Value Added Productivity Performance of the Peninsular Malaysian Wood Sawmilling Industry

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Value added manufacturing activity in the wood sawmilling industry of Peninsular Malaysia is important for employment opportunities, particularly for low income citizens living in this rural area, to provide returns to the local economy while being environmentally sustainable. This paper is a review on the value added wood sawmill industry in Peninsular Malaysia, using the value of major import and exports of major timbers products and forested area in Peninsular Malaysia over the period 2003 to 2012. The productivity performance measures that are based on the concept of value added are emphasized in this paper. The value added in wood sawmill industry was found to increase from year 2003 to 2012. Consequently, Malaysia is moving on the right path to achieve the goal of National Timber Policy 2020, transforming the timber industry into high value addition industry. However, further analysis using the value added productivity measure found that the value addition rely on international timber price rather than skilled workers.

Keywords: Value added; Peninsular Malaysia; Wood sawmilling industry; Productivity performance

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INTRODUCTION

The forest industry is a major contributor to the Malaysian economy, particularly the wood based sector, which significantly contributes to the economy's growth. The Malaysian wood based sector accounted for 3.4% of the Gross Domestic Product (GDP) and 4.3% of total export earnings in 2013 (Mundi 2014). Equally important, Malaysia is one of the world's largest exporters of tropical timber and timber products. Malaysia's wood based sector generates steady export earnings and is a major job generator, providing employment to about 217,000 workers (Free Malaysia Today 2014). The major wood products contributing to export earnings were furniture, valued at RM 7.36 billion (RM=Ringgit Malaysia), followed by plywood at RM 5.32 billion, sawn timber (RM 2.41 billion), logs (RM 1.86 billion), and wood composite estimated at RM 1.5 billion (Malaysia Timber Council 2013; Free Malaysia Today 2014; MIDA 2014).

Over the past 50 years, there have been many efforts by the Malaysian Government to identify opportunities for the enhancement of the wood-based sector. Both primary and secondary manufacturing alternatives have been considered, as well as the local and export market potential for wood products. Thus far, there has been very little evidence of any advancement in the sector as a result of these initiatives. The reasons for the lack of advancement are the low level of technology employed by the Malaysian wood based industry—below par performance—and uncertainty in the supply of timber (Ratnasingam 2002; Ng and Thiruchelvam 2011). In the same vein, most of the

technology used (more than 60%) is sourced from Taiwan, while a portion is from Italy and Germany (Ratnasingam 2005). Small portions of the technology used are locally modified machines, which include presses, table saws, and bench drills. Despite this apparent lack of advancement in local manufacturing capacity, there remains a high value added manufacturing activity in the wood sawmilling industry in Malaysia. Use of frame gang saws and smaller kerf in the band saw are two examples of technology advancement that increase the recovery rate, thus giving rise to the value added sawmilling process (Baltrusaitis 2008). In business and economics, value added is defined as the difference between the sale price and the production cost of a product. The value added is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources (Berg 1976). The manufacturing sector normally has a higher value added compared to the retail and services sector. This is due to the fact that there are higher portions of revenue in the manufacturing sector.

Value added to the wood sawmill industry may provide opportunities, which include increases in employment opportunities, particularly for low income citizens, returns to the local economy, and environmental sustainability. The productivity measures that are based on the concept of value added are emphasized in this paper. Therefore, this paper is a review on the value added of wood sawmill industry in Peninsular Malaysia, and its productivity performance correlates with the job employment using the value of major imports and exports of major timber products and forested areas in Peninsular Malaysia over the period of 2003 to 2012. Malaysia is run by a federal system of government, operating within the following three geographical demarcations: Peninsular Malaysia, Sabah, and Sarawak. Sabah and Sarawak have their own forestry policies, hence there is no mention of the two states in this review. The statistical ratio using value-added performance measurement developed in this study can be used as benchmarks for the wood sawmill industry in Malaysia for future development or investment opportunity.

