



UNIVERSITI PUTRA MALAYSIA

***MODELLING AND FORECASTING OF PRIMARY TIMBER-BASED
INDUSTRY IN PENINSULAR MALAYSIA***

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INDUSTRY IN PENINSULAR MALAYSIA**

By

NORAIDA BINTI ABD WAHOB

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for the Degree of Master of Science**

November 2014

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Degree of Master of Science

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November 2014

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Faculty: Economics and Management

Malaysia is one of the major producing countries in global timber market. The Malaysian Government has put priority to the implementation of Sustainable Forest Management (SFM) practices. Recognizing the need to strengthen the SFM practices, Malaysia has undertaken a critical step to reduce the Annual Allowable Cutting (AAC) and has imposed stringent criteria on timber harvesting operations. As a result, this policy implementation has influenced the volume of timber that can be extracted from the natural forests which has and simultaneously affected the timber processing industry in Peninsular Malaysia.

Hence, impact analysis of SFM practices on timber-based industries in Peninsular Malaysia is needed. This study covered timber-based products namely sawn timber, veneer and plywood and those representing the first stage of timber-based processing industry. The data used are annual time series from 1980 until 2012 which are obtained from three major resources namely; the Statistics Forestry Department Peninsular Malaysia, the Malaysian Timber Industry Board Resource Center and the World Bank.

The analysis of each commodity uses 4 models; specifically, the supply model, domestic demand model, import demand model and export demand model. The Augmented Distribution Lagged (ARDL) is employed in order to get the goodness of fit for each commodity model. This model provides short run and long run coefficients which are being used for impact analysis. Based on the supply model of the sawn timber, the results show that harvested area is statistically significant at 5% level in determining the production of sawn timber. The domestic price of plywood is highly significant at 1% level in determining plywood supply. Whereas in domestic demand model, import prices of veneer and sawn timber are statistically significant at 5% and 10% level respectively. For export demand model, the export price of sawn timber and veneer are highly significant at 1% level. Lastly, for the import demand model, the import price for sawn timber and veneer shows that they are statistically significant at 5% and 10% level respectively.

Moving on to the forecasting analysis, each timber commodity has been forecasted based on four scenarios under SFM practices, namely; (1) reduction by 20% in harvested area, (2) a rise by 25% in price of commodity; (3) rise by 47% in input

cost; (4) integration of scenario 1, 2 and 3 and; (5) rise by 10% in the Contribution of Forestry Activity and Harvesting to Total Gross Domestic Products (CGDP). The results revealed that, the most affected SFM practices are on veneer and plywood. In the production of veneer and plywood, particularly when the scenario is imposed, production tended to decrease. Henceforth, the results suggest that, producers tend to decrease production of veneer and plywood due to SFM practices since both commodities are produced in come from the same mill. On the other hand, consumers of veneer and plywood products for the making of value-added product such as furniture has to import the commodity, since the availability of veneer and plywood are scares.

However, the trend in the production of sawn timber has been constantly increasing even after the imposition of the scenario under SFM practices. This indicates that, the production of sawn timber has been continuously, growing with SFM practices. The result suggested that, the producers would be able to produce more sawn timber after imposing the scenario under SFM practices. Thus, such SFM practices certainly help generate economic growth in the timber-based sector besides its sustainability. It will also help to enhance forest conservation goal in Peninsular Malaysia.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

MODEL DAN RAMALAN TERHADAP INDUSTRI PERKAYUAN DI SEMENANJUNG MALAYSIA

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Malaysia merupakan salah sebuah negara pengeluar balak utama dunia. Kerajaan Malaysia telah memberi keutamaan untuk mengimplementasikan prinsip Pengurusan Hutan Lestari (Sustainable Forest Management) (SFM). Bagi memenuhi prinsip tersebut, Malaysia telah mengambil langkah kritikal untuk mengurangkan jumlah Catuan Tebangan Tahunan (Annual Allowable Cutting) (AAC) dan penguatkuasaan syarat yang ketat terhadap operasi pembalakan. Pelaksanaan polisi ini tidak hanya memberi kesan terhadap jumlah balak yang boleh diekstrak daripada hutan semulajadi, malah mempengaruhi industri pemprosesan balak di Semenanjung Malaysia.

Oleh itu, analisis kesan amalan prinsip SFM terhadap industri berasaskan balak di Semenanjung Malaysia perlu dilakukan. Kajian ini merangkumi produk berasaskan balak, termasuklah kayu gergaji (sawn timber), venir dan kayu lapis dan jenis-jenis produk kayu yang mewakili tahap pertama industri pemprosesan berasaskan balak. Data diambil daripada tempoh tahunan yang bermula dari tahun 1970 hingga 2012. Data-data ini diperolehi daripada tiga sumber utama, iaitu statistik Jabatan Perhutanan Semenanjung Malaysia, pusat sumber Lembaga Perindustrian Kayu Malaysia dan Bank Dunia.

Setiap komoditi memiliki empat model yang merangkumi bekalan, permintaan domestik, permintaan import dan permintaan eksport. Kajian ini menggunakan model Augmented Distribution Lagged (ARDL) bagi mendapatkan kualiti optimum setiap mod komoditi. ARDL menyediakan pekali jangka pendek dan jangka masa panjang yang sesuai untuk kajian berbentuk analisis Impak. Berdasarkan model bekalan kayu gergaji, hasil kajian ini menunjukkan bahawa kawasan penuaian berada pada paras signifikan iaitu 5% dalam menentukan jumlah pengeluaran kayu gergaji. Harga domestik kayu lapis adalah tinggi pada paras 1% dalam menentukan jumlah pengeluaran papan lapis. Sementara itu, model permintaan domestik menunjukkan bahawa harga import venir adalah pada paras statistik 5% dan kayu gergaji pula ada sebanyak 10%. Model permintaan eksport pula menyaksikan harga kayu gergaji dan venir masing-masing menunjukkan aras 1% yang sangat signifikan. Model terakhir, yakni model permintaan import memperlihatkan harga import bagi kayu gergaji dan venir berada pada paras 5% dan 10% bagi setiap jenis yang tersebut.

