & 2021; Sulaiman et al., 2016, 2018 & 2019). Nonetheless, rattan is an indigenous to tropical regions and the most important renewable non-wood forest product in Malaysia also has wider growth in Malaysia, Indonesia, Philippines, China, Bangladesh, Sri Lanka, Myanmar, and India (Wahab et al., 2019, 2016 & 2007). The rattan-based industry has contributed to the social-economic development not only of the domestic economy but the international economy, too. Competition in the business world is inevitable; industries face various opportunities and threats from both outside and inside the country. To compete with similar sectors, it's required to understand what is happening on the market, what the consumer wants, and various changes in the business environment (Suparman and Endang Ruswanti, 2017).

Rattans have been recognized as having a wide variety of both industrial and household applications. Especially the rattan furniture design is quite attractive with recliner/swing from the beginning of the year 1960 until the end of 1990. It shifted a symbol of traditional houses in Malaysia, notwithstanding race (Rashid et al., 2016). It has long been associated with the rural community's liveliness and has undoubtedly become an essential non-wood forest product produced in Asia. Because of its strength and flexibility, it is a material of choice for the manufacture of furniture and handicrafts pieces (Wahab et al., 2016 & 2010). In rattan production activity, the crucial questions basically on the types of product design development, methods used for production, and also the people involved in output. The items will really be a problem since the resources for the production activity are limited (Aminah et al., 2017). The economic aspect of communities' income growth rate for rattan is related to the fields of academics, private and government businesses (Deny, 2016). The happening when academicians should study rattan content, research, workshop, pattern and also technical based while the industries were expanding the support through to the international market, collaboration, design, trading, and management. Nevertheless, the government plays the role which is providing training, build policy and regulations, and competition and exhibition events. But, the significant issues for rattan are unstable at the price rate (Wahab et al., 2019).

Rattan furniture design is inspired by the level of expertise of the furniture producers; it is created uniquely by skill and crossed down from generation to generation. The ideas of rattan furniture design were usually carried out from nature and also used a concept of webbing. It's also depends on the level of expertise of the manufacturer and the unprecedented flexibility of selected rattan species (Rashid et al., 2016).

On the features side, rattan is a versatile material for products advancement (Razak et al., 2017). The more comprehensive diameter rattans used for making furniture, carpet-beaters and walking sticks while the more diminutive diameter is used for making mats, baskets, marine traps, animal cages and coarse wickerwork (Wahab et al., 2019; Wan Arrifin et al., 2018).

The rattan raw material price has increased up to 30% since 1985 (Nurlaela, 2017). Starting from 2005 till currently, bamboo was not going to be a significant source of community income. Then, it was replaced by oil palm and rubberwood as more prominent sources of society's benefits (Erik et al., 2014). The trend highlighted that communities' income declined to 62.5% from 2004 to 2011 as a result of the global economic crisis, the higher transaction cost, lack of information or research for rattan processing and poor connection between rattan producers with domestic rattan consumers (Wahab et al., 2019). The determination of the research is to gain as much as can the information for rattan industries set up mainly in rattan processing, rattan fibre sustainability and also rattan furniture. It was focused on the technique of supervised business began from fixed cost, materials cost, labour cost, administrations cost, till to the profit.

Materials and Methods

Rattan Processing Industry

The study focuses on the rattan basic processing which are rattan oil curing, bleaching, and preservation. The oil curing process was carried out using 2 – 4 mm thicknesses mild steel container (0.75 m x 0.75 m x 3.5 m) and applied a diesel solution to cure the rattan. The sources of heat can be firewood, kerosene or LPG (depending on convenience conditions). The immersion period ranges from 20 to 45 minutes at a temperature ranging from 90 to 140°C depending on the rattan's size and species. The process was removing waxy materials, gums, and resins by rattan itself. At the same time, it could be enhanced the rattan appearance and increased the durability of materials.

During the bleaching process, 1% solution of sodium hypochlorite and hydrogen peroxide was used. The sample was carried out with soak in a tank for 1 hour (depending on the rattan diameter). Prolonged immersion will affect the rattan's strength.

Adequate loading of preservative chemicals needs to be assured in treated materials. In this study, boron formulations are recommended for treating rattans. Boron preservation treatment has been tested as per Indian Standard IS: 401 – 2001 (BIS, 2001).