FOREST RESOURCES

Today, forest cover in Malaysia constitutes nearly 60% of total land area, or 19.52 million ha (Noridah *et al.* 2014). Of that area, roughly 15 million ha have been designated as permanent reserved forests (PRFs), which include 11 million ha of production forests (Forestry Statistics Peninsular Malaysia 2013). In Peninsular Malaysia, the total forested area is 5.8 million ha, or 43.9%, of Peninsular Malaysia land area. Of this, 2.92 million ha of forest are categorized as "Production Forest," while 1.99 million ha are "Protected Forest" (Forestry Department of Peninsular Malaysia 2012).

As mentioned above, Malaysia is one of the major timber producing countries in the global market. At the same time, issues relating to forests, such as climate change, global warming effects, and proper forest management, have continued to be the Malaysian Government's main concern. Thus, the Malaysian Government has given priority to sustainable forest management (SFM) policy in the management of forest (Abdul-Rahim *et al.* 2011). It is noted that the reduced impact logging (RIL) option is widely known as a tool to achieve SFM. Recognizing the need to strengthen the SFM, Malaysia has undertaken a critical step to reduce the annual allowable cutting (AAC) in the country and imposed stringent criteria on harvesting operations (Acton 2013). This step was taken to ensure the sustainable capacity of the forests and to ensure the

reduction or internalization of externalities by minimizing damage from timber harvesting activities. Consequently, this policy implementation has affected the volume of timber that can be extracted from the forests.

The steps taken by the Malaysian government towards conservation of resources provide more protection to forests, and, at the same time, maximize the utilization of the usable wood from trees that are logged. In other words, this will result in better values of forest products. Furthermore, this is essential to protect forest biological diversity, which ensures greater forest health, and also to give the forests best chance to adapt to a changing climate.

Log Production

Malaysia's rainforest is one of the most species-rich and biologically diverse ecosystems in the tropics, with a substantial number of endemic species. The incredible diversity significantly contributes to the socio-economic development of the country. There are at least 10,000 species of flowering plants in Malaysia, of which 2,830 are tree species in Peninsular Malaysia (Bidin and Latiff 1995; Saiful and Latiff 2014). The lowland and hill dipterocarp forests in Malaysia provide many valuable tropical timber species and lead in the international tropical timber market trade. Awang and Faridah (2008) stated that the average commercial stumpage value per ha in hill forest above the cutting limit was RM 25,413 per ha in Malaysia. On average, more than half of the stumpage values are attributed to the family Dipterocarpaceae, followed by Myristicaceae (11.1 %), Sapotaceae (7.7%), Guttiferae (5.8%), and Myrtaceae (4.1%) (Awang and Faridah 2008). As Malaysia is well-blessed with rich timber species diversity, the steady supply of trees and logs highlight the importance of this resource-based sector to the wood based sector. Table 1 below shows the area for harvesting and the log production (x1000 cubic meters (m^3)) for the Peninsular Malaysia. As previously mentioned, all the data presented hereafter is only for Peninsular Malaysia. The forestry sector in Sabah and Sarawak is independent from Peninsular Malaysia.

Table 1. Area for Harvesting and Log Production in Peninsular Malaysia

Year	Area for Harvesting (ha)	Log Production (x1000 m^3)	Log Production per ha (m^3/ha)
2003	129,739	4,419	34.1
2004	114,830	4,573	39.8
2005	103,270	4,405	42.7
2006	112,075	4,693	41.9
2007	103,599	4,220	40.7
2008	103,210	4,028	39.0
2009	86,344	3,687	42.7
2010	98,635	4,161	42.2
2011	110,520	4,171	37.7
2012	93,164	4,467	47.9

Source: Wan-Razali and Shahwahid (2013); Forestry Statistics Peninsular Malaysia (2014)

As shown in Table 1, the total land area in Peninsular Malaysia designated for harvesting dwindled around 40,000 ha from nearly 130,000 ha in 2003 to 93,000 ha in 2012. A reduction in 40% of harvesting area was observed in Peninsular Malaysia over that period. Nonetheless, the volume of log production in Peninsular Malaysia has not changed much since 2003. This resulted in a slight increase in log production per ha over

a 10-year period. Timber extraction from Peninsular Malaysia experienced higher log production per ha, which may be attributed to the improvement of technology for logging activities and the efficiency of the existing Selective Management System (SMS) for managing Peninsular Malaysia hill dipterocarp forest (Saiful and Latiff 2014).