Kajian ini seterusnya beralih pada analisis jangkaan untuk setiap komoditi balak terhadap empat senario SFM, iaitu (1) pengurangan sebanyak 20% di kawasan penuaian; (2) peningkatan harga komoditi sebanyak 25%; (3) peningkatan sebanyak 47% untuk kos imput; (4) integrasi senario 1, 2 dan 3 dan; (5) peningkatan 10% dalam Sumbangan Hutan dan Aktiviti Penuaian kepada Jumlah Keluaran Dalam Negara Kasar (KDNK). Dapatan daripada analisis ini mendedahkan bahawa amalan SFM telah menyebabkan kecenderungan nilai penurunan pada tahap pengeluaran venir dan kayu lapis. Pengurangan jumlah pengeluaran ini memberi pertimbangan terhadap kedua-dua jenis kayu yang berasal daripada pengeluar yang sama. Sementara itu, pengguna venir dan kayu lapis dalam pembuatan produk bernilai tambah seperti perabot, perlu mengimport bagi memenuhi kekurangan yang runcing.

Walau bagaimanapun, pola pengeluaran kayu gergaji dilihat meningkat secara konsisten meskipun selepas senario ujikaji berdasarkan SFM dijalankan. Hal ini membuktikan bahawa SFM memberi kesan baik terhadap pengeluaran kayu gergaji. Hasilnya, pengeluar berupaya membekalkan lebih banyak kayu gergaji yang sekaligus menjana perkembangan ekonomi industri berasaskan balak secara lestari. Senario di bawah amalan SFM akan menjana pertumbuhan ekonomi dalam sektor kayu sejajar dengan kemampuannya. SFM turut meningkatkan capaian matlamat pemuliharaan hutan di Semenanjung Malaysia.

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APPROVAL

I certify that a Thesis Examination Committee has met on (24 November 2014) to conduct the final examination of (Noraida Abd. Wahob) on her thesis entitled “Modeling And Forecasting Of Primary Timber-Based Industry In Peninsular Malaysia” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the (Master of Science).

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LIST OF ABBREVIATION/GLOSSARY OF TERMS

2SLS	Two-stage-least-square
3SLS	Three-stage-least-square
AAC	Annual Allowable Cutting
ADF	Augmented Dickey-Fuller
ARDL	Autoregressive Distributed Lag
CL	Conventional Logging
DF	Dickey-Fuller
DOS	Department of Statistic
ECM	Error Correction Model
ER	Exchange Rate
EU	European Union
FAO	Food and Agriculture Organization of the United Nation
FDPM	Forestry Department of Peninsular Malaysia
FMC	Forest Management Certification
FMUs	Forest Management Units
FSC	Forest Steward Council
GDP	Gross Domestic Product
GSP	Generalized Scheme of Purchasing
IPI	Industrial Production Index
ITTO	International Tropical Timber Organization
In	Natural Logarithm
KDNK	Keluaran Dalam Negara Kasar
LP	‘Logfisher’ Practices
MC&I	Malaysian Criteria & Indicator
MPIC	Ministry of Plantation Industries and Commodities

MTC	Malaysian Timber Council
MTCC	Malaysian Timber Certification Council
MTIB	Malaysian Timber Industry Board
NFP	National Forest Policy
OLS	Ordinary Least Square
PFE	Permanent Forest Estate
PP	Philips-Perron
PRF	Permanent Reserve Forest
RIL	Reduce Impact Logging
SFM	Sustainable Forest Management
SIC	Schwarz Information Criterion
TS	Timber Supply
UECM	Unrestricted Error Correction Model
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
WRT	Wood Resource Taskforce

CHAPTER 1

INTRODUCTION

This chapter discusses the background of the study regarding Sustainable Forest Management (SFM) practices and its effects on primary timber-based industry. This chapter also discusses briefly about the stages of timber-based processing. However, the discussion only focuses on primary timber-processing specifically on the first stage of primary timber-based processing in Peninsular Malaysia. Furthermore, the contributions of primary timber-based products will be discussed. Problem statement and objectives of this study will be provided. Lastly, the organization of this study will be described in order to make it easy for the readers to understand the flow of the whole chapter.

1.1 Background of Study

Timber-based industry appeared in the late 1940s and started to process Ramin timbers in 1950s. In 1959, timber-based products in Malaysia started to diversify into manufacturing of plywood, veneer and moulding (Woon and Norini, 2002). The timber-based industry has been established in Malaysia for over two decades and becomes one of the socioeconomic sectors and major contributors towards the economy in Malaysia. This industry has been progressing tremendously and has the potential to grow rapidly in the future. It has become the major contributor to export earnings and employments in manufacturing sector. Based on the first Master Plan in 1986, followed by the second (IMP2) in 1996 and the ongoing third (IMP3), the industry was made very profitable with enormous growth rates.

Recognizing the important role of timber-based industry in the country, the Malaysian Government has created a variety of efforts and plannings to support its growth and development. Started with the First Industrial Master Plan (IMP1) from 1986 to 1995, the Timber-Based Industry (TBI) was identified as one of twelve sub-sector industries comprising seven resources-based industries to be developed in over ten years period. The timber-based industry is identified to be more export-oriented industry. During IMP1, the activities in timber industry were mainly concentrated to the production of timber, sawn timber, veneer and plywood with special emphasis on value added processing (Anon, 2013).