Rattan Fiber Sustainability Industry

The fiber sustainability industry focuses on rattan core and rattan skin manufacturing. The industry segregated rattan into diameter classes, splitting of rattans, sizing, skin peeling, and polishing. Cores' skin products were graded into three (3) quality stages which are high, medium, and low quality. Every stage was marketed with different prices and prices also depend on an additional process (either bleached or natural).

Rattan Furniture Industry

Rattan furniture manufacturing is a process of converting rattan materials into value-added products, namely furniture. The model was developed based on the data and information collected during a recent survey of some rattan furniture mills/factories in Malaysia. From the survey conducted, it is highly recommended that rattan furniture manufacturing be run by an individual or with a partner who oversees the overall operation of the company. In the rattan furniture industry, a few stages were involved before the products-completed are rattan selecting, straightening of rattan poles, poles measurement, cross-cutting, bending, moulding, drilling, grooving, end-coping, and lastly assembly. To improve the furniture's appearance, quality, and strength, the process of bending, weaving, jointing, scraping, sanding, and finishing are involved.

Results and Discussion

Rattan Oil Curing, Bleaching, and Preservation Industry (Processing)

Cost Structure

To commercialize the production of rattan-based products, the firm needs to take into account the expenses when manufacturing a product or providing a service known as cost structure. The common cost structure incurred in production namely; fixed cost, materials cost, administrative cost, etc. The fixed cost can be defined as expenses that e bear by the company to fund it, which are not related to their production level. The fixed cost incurred in setting up a rattan oil curing mill, bleaching, and preservation of a small scale is depicted in Table 1. This table showed that the total fixed cost is USD 53,950.00, which is 48.2% for land, 25.3% for building, 19.3% for machines and equipment, and the rest 7.2% for utilities and other miscellaneous matters.

Table 1: Fixed cost for rattan oil curing mill.

Item No.	**FIXED COST**	**COST (USD)**
1.	Land area (3 acres)	26,000.00
2.	Building	
	➢ Oil curing shed (7 x 12) m2	3,510.00
	➢ Storage building (12 x 20) m2 and office	9,100.00
	➢ Fumigation chambers with concrete walls	1,040.00
3.	Machines and other equipment	
	➢ Rattan straightening machine - 2 units	2,600.00
	➢ Pressurized water pump - 2 units	1,950.00
	➢ Boiling tank (4.3 m x 1.2 m x 1.5 m)	1,950.00
	➢ Dipping tank for bleaching and cleaning - 2 units	650.00
	➢ Second hand 1 ton lorry	3,250.00
4.	Hand tools	1,950.00
5.	Electrical, water installation and telephone	1,040.00
6.	Miscellaneous	910.00
TOTAL		**53,950.00**

The major raw materials used in the rattan oil curing, bleaching, and preservation industry are represented in Table 2. The total raw materials cost for one month's supply incurred in this industry is USD 14,690.00 which is 88.5% for raw rattan, 8.8% for chemicals, and the rest 2.7% for the treatment process.

Table 2: Materials cost for one (1) month

Item No.	**RAW MATERIALS (1 MONTH SUPPLY)**	**COST (USD)**
1.	Raw rattan	13,000.00
2.	Chemicals such as diesel, bleaching agents, sulfur, preservatives, etc.	1,300.00
3.	Fuel for oil curing treatment process	390.00
TOTAL		**14,690.00**

Instead of fixed cost and materials cost, labour cost is also a vital cost that needs to be considered by the entrepreneur. A percentage of labour-force at all levels, nameless in the processing industry which is manager (14.6%), supervisor (10.4%), clerk (4.2%), skilled workers (31.2%), general workers (30.2%), guard (4.2%) and driver (5.2%). In this industry, around 19 full-time employees are needed, indicating a total cost of USD 6,235.00 per month. The details of the calculation are shown in Table 3.

Table 3: Labour cost per month.

Item No.	**LABOUR-FORCE COST (PER MONTH)**	**QUANTITY**	**COST (USD)**
1.	Manager	1	910.00
2.	Supervisor	1	650.00
3.	Clerk	1	260.00
4.	Skilled workers @USD325.00	6	1,950.00
5.	General workers @USD235.00	8	1,880.00
6.	Guard	1	260.00
7.	Driver	1	325.00
TOTAL			**6,235.00**

Meanwhile, the percentages of administrative costs such as licenses, logistics, utilities, maintenance, and other costs w.7%, 17.4%, 13.0%, 13.0%, 26.2%, and 21.7%, respectively also need to be covered by the business. The total administrative cost incurred in this industry is about USD 1,495.00 monthly. The summary of the administrative cost incurred is represented in Table 4.