Domestic Price of Logs

Table 2 shows the average price for the logs by timber group and the mean domestic price of logs. The average price of logs for mixed heavy, mixed medium, and mixed light hardwoods differ roughly about RM 10 per m^3 to RM 80 per m^3. The mean domestic price of logs from 2003 to 2012 experienced slight changes, although the highest mean domestic price of logs at RM 607 per m^3 was recorded in the year 2010.

Table 2. Mean Domestic Price of Logs 2003-2012

Year	Average Price for Mixed Heavy Hardwood logs per m^3 (RM)	Average Price for Mixed Medium Hardwood logs per m^3 (RM)	Average Price for Mixed Light Hardwood logs per m^3 (RM)	Mean Domestic Price of Logs per m^3 (RM)*
2003	426	413	403	414.0±(11.5)
2004	455	413	400	422.7±(28.7)
2005	524	457	429	470.0±(48.8)
2006	460	470	450	460.0±(10.0)
2007	531	495	450	492.0±(40.6)
2008	580	552	486	539.3±(48.3)
2009	609	565	501	558.3±(54.3)
2010	676	608	538	607.3±(69.0)
2011	549	474	440	487.7±(55.8)
2012	510	485	457	484.0±(26.5)

Source: Wan-Razali and Shahwahid (2013); Forestry Statistics Peninsular Malaysia (2014)
Note : * The mean domestic price of logs per cubic metres is the mean value from sum of average price for mixed heavy, mixed medium, and mixed light hardwoods
( ) standard deviation

Generally, the supply of logs to the sawmills is derived from three forested land areas, namely Permanent Reserved Forests (PRFs), state land, and private lands. The increase in log price recorded over the 10-year period may be related to decline of forested log production areas, especially reduced state land forests and alienated lands for development (NATIP 2009; Wan-Razali and Shahwahid 2013).

WOOD BASED SECTOR

The Malaysian wood based sector generally can be grouped into four major industries: sawmilling (including logs and sawn timber), veneer and panel products (including plywood and other reconstituted panel products such as particleboard and fiberboard), mouldings and builders' joinery and carpentry (BJC) (doors, windows, and its components panels, flooring board, and parquet), and lastly the furniture and furniture components industry. The whole sector is predominantly owned by Malaysians, and around an estimated 90% of the companies are small and medium-size (SME) establishments (Woon and Tong 2004; MITI 2012).

Wood Sawmill

The wood sawmill industry in Malaysia is one of the oldest and most prominently established, garnering much attention as one of the key nodes of the country's socio-economic growth. This may directly relate to the abundance of resources from rainforest and land. The steady supply of trees and logs over the centuries highlight the importance of this resource-based industry. Currently, there are 1,019 sawmills still in operation; 671 of these sawmills are located in Peninsular Malaysia, and the remaining are found in Sabah and Sarawak (Norcahaya 2012). Exports of saw logs and sawn timber in 2013 amounted to RM 2.14 billion, with exports mainly to Thailand, the Netherlands, People's Republic of China, Japan, and Republic of Singapore (Forestry Statistics Peninsular Malaysia 2012; Norcahaya 2012; The Star 2014).

Table 3 shows the capacity and number of sawmills in Peninsular Malaysia from 2003 to 2012. In 2003, Peninsular Malaysia had the highest log production at 12.27 million m^3, but dropped to 10.95 million m^3 in 2005. In 2006, the log production was recorded at 11.02 million m^3 and improved thereafter. The number of sawmills in Peninsular Malaysia remained at 671 sawmills for the period 2009 to 2012, which was a slight increase from the year 2003.