Then, as for the Second Industrial Master plan (IMP2) which was started from 1996 to 2005, the (TBI) in Malaysia developed massively to increase its productivity by producing value added products such as MDF, panel products, and furniture. This was proved by a significant increment in panel products. The total exports of (TBI) products increased at an average annual growth rate of 5.7 percent from RM12.8 billion in 1996 to RM21 billion in 2006 (Jean-Marc et al., 2011). The significant increment was recorded in panel products (plywood, particleboard, chipboard and fibreboard), builder's joineries and wooden frames, wooden furniture, pulp and papers. During IMP2, plywood became the major export earner. The export of plywood increased at an average annual rate of 4.4 per cent from RM4.5 billion in

1996 to RM 5.6 billion in 2005. However, during the same period, export of sawn timber and veneer decreased by average annual rates of 1.4 percent and 3.1 per cent, respectively. These were due to the declination in the supply of timbers, as well as higher utilization of these intermediate products for further value-added downstream processing (Anon, 2008).

As for the current situation, the Third Industrial Master Plan (IMP3), which covers from the year of 2006 till 2020, the industry will continue to be export driven. The government of Malaysia will enhance the production of sawn timber including rubber wood through efficient and effective managements of forest plantations. Other than that, promotions regarding lesser known species will be taken into consideration. In order to increase the productivity of timber-based products, Bio-composite Development Centre has been established under Malaysian Timber Industry Board (MTIB) to enhance Research and Development (R&D) activities related to timber-based development.

Based on FAO (2012), it is proposed that from the year of 2006 to 2012, the export of sawn timber, veneer and plywood were decreased at the average annual rates of 2 percent, 2 percent and 1 percent respectively, due to the substitution of value added to products such as furniture. According to Jean-Marc et al. (2011), last 10 years had showed that the main reason why primary timber processing decreased was because of the rapid production and development of furniture which was meant to be exported.

Furthermore, the government of Malaysia has recognized a specific policy for timber-based industry namely National Timber Policy (NATIP). According to the Minister of Plantation Industries and Commodities Malaysia, Datuk Peter Chin Fah Kui, NATIP is established as the guideline for the development of the timber industry in Malaysia. Referring to the policy, the timber fraternity will be able to align their operation and long term plans from 2009 to 2020 according to the strategies prescribed in NATIP. Also, NATIP will take part actively in the mainstream development of the industry (Anon, 2009). Based on NATIP (2009), the policy targets 6.4 percent of annual growth rate and RM53 billion in export earnings with 40 percent gathered from primary activities and 60 percent from downstream timber products.

Malaysia, which is known as one of the leading exporters of tropical timber and timber-based products has become the legacy of orderly growth based on sound foundation of environmental management. Hence, Malaysia has always subscribed to international best practices that ensure protections and conservations of its environment. Thus, Malaysia takes full responsibilities by implementing Sustainable Forest Management (SFM) practices instead of conventional timbering (CL) since 1990 (ITTO, 1990).

By practicing SFM, the world demand for timber products is growing smoothly and this trend is expected to continue for years. Instead of fulfilling the demand of the world's market, Malaysia is also transparent in sustaining and managing the forest resources. To fulfill the SFM practices, Malaysia has to face several major challenges, for instance, to reduce deforestation and forest degradation by ensuring

the sustainability of forest resources, to protect and conserve timber diversity thus ensuring the sustainable use of the genetic resources and to enhance its full valuation of forest goods and services.

1.1.1 Sustainable Forest Management (SFM) practices in Peninsular Malaysia

According to MCPFE (1993), Sustainable Forest Management (SFM) practices can be defined as stewardship and usage of forests and forest lands in a way, and at rate, maintain biodiversity, productivity, regeneration capacity, vitality, potential to fulfil now and in future for relevant ecological, economics and social functions at local, national and global levels. In other words, SFM practices do not cause damages to other ecosystems.

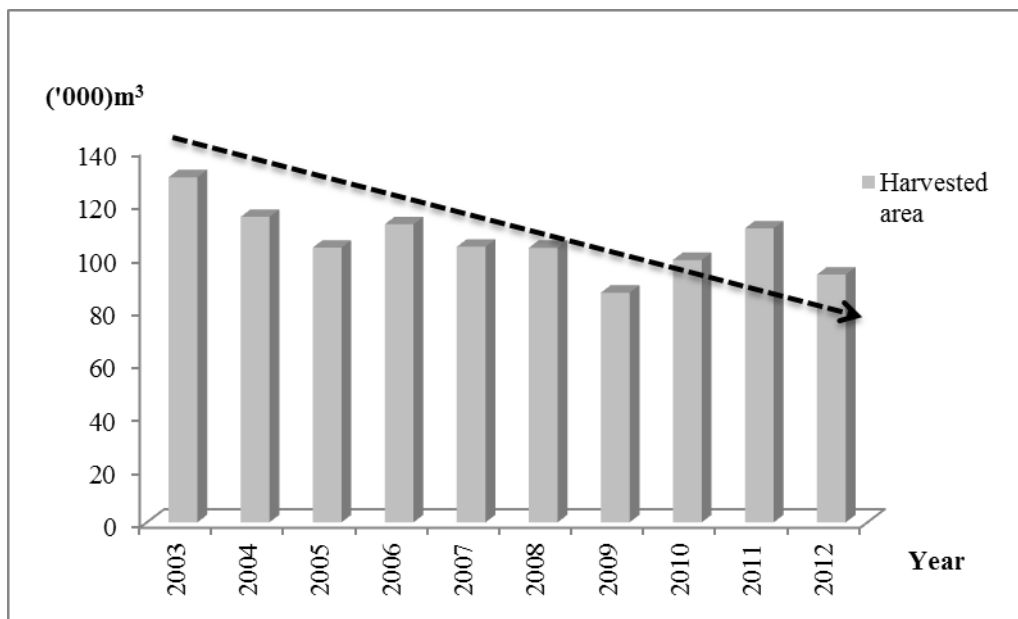
The first global policy on sustainable forest management (Earth Summit Declaration) was established in 1992 at Rio. There are many countries that had promoted and launched sustainable forest management with complying criteria and indicators (Wijewardana, 1998). In Peninsular Malaysia, the Malaysia criteria and indicators (MC&I) were developed and prepared at the national forest management unit to achieve sustainable forest management (Samsudin and Heyde, 1995).