Table 4: Administrative cost per month.

Item No.	**ADMINISTRATIVE COST (PER MONTH)**	**COST (USD)**
1.	Licenses	130.00
2.	Electric, water and telephone	260.00
3.	Transportation	195.00
4.	Papers, printings, etc.	195.00
5.	Maintenance, etc.	390.00
6.	Others	325.00
	Total	**1,495.00**

Estimation of Profit

According to the cost structure, the profit can be translated as the difference between the purchase price and the costs of bringing it to market. The profit is calculated based on formula 1;

Profit (π) = Total revenue (TR) / total sales (TS) – Total expenses / total cost (TC)..... (1)

The profit of the processing industry represented an assumed USD 27,300.00 of total revenue from the selling of oil-cured rattans with various species. The calculation of profit value is exclusive to the amount of fixed cost. As a result, this industry is estimated can generate a monthly profit of around USD 4,880.00. The details calculation is displayed in Table 5.

Table 5: Estimation of profit per month

Item No.	**ESTIMATION OF MONTHLY PROFIT (EXCLUDING FIXED COST)**	**SUB-TOTAL (USD)**
1.	Selling of oil-cured rattans of various species and sizes	27,300.00
2.	(-) raw materials per month	(14,690.00)

3.	(-) labor-force salary per month	(6,235.00)
4.	(-) Administration cost	(1,495.00)
	TOTAL MONTHLY PROFIT	**4,880.00**

Eventually, this industry is projected to generate a profit of approximately USD 22,317.17 per year by considering the finance for fixed assets and government tax. The calculation details regarding the estimation of profit from year 1 to year 3 are demonstrated in Table 6.

Table 6: Estimation of profit for Year 1 to Year 3

Year	Calculations	**SUB-TOTAL (USD)**
YEAR 1	Monthly profit (USD4,880.00 x 12)	58,560.00
	(-) finance for 1/3 of fixed asset	(17,983.33)
	Profit	**40,576.67**
	(-) 45% government tax	(18,259.50)
	Net Profit	**22,317.17**
YEAR 2	Monthly profit (USD3,760.00 x 12)	58,560.00
	(-) finance for 1/3 of fixed asset	(17,983.33)
	Profit	**40,576.67**
	(-) 45% government tax	(18,259.50)
	Net Profit	**22,317.17**
YEAR 3	Monthly profit (USD3,760.00 x 12)	58,560.00
	(-) finance for 1/3 of fixed asset	(17,983.33)
	Profit	**40,576.67**
	(-) 45% government tax	(18,259.50)
	Net Profit	**22,317.17**
TOTAL PROFIT FOR 3 YEARS		**66,951.51**

Estimation of Profit Margin

Profit Margin, net margin, net profit margin or net profit ratio is a measure of profitability. Based on Formula 2, the net profit ratio was calculated. The percentage highlighted that USD 27,300 of total sales per annum can generate 17.88% profit.

$$\text{Net Profit Ratio} = \frac{\text{Net Profit}}{\text{Sales}}$$

$$= \frac{4{,}880.00}{27{,}300.00}$$

$$= 17.88\%$$

.....(2)

Rattan Core and Skin Industry

Cost Structure

In an industry of core and skin, highlighted that the rattan was selected according to the species and diameters. Typically, it was segregated into the two sections which are diameters below 20 mm and a diameter above 20 mm. The forward process included boiled rattan with a diesel (preservation), cleaned with pressurized, dried, and sorted. Furthermore, the classes of rattan core and skin were graded (under six grades) and ready for commercialization. The common cost structure incurred in the production of rattan core and skin industry is fixed cost, materials cost, administrative cost, etc.

The fixed cost or namely fixed assets incurred in the production of rattan core and skin industry such as land area (24.5%), building (20.4%), machines and equipment (40.8%), also hand tools (4.9%). The rest others cost was covered as overhead expenses including the cost for electrical, wiring, water, and telephone installations, and also miscellaneous with 9.3% of total fixed cost. Fixed cost for rattan core and skin industry illustrated in Table 7, indicated the total fixed cost incurred of USD 79,560.00.

Table 7: Fixed cost for rattan core and skin industry.