Table 3. Capacity and Number of Sawmills in Peninsular Malaysia

Year	No. of Mill	Capacity for all the Sawmills (million m^3)	Average capacity per sawmill (m^3)*
2003	662	12.27	18,530
2004	657	10.90	16,590
2005	664	10.95	16,490
2006	662	11.02	16,650
2007	667	11.10	16,640
2008	670	11.14	16,630
2009	671	11.18	16,660
2010	671	11.28	16,810
2011	671	11.41	17,000
2012	671	11.57	17,240

Source: Forestry Statistics Peninsular Malaysia (2014)
*Note: average capacity per sawmill calculated based on the total capacity of the sawmills divided by the number of mill

As shown in Table 3, the average capacity for the single sawmill in Peninsular Malaysia is about 16,000 m^3 to 17,000 m^3 per annum. The volume produced by sawmills in Peninsular Malaysia is far below the volume of a modern operation, which will produce between 23,000 m^3 and 140,000 m^3 annually (Brackley and Crone 2009). Sawmills are composed of various sawing and cutting machines and numerous processing steps. In a well-designed mill, the processing speeds of individual machines and production steps have been taken into consideration (balanced) to generate a product at a desired rate. Since most of the wood sawmills in Peninsular Malaysia were established more than 30 years ago, the mills are well designed to process any logs from the forest for the highest sawn timber recovery at the fastest pace. The low production capacity experienced by sawmills might be due to the limited supply of raw materials as well as facing stiff competition with plywood and other secondary processing mills for the limited supply of logs (NATIP 2009).

Employment

The labor shortage in the sawmill sector of Peninsular Malaysia is becoming a serious problem. The sawmill industry there relies on foreign workers, as most Malaysians are not keen to take up such jobs. Skilled workers in sawmills are also scarce, especially heavy-equipment operators to fell and load the timber, as turnover is very high in this sector because people select jobs in manufacturing high-end products, such as electronics. Low wages and high risk are the two key components associated with sawmills, thus limiting the number of workers able to be recruited by this industry.

Table 4 shows the total labor force and employment in sawmills of Peninsular Malaysia. The total labor force in Malaysia has increased from 10.2 million (2003) to 13.1 million for the span of ten years (2012). The employment rate in Malaysia averaged 97% throughout the 10 year period. On the other hand, the employment in sawmills located in Peninsular Malaysia increased from 2003 until 2006 (40% of the 10-year period) and then dropped thereafter at a rate of about 4% per year from 2006 to 2012.

Table 4. Employment and Employment in Sawmill of Peninsular Malaysia

Year	Total Labour Force	Employed	Employment in sawmill of Peninsular Malaysia
2003	10,239,600	9,869,700	20,748
2004	10,535,500	9,986,600	21,898
2005	10,413,400	10,045,400	22,209
2006	10,628,900	10,275,400	22,827
2007	10,889,500	10,538,100	21,031
2008	11,028,100	10,659,600	22,270
2009	11,315,300	10,897,300	20,067
2010	12,303,900	11,899,500	18,417
2011	12,675,800	12,284,400	17,796
2012	13,119,600	12,723,200	17,457

Source: Forestry Statistics Peninsular Malaysia (2014)

For many years, the nearly 700 sawmills located in Peninsular Malaysia, have had a workforce of roughly 20,000 employees or 0.2% of Malaysia total labour force. Recently, the decrease of labor in the sawmill sector and the increase in the total labor force may suggest that proportionately fewer young people are entering the sawmill labor market. The sawmill sector is predominantly rural, meaning most jobs are also based in rural areas. Further, the National Development Policy, formulated to eradicate hard-core poverty and increase the participation of rural people in the modern sectors of the economy, provides a foundation for young people to join the service-sector industries, particularly information, professional scientific and technical industries, business services (including call centers), and financial, insurance, and real estate (FIRE), and are predominantly urban in location (United Nations Development Programme 2005; Aminuddin 2009).

SAWN TIMBER

In Malaysia, the number three export earner in the timber trade is sawn timber (The Sun 2013). It amounted RM 2.5 billion with a volume of more than 2.1 million

cubic meters, or 12.4% of Malaysia's total timber export value (Malaysian-German Chamber of Commerce and Industry 2012). In 2010, the industry showed improved performance in terms of both volume and value. Important partners in the timber trade are Thailand, Netherlands, and UAE as well as traditional markets in the Far East like Japan, Taiwan, and China. Sawn timber is produced in various sizes and species and exported as either graded or ungraded sawn timber.