The MC&I in Malaysia was initially formulated in 1994 after 2 years of the first global policy on sustainable forest management was launched (Mohd Shahwahid, 2006). It was implemented in 1997 based on the International Tropical Timber Organization (ITTO) guidelines, namely “*Guidelines for the Sustainable Management of Natural Tropical Forests and Criteria for the Measurement of Sustainable Tropical Forest Management.*” However, MC&I were revised in 1999 as the *Malaysian criteria, indicators, activities and standards of performance for forest management certification*. In 2002, the MC&I once again was further revised, and finally be known as the *Malaysian criteria and indicators for forest management certification*. According to Ismail (2002), the Malaysian Timber Certification Council (MTCC) in Peninsular Malaysia carries the hand to evaluate the implementation of the MC&I particularly in timber harvesting. This scenario allows the producers of timber to follow all activities stated by MC&I in order to make sure their timber-based products can be exported to the international market level.

In Malaysia, the role-play of forest harvesting activities is subjected to socio-economic and rural development. The production of timbers from timber harvesting in 2012 was 4.4 million cubic meters with the export value of major timber products for about RM3.11 billion (Forestry Statistics Peninsular Malaysia, 2012). By referring to the above requirements, in order to cater the international market situation, all timber and timber-based products produced for export should follow the criteria and indicators certified by forest certification (Baharuddin and Simula, 1996).

1.1.2 Effects of MC&I in Peninsular Malaysia

The implementation of MC&I would affect the cost of forest harvesting. According to Ahmad Fauzi, (2002), 24 percent reduction in harvested area was due to SFM practices. Based on Figure 1.1, areas licensed for harvesting in Peninsular Malaysia were fluctuated with declining trends from the year 2003 and onwards. The Forestry Department of Peninsular Malaysia took several actions by reducing area licensed for harvesting through the year to obtain a sustainable yield among the potential yield.



Source: FDPM (various issues)

Figure 1.1: Areas Licensed for Harvesting in Peninsular Malaysia (2003-2012)

The role of timber as raw material for primary timber processing resulted the primary timber products to be diminished through the years due to shortage of availability of timber (refer to Table 1.1).

Table 1.1: Production of Primary Timber Processing 2003 and 2012

Type of Timber-based Products	Production ('000,000) m ³	
	2003	2012
Sawn timber	2.93	2.79
Veneer	0.13	0.06
Plywood	0.50	0.42

Source: FDPM (various issues)

Henceforth, this may reduce the concessionaire's profit. Based on Maser, (1997), the early estimation on the cost of complying with the criteria and indicators in timber harvesting was USD2.2 million per year (RM7.85 million per year). In Malaysia, the cost of improving forest harvesting operations from current practices to a certifiable level could exceed the current costs by 62.5 percent (Thang, 2003). With the increasing cost compliance with the MC&I in forest harvesting, it will affect the feasibility of long-term management of forest concession. In a long-run, the price of timber-based products will be affected due to this implementation. Once the

government changed conventional logging (CL) practices to SFM practices in order to manage the natural forest, the equilibrium quantity of timber had reduced. This gave the result of the quantity of timber for primary timber processing to be condensed (Mohd Shahwahid, 2006). In addition, the price level of timber had also increased simultaneously resulted the operational cost of primary timber processing to be increased. This is in compliance with Abdul Rahim et al. (2012) statement that in order to offset the operational cost, the producer had to increase the price of primary timber-based products.

Furthermore, the annual coupe had been reduced from 71,200 ha per annum for Peninsular Malaysia during the Fifth Malaysia Plan (1985-1990) to 42,870 ha per annum during the Eight Malaysia Plan (2001-2005). For the Ninth Malaysia Plan (2006-2010), the annual coupe was set at 36,940 ha. This showed that the annual coupe had been declining steadily. It was due to the effort taken in conservation strategy to ensure sustainable timber production (Mohd Shahwahid and Awang Noor, 2002) and to comply with SFM (Woon and Tong, 2004). This was the fundamental pillar of Peninsular Malaysia's commitment to SFM (MTC, 2007). Presently, in the Tenth Malaysia Plan (2011-2015), Malaysian government is conducting Central Forest Spine of 4.32 million hectares in Peninsular Malaysia. This plan is a starting point of awareness in order to create a network of ecological or green corridors to generate one contiguous, forested wildlife sanctuary. This is one of the efforts to protect and strengthen the biodiversity and habitats of flora and fauna.

Lately, the shortage of timber productions gives an impact towards the productions of primary timber processing. The role of timber as raw material for primary timber processing causes the diminishing of productions of primary timber processing. According to FDPM (2012), overall timber production was fluctuated with decreased trends especially during 2004 from 4.5 million ha to 3.7 million in 2009. In 2009, the production showed increased trends from 3.7 million to 4.5 million in 2012. In addition, the quantity of timber import was increased from 0.034 million m³ to 0.035 million m³ in 2012 to equip the shortage of timber productions (Refer Table 1.2).

Table 1.2: Timber Productions, Consumptions and Trades in Peninsular Malaysia (million m³)

Year	Total timber production	Consumption		Total Timber Consumption	Timber import	Surplus /deficit
		Sawmills	Plywood & Veneer mills			
2003	4.419	5.519	0.760	6.279	0.340	(2.20)
2004	4.572	6.082	0.778	6.860	0.080	(2.37)
2005	4.405	5.106	0.630	5.736	0.072	(1.40)
2006	4.693	6.445	0.546	6.991	0.112	(2.41)
2007	4.220	4.381	0.599	4.980	0.070	(0.83)
2008	4.028	3.681	0.522	4.203	0.078	(0.25)
2009	3.686	3.131	0.469	3.600	0.034	0.05
2010	4.161	3.892	0.604	4.496	0.023	(0.36)
2011	4.171	3.920	0.681	4.601	0.021	(0.45)
2012	4.467	4.772	0.708	5.480	0.035	(1.05)

Source: FDPM (various issues)

As a result, the primary timber processing showed deficit trends mostly from 2003 to 2012. The productions, consumptions and trades for sawn timber, veneer and plywood were shown in Table 1.3 (sawn timber), 1.4 (veneer) and 1.5 (plywood), respectively.