Item No.	**FIXED COST COST (USD)**	**QUANTITY**	**COST (USD)**
1.	Land area (2 acres)		19,500.00
2.	Building ➢ Working building ➢ Storage building ➢ Fumigation chamber with concrete walls		 7,800.00 6,500.00 1,040.00

	➢ Office and furniture		910.00
3.	Machines and equipment ➢ Splitting machines of various sizes ➢ Peeling machines ➢ Rattan straightening machines and devices ➢ Dipping tank for bleaching and cleaning ➢ Second hand 1-ton lorry ➢ Cutting tools	 7 units 2 units 2 units	 23,400.00 2,600.00 1,300.00 650.00 3,250.00 1,300.00
4.	Hand tools		3,900.00
5.	Electrical, wiring, water and telephone installations		6,500.00
6.	Miscellaneous		910.00
TOTAL			**79,560.00**

The curing oil process is mean immersing the large diameter rattans in hot oil or oil mixtures (using a specially designed curing tank) for the specified duration just below the boiling point and subsequent cleaning and drying yield an ivory white colour and better appearance. The process to protect a rattan itself from attack by fungal and at the same time not affect the physical-mechanical properties. In fact, oil-cured rattans have a great domestic as well as export demand and are fetching more price.

In this study, major raw materials used in the rattan core and skin industry are oil-cured rattans and respective chemicals with costs of around 90.9% and 6.1%, respectively against a total materials cost. However, the firm also needs to consider the cost for miscellaneous matters as a backup of 3.0% of the total cost. Table 8 enlightens the cost of the raw materials for one month's supply in this industry. It shows that the total cost incurred is around USD 21,450.00.

Table 8: Materials cost for one month

Item No.	**RAW MATERIALS (ONE MONTH SUPPLY)**	**COST (USD)**
1.	Oil cured rattans of various species, type, and diameters	19,500.00

2.	Chemicals such as bleaching agents, sulfur, preservative, etc.	1,300.00
3.	Miscellaneous	650,00
Total		**21,450.00**

To manage an operational system, Table 9 highlighted that the rattan core and skin industry employed the labour force such as managers, supervisors, clerks, skilled workers, general workers, guards and drivers with respectively accumulative percentages which are 12.4%, 17.8%, 3.5%, 26.6%, 25.7%, 6.2%, 3.5%, and 4.4%. In this industry, around 21 full-time employees are needed. Hence, the 100% total monthly labour cost incurred is USD 7.332.00. Further information on the calculation is shown in Table 9.

Table 9: Labour cost per month.

Item No.	**LABOUR-FORCE COST (PER MONTH) NO.**	**QUANTITY**	**COST (USD)**
1.	Manager	1	910.00
2.	Supervisors	2	1,300.00
3.	Clerk	1	260.00
4.	Skill workers @USD325.00	6	1,950.00
5.	General workers @USD235.00	8	1,872.00
6.	Mechanic	1	455.00
7.	Guard	1	260.00
8.	Driver	1	325.00
TOTAL			**7,332.00**

Apart from labour costs, the administrative cost is also one important thing in the rattan core and skin industry. There are included expenses of licenses with 11.8%, utility bills with 23.5%, logistics with 17.7%, stationery equipment with 17.6%, and so forth with an estimation of 29.4%. The total administrative cost incurred in this industry is approximately USD 1,105.00 per month. The summary of the administrative cost incurred is exemplified in Table 10.

Table 10: Administrative cost per month

Item No.	ADMINISTRATIVE COST (PER MONTH)	COST (USD)
1.	Licenses	130.00
2.	Electric, water and telephone	260.00
3.	Transportation	195.00
4.	Papers, printings, etc.	195.00
5.	Others	325.00
Total		**1,105.00**

Estimation of Profit

As discussed in the rattan processing industry, the profit can be calculated by total revenue or total sales minus total expenses or total cost (TR-TC). Thus, for calculation purposes, the rattan core and skin industry are assumed to can generate USD 39,000.00 in total sales from selling oil-cured rattans of various species and sizes. As a result, this industry is estimated to can generate a monthly profit of around USD 9,113.00 excluding the fixed cost. The details of the calculation are illustrated in Table 11.

Table 11: Estimation of profit per month.

Item No.	Estimation Of Monthly Profit (Excluding Fixed Cost)	Sub-Total (USD)
1.	Selling of oil cured rattans of various species and sizes (-) Raw materials per month (-) labour-force per month (-) Administrative cost	39,000.00 (21,450.00) (7,332.00) (1,105.00)
Total Monthly Profit		**9,113.00**

Nevertheless, the rattan core and skin industry were forecasted to generate a net profit of around USD 45,559.80 per year by considering the cost of fixed asset financing and government tax. The details calculation of estimation of profit for year 1 to year 3 is demonstrated in Table 12.