The success of the sawn timber industry may directly relate to the performance of sawmills. Table 5 shows the recovery rate of the logs in sawmills of Peninsular Malaysia. On average, the recovery rate of logs was recorded at 60%. According to report published by the Food and Agriculture Organization of the United Nations comparing China, Malaysia, and Indonesia, a fairly common recovery rate of about 55% can be achieved by sawmill operators in those countries (Enters 2001). Higher utilization rates of logs found in Peninsular Malaysia sawmills may be attributed to the advance technology and large downstream wood-processing facilities. Operators that are able to reduce volume, especially that of wasted top logs and various off-cuts, increase the usage of logs from forests (Enters 2001; Othman 2014; Saiful and Latiff 2014).

Table 5. Recovery Rate of Logs

Year	Sawn timber Production ('000 m^3)	Consumption of Logs by Sawmills ('000 m^3)	Recovery Rate* (%)
2003	2,928	5,519	53.1
2004	3,199	6,082	52.6
2005	3,235	5,106	63.4
2006	3,019	6,446	46.8
2007	2,668	4,381	60.9
2008	2,386	3,681	64.8
2009	2,080	3,131	66.4
2010	2,659	3,892	68.3
2011	2,675	3,921	68.2
2012	2,790	4,772	58.5

Source: Forestry Statistics Peninsular Malaysia (2014)
Note: *Recovery rate calculated based on the percentage of sawn timber production over the consumption of logs by sawmills

However since 2006, the data for the production of rubberwood logs and sawn timber (averaging in the range of 500,000 m^3 of logs and 240,000m^3 of sawn timber) was not fully reflected in the data collected by Forestry Department due to non-mandatory declaration for that species.

As shown in Table 5, the consumption of logs by sawmills steadily increased after the economic crisis hit the world in 2009. Additionally, 1.6 million m^3 of logs were consumed by sawmills in Peninsular Malaysia in 2012, as compared to the volume in 2009. Much of the increase in importance of logs consumption relates to parallel growth in domestic markets. The domestic market, particularly the construction industry, continues to be an important market for primary and secondary timber products with value estimated to be RM13 billion (Roda *et al.* 2011). The construction industry, driven by both private and government projects such as the Economic Transformation Program (ETP), saw the launch of 195 projects in three years, bringing in a total committed investment of RM 220 billion. The construction industry performed well over the span of

three years; growing 18% despite the gloomy global economy (CIDB 2013; Malay Mail 2013).

Table 6 shows the average price of the timber by category per m^3. It clearly shows that the last decade has seen domestic timber prices increase almost linearly. On average, the price of sawn timber was doubled over the span of 9 years (2003 to 2011). Sawn timber prices soared in 2011 due to enormous demand in the domestic market and China, but the demand and prices have started to fall and will probably continue for the next few years. The average price of mixed heavy hardwood in 2012 decreased to RM 1,472 per m^3 from RM 2,090 in 2011, a 30% reduction. For mixed hardwood and light hardwood sawn timber, the average prices declined 25%, from RM 1,764 per m^3 to RM 1,320, and 29% from RM 1552 per m^3 to RM 1,100, respectively, over the previous year.

Table 6. Average Price for Sawn Timber by Category

Year	Average Prices for Mixed Heavy Hardwood sawn timber per m^3 (RM)	Average Prices for Mixed Medium Hardwood sawn timber per m^3 (RM)	Average Prices for Mixed Light Hardwood sawn timber per m^3 (RM)	Mean Prices of sawn timber per m^3 * (RM)
2003	633	617	609	609.7±(12.2)
2004	648	620	617	628.3±(17.1)
2005	765	692	616	691.0±(74.5)
2006	942	771	675	796.0±(135.2)
2007	998	804	794	865.3±(115.0)
2008	1066	909	878	951.0±(100.8)
2009	1133	950	914	999.0±(117.4)
2010	1393	1128	1028	1183.0±(188.6)
2011	2090	1764	1552	1802.0±(271.0)
2012	1472	1320	1100	1297.3±(187.0)