Table 1.3: Sawn timber Productions, Consumptions and Trades in Peninsular Malaysia (Million m³)

Year	Total Sawn timber Production	Consumption		Total Sawn timber Consumption	Sawn timber Import	Surplus /deficit
		Domestic	Export			
2003	2.928	2.689	1.048	3.737	0.575	(1.38)
2004	3.200	2.682	1.137	3.819	0.665	(1.28)
2005	3.236	2.751	1.198	3.949	0.689	(1.40)
2006	3.019	2.945	1.104	4.050	0.746	(1.78)
2007	2.668	2.731	0.812	3.544	0.547	(1.42)
2008	2.387	2.029	0.944	2.973	0.395	(0.98)
2009	2.081	1.361	0.793	2.153	0.312	(0.38)
2010	2.659	2.107	0.879	2.986	0.294	(0.62)
2011	2.675	2.501	0.993	3.494	0.268	(1.09)
2012	2.790	2.758	0.963	3.721	0.295	(1.23)

Source: FDPM (various issues)

Table 1.4: Veneer Productions, Consumptions and Trades in Peninsular Malaysia (Million m³)

Year	Total Veneer Production	Consumption		Total Veneer Consumption	Veneer Import	Surplus/ deficit
		Domestic	Export			
2003	0.128	0.014	0.006	0.020	0.469	(0.36)
2004	0.117	0.019	0.005	0.024	0.039	0.05
2005	0.097	0.024	0.006	0.030	0.031	0.04
2006	0.101	0.014	0.005	0.019	0.050	0.03
2007	0.045	0.009	0.004	0.014	0.047	(0.02)
2008	0.014	0.003	0.004	0.007	0.037	(0.03)
2009	0.008	0.005	0.004	0.009	0.072	(0.07)
2010	0.035	0.017	0.004	0.021	0.128	(0.11)
2011	0.055	0.019	0.005	0.025	0.089	(0.06)
2012	0.062	0.019	0.005	0.024	0.131	(0.09)

Source: FDPM (various issues)

Table 1.5: Plywood Productions, Consumptions and Trades in Peninsular Malaysia (Million m³)

Year	Total Plywood Production	Consumption		Total Plywood Consumption	Plywood Import	Surplus/ deficit
		Domestic	Export			
2003	0.504	0.408	0.155	0.563	0.003	(0.06)
2004	0.516	0.358	0.182	0.540	0.013	(0.04)
2005	0.492	0.364	0.180	0.544	0.020	(0.07)
2006	0.459	0.328	0.239	0.567	0.050	(0.16)
2007	0.473	0.322	0.232	0.554	0.063	(0.14)
2008	0.467	0.283	0.314	0.597	0.058	(0.19)
2009	0.357	0.262	0.239	0.500	0.059	(0.20)
2010	0.383	0.277	0.248	0.526	0.146	(0.29)
2011	0.403	0.321	0.217	0.538	0.233	(0.37)
2012	0.415	0.330	0.181	0.511	0.327	(0.42)

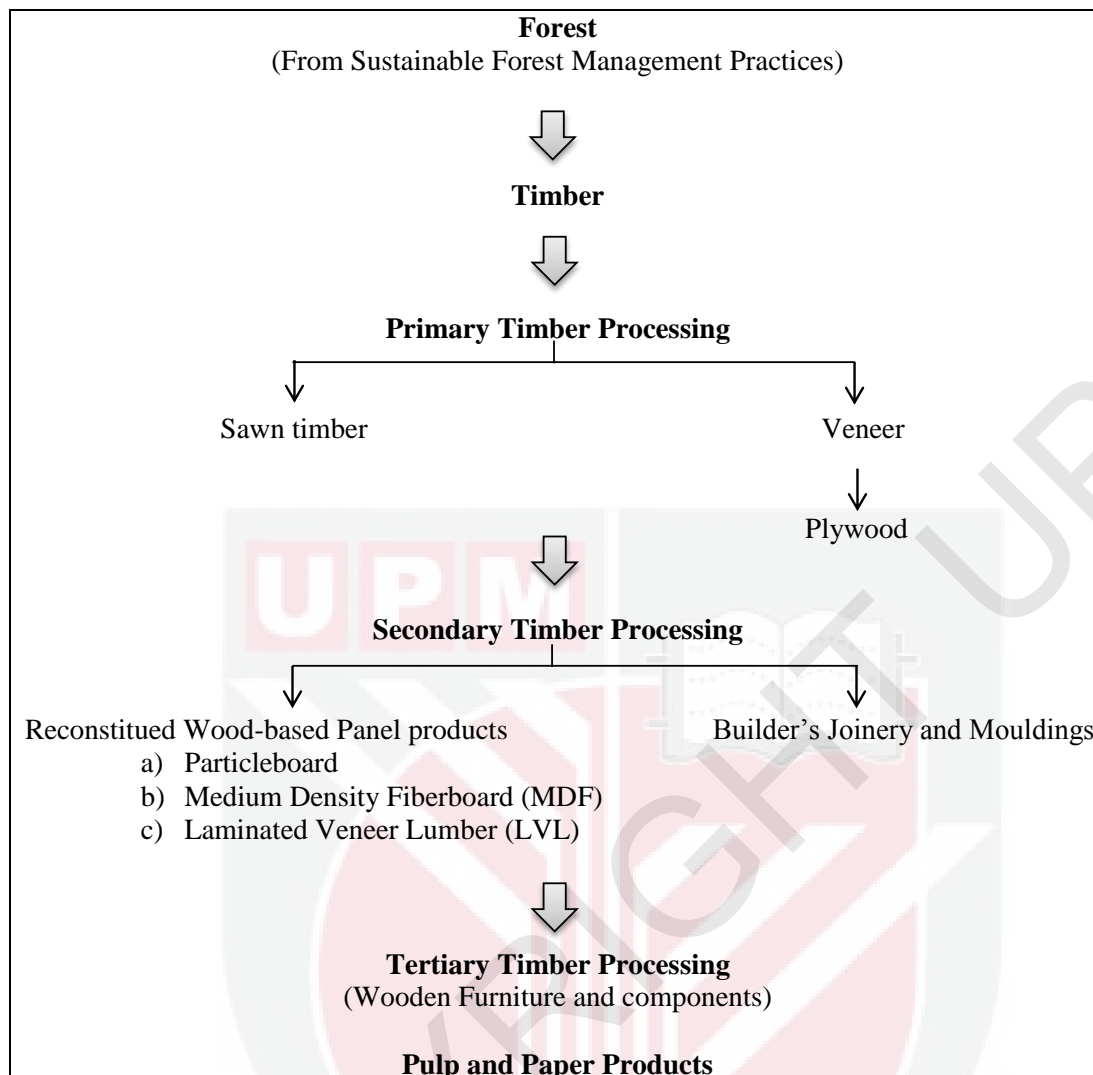
Source: FDPM (various issues)