Table 12: Estimation of Profit for Year 1 to Year 3

Year	**Items**	**Sub-Total (USD)**
1	Monthly profit (USD 9,113.00 x 12)	109,356.00
	(-) finance for 1/3 of fixed asset	(26,520.00)
	Profit	**82,836.00**
	(-) 45% government tax	**(37,276.20)**
	Net Profit	**45,559.80**
2	Monthly profit (USD 7,010.00 x 12)	109,356.00
	(-) finance for 1/3 of fixed asset	(26,520.00)
	Profit	**82,836.00**
	(-) 45% government tax	**(37,276.20)**
	Net Profit	**45,559.80**
3	Monthly profit (USD 7,010.00 x 12)	109,356.00
	(-) finance for 1/3 of fixed asset	(26,520.00)
	Profit	**82,836.00**
	(-) 45% government tax	**(37,276.20)**
	Net Profit	**45,559.80**
Total		**136,679.40**

Estimation of Profit Margin

Every business needed to estimate the amount by which revenue from sales exceeds costs in a business namely as profit margin. The ratio of net profit to product sales is calculated according to formula 3. Thus, the net profit ratio for this industry was highlighted in formula 3 and the percentage indicated that USD 39,000 of total sales per annum can generate 23.37% profit.

$$\text{Net Profit Ratio} = \frac{\text{Net Profit}}{\text{Sales}}$$

$$= \frac{9113.00}{}$$

39,000.00

= 23.37%

……..…(3)

Rattan Furniture Industry

The largest rattan product industry in the world is ranked as the furniture industry. In the process, rattan was selected according to grades to ensure the quality of materials in furniture making. Typically, rattan poles were bent out of shapes, and a straightened process is needed. A selected rattan pole was measured and cut into various sizes according to the design and suitability of furniture products. Rattan was heated or steamed to soften fibre and bent to the desired shape applied.

Furthermore, most of the rattan component was drilled, grooved, and assembled. For an aesthetic value on the products, a process of binder, weaver, and jointed was applied. The accessible materials used in the process are rattan cores and skin from the previous industry. To smooth the surface of the products, a scraped and sanded operation applied and also the crucial stages are finishing to the products that using coats of wax, shellac, drying oil, lacquer, varnish, or paint.

The element such as workforce, raw material acquisition, tool and machine is an important thing to growth and sustained the stability of industry. Moreover, to make an estimation of profit the variable like fixed cost and operational cost compulsory to consider as major part for setup the industry.

Workforce

For sustained the furniture industry, there are proposed set-up of a small-sized factory with the employment of around 42 full-time employees accordingly five main stages which are managerial, clerical designer and marketing with estimated with 23.4% of total workforce cost. Followed by the cut, drilled, bent, and assembled process with 27.2% and also conformed to the stage 3 (scraped, sanded, and filled), stage 4 (binder and weaved), and stage 5 (finished) with 15.3%, 27.2%, and 6.9%, respectively. The presence of skilled and experienced workers plays an integral part in the daily operation. The detailed distribution of the workforce and the wages have shown in Table 13. This table indicated that the total cost for workforce distribution in the model factory is about USD 16,965.00.

Table 13: Workforce distribution in the model factory

Department	Position	No. of Workers	Wages (USD)	Sub – Total (USD)
Managerial,	i. Manager	1	910	910.00
Clerical,	ii. Supervisors	3	650	1,950.00

design, marketing	iii. Designer iv. Clerk	1 2	455 325	455.00 650.00
Cross-cutting, drilling, bending and assembling	i. Skilled ii. Semi-skilled	7 3	520 325	3,640.00 975.00
Scraping, sanding and filling	i. Semi-skilled ii. Unskilled	2 10	325 195	650.00 1,950.00
Binding and weaving	i. Skilled ii. Semi-skilled	7 3	520 325	3,640.00 975.00
Finishing	i. Skilled	3	390	1,170.00
Total				**16,965.00**

*Skilled = normally craftsmen with more than ten years experience;

*Semi-skilled = Younger generation with potential skill and work as apprentices under the supervision of the master craftsmen;

*Unskilled = Apprentice for less skill required task.