Note : * the mean price of sawn timber per cubic metres is the mean value from sum of average price for mixed heavy, mixed medium and mixed light hardwoods
( ) standard deviation

VALUE ADDED

"Value added" in the wood sawmilling industry refers to the net value of sawn timbers, subtracting the value of round logs used by sawmills. In generic terms, "value-added" in sawmills is the process required to produce a wood product of greater value than the value of the product in its previous form. Starting with tree logs, any further processing involving human effort, tools, or machines increases the market value of the raw log. Each of these steps adds more value to the logs, creating a greater potential for jobs and other economic spinoffs.

As mentioned above, value added on sawmills directly relates to the profit made by every sawing operation. Recovery yield or log recovery is a major factor controlling profitability in sawmills, thus determining the value added to the industry. As the cost of logs increased over the past 10 years without a proportionate increase in the yield of sawn timber, making a profit with sawmills has become impossible. The above statement can be explained by employing a simple example involving the recovery of chengal. The price for one hoppus ton (1.8 m^3) of chengal logs, as published by Malaysia Timber Industry Board (MTIB) for small diameter logs 18 inches and up, is at RM 4,000.00, whereas sawn timbers under the category of General Market Specification (GMS) are

valued at RM 6,638 per m^3 (MTIB 2014). If the recovery rate for producing GMS is estimated at 40%, the value added from the wood sawmill process can be calculated from the sale value (RM 6,638*1.8*0.4) by subtracting the cost of the logs (RM 4,000), which is equivalent to a value added of RM 779 per m^3. By increasing the yield of the process to 50%, the value added of the process increased to RM 1,975. Furthermore, the conversion of off cuts or logs into short lumber and selling sawdust to increase the rate of return for investment are other two options that help sawmills create value in their processes.

Table 7 shows the value added of wood sawmills in Peninsular Malaysia over the period 2003 to 2012. As shown in Table 7, sawmill industry in Peninsular Malaysia achieved tremendous value added for the year 2011 to 2012. The value added calculated below was based on the mean price from sum of average price for mixed heavy, mixed medium, and mixed light hardwoods. The value added in wood sawmills presented in Table 7 proved that Malaysia is moving along the right path to achieve the goal of transforming the local timber industry from a revenue oriented small scale enterprise into a high value added timber industry.

Table 7. Value Added of Wood Sawmills in Peninsular Malaysia

Year	Estimated value of Logs consumption by sawmill[1] (RM)	Estimated value of sawn timber[2] (RM)	Value added of wood sawmill in Peninsular Malaysia (RM)
2003	2,284,866,000	1,785,201,600	-499,664,400
2004	2,570,861,400	2,009,931,700	-560,929,700
2005	2,399,820,000	2,235,385,000	-164,435,000
2006	2,965,160,000	2,403,124,000	-562,036,000
2007	2,155,452,000	2,308,620,400	153,168,400
2008	1,985,163,300	2,269,086,000	283,922,700
2009	1,748,037,300	2,077,920,000	329,882,700
2010	2,363,611,600	3,145,597,000	781,985,400
2011	1,912,271,700	4,820,350,000	2,908,078,300
2012	2,309,648,000	3,619,467,000	1,309,819,000

Note : Value added = Estimated value of logs consumption – Estimated value of sawn timber
[1]Estimated value of Logs consumption by sawmill = Mean Price of logs per m^3 x Consumption of Logs by Sawmills
[2] Estimated value of sawn timber = Mean Prices of sawn timber per m^3 x Sawn timber Production

As calculated above, the value added corresponds to the difference between the estimated value of sawn timber less the estimated value of logs consumption by sawmills. Given the definitions of value added, it is natural that in an establishment when the value of sales is less than the value of bought-in goods and services over a particular period of time, a negative amount of value added is generated (Silver and Golder 1981). This is not to imply that the production process should not have been carried out, and neither are the goods sold by the enterprise necessarily worthless. The table, however, did not take into consideration the spin-off effects from the sawmilling sector. The sawmilling sector plays a major role in providing raw materials (off cut and small lumber) for the production of secondary products such as moulding, builders' joinery and carpentry (BJC) and furniture

and furniture components amounting to RM8.65 billion in export for 2011 and 8.62 billion in 2012.