From the tables shown above, it can be concluded that the main reason for this decreased trends was possibly due to the shortage of timber supply resulted from the increase in local demands for high value-added manufactured goods as well as the obligations of SFM practices (Norini, 2001 and Ahmad Zuhaidi et al., 2007).

1.2 Stages of Timber-Based Products Processing

The implementation of Sustainable Forest Management produces the capability of timber productions which can meet the demand and market to be one of the leading exporters in timber and timber-based products. The timber industry in Malaysia covers both upstream and downstream activities. The upstream activities entail systematic and sustainable harvesting of natural forests and forest plantations, while the downstream activities cover primary, secondary and tertiary timber processing, ranging from processing of the raw materials (timber) to the manufacturing of semi-finished and finished timber products.

Primary timber processing consists of sawn timber, veneer and plywood. While in secondary timber processing covers reconstituted timber-based panel products namely particleboard, medium density fiberboard (MDF) and laminated veneer lumber (LVL). Other products in secondary timber processing are builder's joinery and mouldings. Apart from that, tertiary timber processing is the process of making timber products. Products from primary and secondary timber processing will be used to build wooden furniture and its components. In addition, other products of timber are pulp and paper products. The whole summary of stage regarding timber-based production is depicted in Figure 1.2.



Source: Third Industrial Master Plan (IMP3) 2006-2020

Figure 1.2: The Summary of Stages regarding Timber-Based Production

Overall, this study covers primary timber processing. In primary timber processing, there are sawn timber, veneer and plywood. Since the raw material of primary timber processing is timber that comes from the forest, so the impact of SFM practices can be seen clearly compared to other timber-based processing products.

1.2.1 Primary Timber-Based Products and Market

In primary timber processing, there are two types of timber-based products which are first, sawn timber and second veneer and plywood. Each of the product has its own mill which is sawn timber sourced from sawmill while veneer and plywood come from the same mill. The timber as raw material is harvested from natural and plantation forests, transported to timber processing mills for processing into the output of timber-based products. The discussion on primary timber processing is discussed briefly below.

1.2.2 Sawn timber

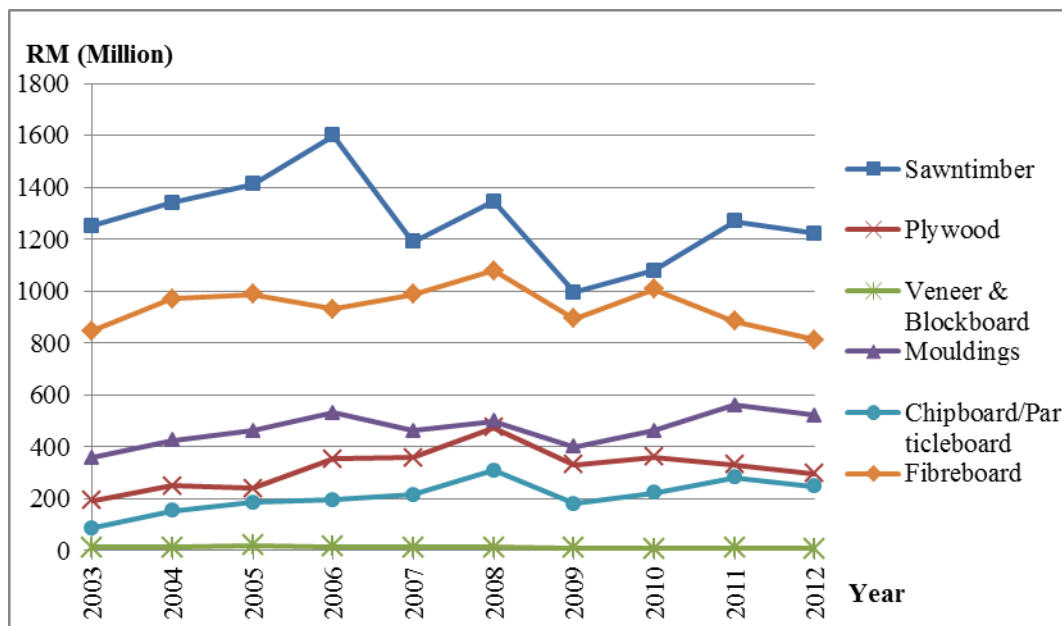
Sawn timber has well anchored in Malaysia as an on-going subsector of timber industry. In 2012, there are 671 sawmills located in Peninsular Malaysia which was increased from 667 sawmills in 2007, 172 in Sabah and 170 in Sarawak. Export of sawn timber in 2012 amounted to RM 1.22 billion with exports primarily to Thailand (RM 192 million), Netherlands (RM 115 million), Singapore (RM 96 million), UAE (RM 72 million) and South Africa (RM 58 million) (Forestry Statistics Peninsular Malaysia, 2012).