Raw Material Acquisition

Moreover, to complete a product's development in industry, the major raw materials, and the cost to produce a proposed capacity of the rattan furniture are depicted in Table 14 below. As followed the Table 14, there are three main classes of peeled rattan poles which are grade A, grade 1/3, and grade C. Every grade considers a different price per unit (Table 14). In one cycle production estimated about 73.7% of total raw material cost needed to spend for grade A rattan poles and followed by 12.4% and 2.1% material cost for grade 1/3 and grade C, respectively. The rest 11.8% are considered for finishing and jointing purposes. Peeled rattan poles are used for making essential frame components and additional components, respectively. Rattan splits (without skin–grade C) are bought in bundles to be used as binding materials. The total cost for major raw material requirements for the model factory is around USD 42,350.00.

Table 14: Major raw material requirements for the model factory

No.	Material	Quantity Per Month	Price Per Unit (USD)	Total (USD)
1.	Peeled rattan poles (grade A) 3 m in length 30-34 mm diameter	12,000 poles	2.60	31,200.00
2.	Peeled rattan poles (grade 1/3) 3 m in length 25-29 mm diameter	5,000 Poles	1.05	5,250.00
3.	Rattan split (grade C) 6 mm width	350 kg	2.60	910.00
4.	Lacquer Thinner	400 liter 600 liter	4.00 0.65	1,600.00 390.00
5.	Screw	20,000 pieces	0.15	3,000.00
Total				**42,350.00**

Tools and Machines

Apart from raw materials, tools and machines are essential things in the manufacturing industry. The tools and machines can either be imported from Japan, China, Taiwan or fabricated locally whenever practical and economical. Due to their lower prices, Taiwan-made machines are selected to perform less critical jobs such as cross-cutting and drilling. Meanwhile, for assembly, binding, weaving, and spraying processes, it is recommended Japan made pneumatic hand tools be used. Japan made that have a good reputation regarding longer service life, and lesser breakdowns would ensure the manufacturing processes are done smoothly without frequent disturbances caused by jammed parts of the tools. The quantity and price of the tools and machines required to set up the factory are presented in Table 15 below. To wrap up, the overall cost incurred for buying several machines is USD 23,375.00.

Table 15: Tools and machines for rattan furniture manufacturing

No.	Machine	Quantity	Price Per Unit (USD)	Total (USD)
1.	Cross cut saw (Taiwan)	5	260.00	1,300.00

2.	Straightening machine (Local)	2	1,950.00	3,900.00
3.	Bending machine (Taiwan)	2	1,690.00	3,380.00
4.	Bench drill (Taiwan)	5	195.00	975.00
5.	Air compressor (Japan)	6	1,300.00	7,800.00
6.	Spray gun (Japan)	6	130.00	780.00
7.	Staple gun (Japan)	10	155.00	1,550.00
8.	2-D mould bench (Local)	5	170.00	850.00
9.	3-D mould bench (Local)	5	208.00	1,040.00
10.	Pneumatic screw driver (Japan)	10	117.00	1,170.00
11.	Pneumatic nail driver (Japan)	10	130.00	1,300.00
12.	Spray booth (Local)	2	1,690.00	3,380.00
13.	Steaming chest (Local)	3	390.00	1,170.00
14.	Blowtorch (Taiwan)	6	130.00	780.00
Total				**23,375.00**

Maintenance of Machines and Tools

The requirement for the maintenance of machines and tools used in rattan furniture manufacturing is not critical. However, since compressed air powers, most the machines and tools, the compressed air generation and distribution systems must be carefully designed and maintained to ensure that the air produced is clean and free from moisture and debris.

Many factories have neglected these requirements. As a result, the moving parts in the machines and tools get rusted quicker than they are supposed to be. Consequently, these will degrade the performance and shorten the service life of the machines and tools.

Economic Analyses

Policymakers have a variety of economic analyses to help them to assess policies and programs. Economic analysis can be done through various tools. The tools may be more feasible to use with sufficient information. The viability of rattan furniture manufacturing as a business is determined by cost and profit analyses and the results discussed in this section.

Cost Analysis

The overall furniture manufacturing industry highlighted that the cost analysis could be done by calculating the initial and operational costs. The initial investment costs of rattan furniture manufacturing are shown in Table 16. The initial investment is the cost to acquire fixed assets such as a land area with 23.7% of the total cost, building with 29.7%, vehicles with 11.8%, tools and machines with 25.3%, and the rest 9.5% to the installation and equipment. The total initial investment incurred is USD 109,720.00.