In addition, traditionally the contribution of the wood based industry in Malaysia was reflected by her export performance and neglected the contribution of the domestic trade of timber and timber products amounting to RM13 billion of value added in Peninsula Malaysia, among which RM9.9 billion are directly attributable to the wood material (Roda *et al.* 2011). In the mid 2000s, the shifting of low value of output growth in sawmills to higher output growth was observed and this largely contributed to the positive value added in the sawmill industry. The higher output from the sawmill industry may be a result of more efficient utilization of the logs, using better band saws for higher recovery rate, residues for bioenergy, and composite industries, despite the in production of logs from natural forests, declined from 23.1 million m^3 in 2000 to 20.7 million m^3 in 2008 (NATIP 2009; Thang 2009; Chin *et al.* 2010; H'ng *et al.* 2011; Chin *et al.* 2013; Hamza *et al.* 2013). The decline in the production of logs from forests was due to the annual allowable cut subjected to the National Forest Policy (NFP) and Malaysia's commitment towards SFM (The Economic Planning Unit 2006).

Figure 1 shows the linear regression of value added of wood sawmill in Peninsular Malaysia over the 10 years period. The slope of that relationship is positive at an average of RM 291,557,691 per year. This slope with an R^2 value of 0.68 seems to carry major importance in determining the directions of a long-term trend in the value added of sawmill in Peninsular Malaysia.

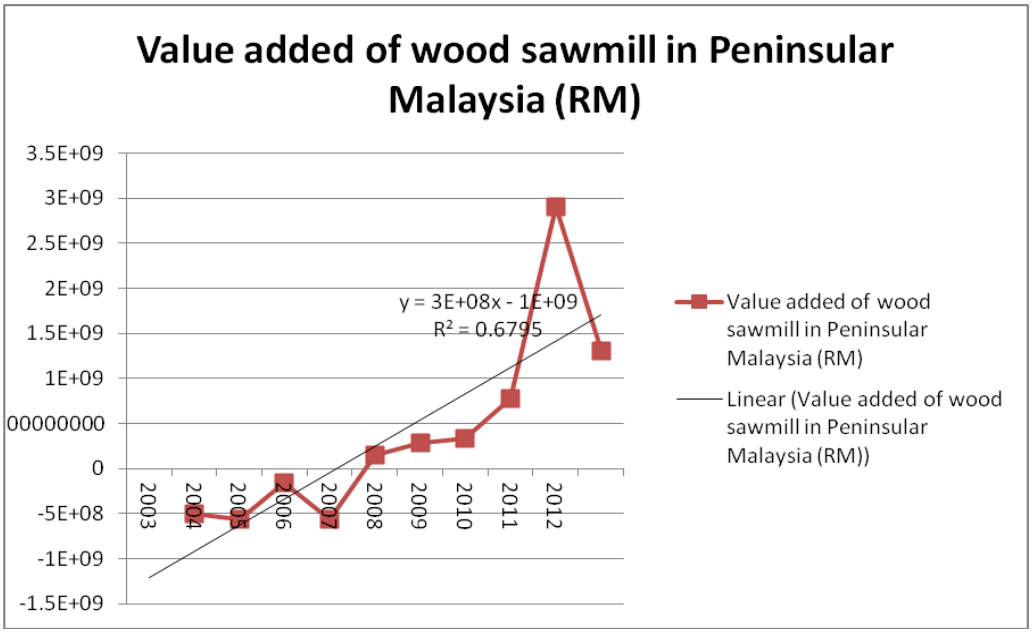

Fig. 1. Linear Regression Value Added of Wood Sawmills in Peninsular Malaysia

PRODUCTIVITY PERFORMANCE

A value added productivity measurement was employed to analyze the value added wood sawmill industry in Peninsular Malaysia. A value added productivity measurement is basically a measure of the effectiveness and efficiency of an organization

in generating output with the resources available (Choong and Tham 1995; Narayana 2013). The value added productivity measurement is comprised of several statistical ratios, including labor productivity, that can be used to determine the productivity performance of the wood sawmill industry. Productivity performance represents the efficiency with which physical inputs are converted to useful outputs.