1.2.3 Veneer and plywood

Veneer is the thin layer of a timber. The layer of veneer is produced by peeling around high quality of timber to produce smooth surface of veneer without any defects. Whereas, plywood consists of three or more layers of veneer, each glued with its grain at right angles to adjacent layers for strength. Veneer and plywood are produced by the same mill. The numbers of plywood/veneer mills in Malaysia recorded in 2012 were 53 from 52 in 2005 which were located in Peninsular Malaysia, while 68 in Sarawak and 62 in Sabah. Export of veneer increased from RM 8.8 million in 2010 to RM 9.3 million in 2012. Whereas, export of plywood decreased from RM 360 million in 2010 to RM 297 million in 2012. However, plywood is still emerged as the second largest exporter after Indonesia in the global market. Plywood and veneer products are the second largest foreign exchange earner for timber-based industry. Major exporter countries are United Kingdom (RM 139 million), Australia (RM 48 million), Singapore (RM 28 million), Netherlands (RM 18 million) and Belgium (RM 11 million) (Forestry Statistics Peninsular Malaysia, 2012).

1.3 Contribution of Timber-Based Industry in Peninsular Malaysia

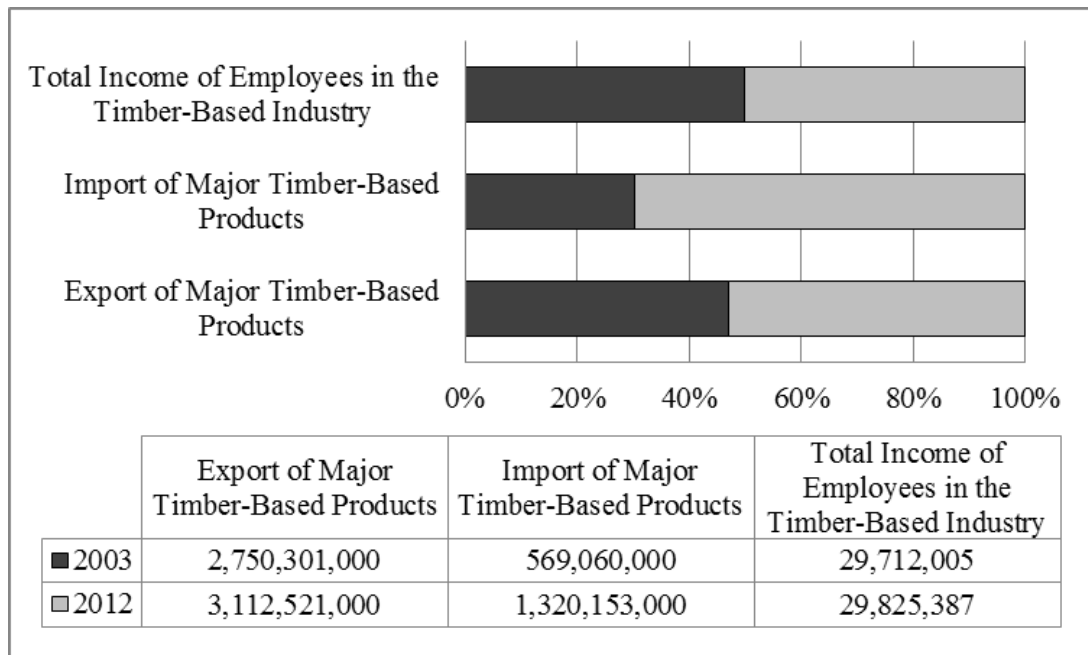
The timber-based industry which is known as export-oriented industry has been developing every year since the First Industrial Master Plans (IMP1). Figure 1.3 shows the export value of major timber products from 2003 to 2012 in Peninsular Malaysia. According to Forestry Department Peninsular Malaysia in 2012, major timber products were exported to European Union (EU) by 24 percent, both West Asia and East Asia 21 percent, followed by ASEAN 19 percent, Oceania/Pacific 7 percent, America 5 percent and Africa 4 percent. According to Islam (2010), Malaysia benefited from the EU markets with Generalised Scheme of Preferences (GSP) tariff rates which allowed developing country exporters to pay less or no duties on their exports to EU countries.



Sources: LPKM/MTIB

Figure 1.3: Export Values of Major Timber-Based Products, (2003-2012)

Like many other export-oriented products, export of timber products from Peninsular Malaysia offer many benefits and advantages to the timber industry and the country as whole. Most importantly, it stimulates a dynamic economic growth by generating revenues and providing employment opportunities. Forestry Department of Peninsular Malaysia (FDPM) stated that the export of major timber products from Peninsular Malaysia has made substantial increments at 13 percent from RM 2.8 million in 2003 to RM 3.1 million in 2012. It has increased the employment rate by creating more than 32 000 job opportunities in related timber-based industry (Forestry Statistics of Peninsular Malaysia, 2012). Figure 1.4 shows a comparison in export, import and employment in timber-based industry in Peninsular Malaysia for previous ten years.