Table 16: Initial Investment Costs

Fixed Cost	**Cost (USD)**
Land area (1 hectare)	26,000.00
Building	32,500.00
Tools and machines	27,820.00
Electrical wiring, water, and telephone installation	6,500.00
One ton lorry	13,000.00
Miscellaneous (office equipment)	3,900.00
Total	**109,720.00**

Same with previous industries involved, the operational cost is a critical thing to running a business — the exact operational costs per month in the furniture industry are shown in Table 17. The total expenses of operational expenses are considered per month. It is consist of expenditure on raw materials with 53.7% of total operational cost, utility bills with 1.6%, salaries with 22.3%, and the rest 22.4% for hardware, rental and miscellaneous. The table indicates the total monthly operational cost is USD 69, 511.00.

Table 17: Operational Costs per month

Item	**Cost (USD)**
Raw materials (rattan)	37,310.00
Hardware (Finishing, nails, screw, and staple)	4,550.00
Salaries	15,496.00
Electricity and water	975.00
Telephone	130.00
Containers rental @ USD2,600 per container	10,400.00
Miscellaneous	650.00

Total	**69,511.00**

Profit Estimation Analysis

Profit projection analysis can be done by calculating profit and profit margin. The monthly profit is calculated by subtracting the operational cost excluding the initial investment cost of the monthly sales. Assumed that free on board (FOB) values is USD 20,800.00 per container and one-hectare areas of rattan can produce four containers. Thus, the detailed monthly profit was represented in formula 4.

Monthly Profit = Monthly Sales – Cost ………………………………………………………………… (4)

= (FOB values x No. of containers) – Operational Cost

= (USD 20,800 x 4) – USD 69,511

= USD 83,200 – USD 69,511

= USD 13,689.00

The ratio of net profit to product sales is calculated by dividing net profit value by total sales. Thus, the detailed calculation of the net profit ratio for the furniture industry was indicated in formula 5:

Net Profit Ratio = Monthly Profit / Sales …………………………………………………………………... (5)

$$= \frac{\text{USD } 13{,}689}{\text{USD } 83{,}200} \times 100 = 16.45\%$$

From the formula 5 calculation, it could be concluded that one hectare of rattan can convert 16.45% into profits. Table 18 indicated that the rattan furniture industry generated a net profit of around USD 70,232.07 in year 1 and USD 69,226.30 in year 2 according to the annum profit after excepted depreciation value of 1/3% of fixed assets and 45% of government tax. Depreciation value means decreasing the value of the asset over its useful life. A decrease in an asset's value regularly occurred during unfavorable market conditions. Hence, the profit value estimates will decrease over time. The detailed calculation of profit for year 1 and year 2 was highlighted in Table 18:

Table 18: Profit calculation within 2 years.

Year	Items	Sub-Total (USD)
1	Monthly profit (USD 13,689.00 x 12)	164,268.00
	(-) finance for 1/3 of fixed asset	(36,573.33)
	Profit	**127,694.67**
	(-) 45% government tax	**(57,462.60)**
	Net Profit	**70,232.07**
2	Monthly profit (USD 13,689.00 x 12)	164,268.00
	(-) 5% Fixed Asset Depreciation Value	(1,828.67)
	(-) finance for 1/3 of fixed asset	(36,573.33)
	Profit	**125,866.00**
	(-) 45% government tax	**(56,639.70)**
	Net Profit	**69,226.30**

Conclusion

In conclusion, the rattan-based industry is devoted to the social-economic development not only in the domestic economy but the international economy as well. Besides, it can be commercialized by the entrepreneur or SME's also. To capitalize rattan-based industry, each entrepreneur needs to plan cost structure and estimate profit. The typical cost structure acquired in production, are fixed cost, materials cost, and administrative cost. Infinite that, labour cost is also a vital cost that needs to be considered by the entrepreneur.

Meanwhile, other administrative costs such as licenses, logistics, utilities, and maintenance also need to be covered by the business. To forecast the viability of this industry, the calculation of estimation of profit for year 1 to year 3 and estimation of profit margin needs to be done—the feasibility of rattan furniture manufacturing as a business is determined through cost and profit analyses. Cost analysis can be done by calculating the initial and operational costs. Then, the projection profit analysis can be done by calculating profit and profit margin. Hence, these calculations can be used as a reference for commercialization purposes.

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