As previously mentioned, productivity is equal to output divided by input. One measure of output is value added. The input can be comprised of any one the following: total number of workers, capital investment, labor wages, size of company, *etc*. However, some industries have adopted a standard way of expressing productivity, based on the intensity of use of a key production factor or drawing on readily available data. For the manufacturing industry, the productivity performance expressed the output per employee and is called labor productivity (Ojo and Obalokun 2005; Spring 2011; Sang *et al.* 2014).

Labor productivity is the most common productivity measure, partly because it is the easiest to compute. Labor productivity corresponds to output per unit of labor input (or value-added per worker-hour, as computed in this study). This indicator provides estimates of growth rates of labor productivity. High labor productivity is often associated with high levels or particular types of human capital, indicating priorities for specific education and training policies (Livesey 2006). Table 8 shows the productivity performance of the wood sawmilling industry using the value added per employee ratio. Malaysian workers had a productivity value of RM 43,952 per year according to the Malaysia Productivity Council Director-general Datuk Mohd Razali Hussain, citing the 2011 Productivity Report (The Star 2013). This value is far below the labor productivity for wood sawmills industry recorded in year 2011 and 2012.

Table 8. Productivity Performance of Peninsular Malaysia Wood Sawmilling

Year	Value added of wood sawmill in Peninsular Malaysia (RM)	Employment in sawmill of Peninsular Malaysia	Labour Productivity
2003	-499,664,400	20,748	-24,082
2004	-560,929,700	21,898	-25,615
2005	-164,435,000	22,209	-7,404
2006	-562,036,000	22,827	-24,622
2007	153,168,400	21,031	7,283
2008	283,922,700	22,270	12,749
2009	329,882,700	20,067	16,439
2010	781,985,400	18,417	42,460
2011	2,908,078,300	17,796	163,412
2012	1,309,819,000	17,457	75,031

The value added per unit of labor is shown in Table 8. Changes in productivity were not strongly correlated with changes in employment from 2003 to 2012. Change in output is more rapid than change in employment. Normally, there is a pattern of productivity such that the workers' experience plays an important role in the productivity measurement and performance. Nonetheless, when the increase in price of timbers, which directly affects the output, grows more rapidly than employment, it may indicate that the productivity of sawmill depends solely on the price of sawn timbers in the timber trade market. In short, the wood sawmills industry relies on the demand from the international market rather than the need for skilled workers in the industry.

CONCLUSIONS

1. This paper outlines some of the key components and outcomes of the productivity performance of wood sawmills in Peninsular Malaysia.
2. The Malaysian sawmilling sector is the largest and oldest wood processing industry in Malaysia.
3. The value added of the wood sawmills in Peninsular Malaysia over 10 years (2003-2012) was calculated and tabulated. The paper concludes that over the 10 year period, value added in Malaysia sawmilling has gone from highly negative to highly positive and breaking the zero barrier in 2006.
4. The sawn timber price is the driving force in value-added calculation of sawmilling as constructed. Roughly 97% of the variation in the value-added number is explained by mean sawn timber price over the 10 year period (R-squared). The R-squared does not improve any by adding sawmill labor as a variable.
5. Government implementation of Sustainable Forest Management using reduced impact logging (RIL) and a reduction of annual allowable cutting (AAC) resulted in higher values of forest products while better protecting forest biological diversity and forest health in the face of changing climate.
6. Besides the productivity performance using the value added productive measurement, using the numbers from labor as inputs explained the issues surrounding wood sawmills in Peninsular Malaysia.
7. The wood sawmills in Peninsular does not require skilled workers, and productivity performance solely depends on the timbers price.

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