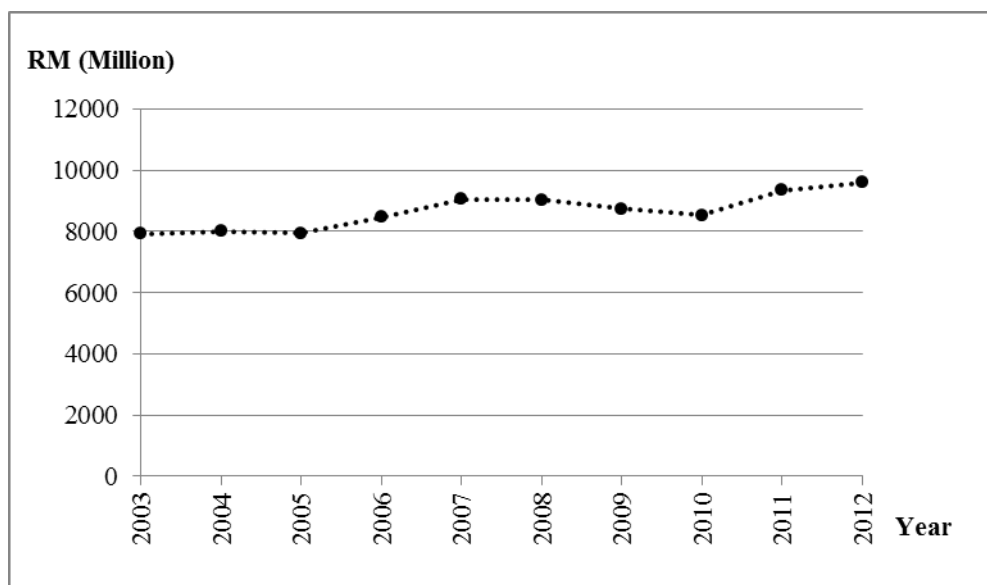


Source: Forestry Statistics Peninsular Malaysia, (2012).

Figure 1.4: Comparison in Export, Import and Employment in Timber-Based Industry in Peninsular Malaysia

Timber-based industry is the major contributor to value-added, export earnings and employments in manufacturing sector with almost 5,870 manufacturing establishments. 80-90% of them are regarded as SME (small or medium enterprise). More than 1200 sawmill cover the capacity of 9.5 million cubic meters per year and have a workforce of 5,500 employers (NATIP, 2009).

As discussed previously, export, import and total income in timber industry display that these industries have been growing every year, progressively. It exhibits the good sign for the development of Malaysian Economy especially in timber-based sector. In addition, Figure 1.5 shows the contribution of forestry and harvesting activities to total GDP in Malaysia and displays an increasing trend along the years. This proves that the timber-based industry is one of the industries that contribute to total GDP of Malaysia. As being noted, the contribution of the timber-based industry in Malaysia is undoubtedly referring to the increasing trend of contribution of forestry and harvesting activities to Malaysian Total GDP.



(Source: Forestry Statistics Peninsular Malaysia, 2012)

Figure 1.5: Contribution of Forestry Activities and Harvesting to Total GDP

1.4 Problem Statement

As mentioned earlier, in order to achieve SFM, there is a need for substantial reduction in the annual coupe or allowable cutting rate in the country. In the recognition to the need of strengthening SFM practices, Malaysia has undertaken a critical step to reduce the annual coupe or AAC in the country (Woon and Teong, 2004). Other than reducing AAC, the stringent criterion of SFM is by harvesting operations that have affected the timber volume which can be extracted. In addition, Peninsular Malaysia has banned the timber export since 1990s. Worst come to worst, the accessible forestland in Malaysia has slowly given way to agriculture especially in oil palm plantation, new satellite towns and other forms of land use, simultaneously creates a conflict between agriculture production and forest management (Ahmad Fauzi et al., 2010). As a result, it has affected the supply of Malaysian timber which represents the raw material for primary timber processing (Abdul Rahim and Mohd Shahwahid, 2009).

According to Anon (2008), the declination of timber supply and high demand to utilize intermediate products for further value-added downstream processing gave an impact towards the exportation of sawn timber and veneer. In 1999, the export of sawn timber and veneer decreased by average annual rates 1.4 percent and 3.1 percent, respectively due to the reasons mentioned above. Furthermore, Norini (2001) stated that in late 1990s, timber-based industry in Malaysia moved from producing products such as timber, sawn timber and plywood/veneer to manufacturing high value-added products like furniture, joinery/mouldings and rubberwood products. In this context, it creates further shortage towards the supply on primary timber-based products as raw materials especially in meeting the demand of the local secondary timber processing mills.

Consequently, the supply of primary timber products from Peninsular Malaysia has been continuously diminishing. As discussed previously in Table 1.1, the production of primary timber processing displayed a shrinking trend. For example, Peninsular Malaysia's timber supply experienced a deficit starting from 2003 to 2008, moving from resource surplus to resource deficit in Peninsular Malaysia and continued to be deficit from 2010 to 2012 (see Table 1.1). Since timber is known as the raw material for primary timber product, the shortage of timber gives an impact towards primary timber products. In general, as what has been discussed previously in Table 1.2, 1.3 and 1.4, primary timber-based supply showed deficit from 2003 to 2012.

Other than that, the demands for environmental-friendly or "green" products have increased up to the international level, especially from the developed countries. The developed countries like New Zealand, the Netherlands, Belgium and Australia have introduced public timber procurement policies and required the certification of imported timber products to be as the originator of the sustainable sources (Parikka-Alhola, 2008). Certification is seen as critical for long term access to key markets in Europe, United States and Japan since those are the major countries that import products from Malaysia.

Furthermore, certification for green timber-based products is being actively pursued to ensure continues market access for Malaysian timber products, particularly in the environmental subtle market. The introduction regarding stringent standards, regulations and purchasing policies (Green Purchasing Network Malaysia) and environmental and legal issues will have an influence in the future timber trade. According to the Ministry of Energy, Green Technology and Air (KETTHA), Green Purchasing Network Malaysia is a Non-Governmental Organization (NGO) which promotes green purchasing to encourage buyers, suppliers and manufacturers to adopt sustainable consumption and production methodologies.

Competition from other tropical timber and temperate timber producing countries, as well as emerging producing countries, is expected to intensify (Vincent, 1992; Atyi et. al., 2002 and Poore, 2013). Other than that, Malaysia is lack of market access for timber-based products and Sarre (2003) noted out that many producers from developing countries perceived limited market access for timber as an impediment to trade and SFM. However, it appears to be increased in demanding for accuracy, reliable information on forest conditions and managements. This trend will give additional pressure to manufacturers in Malaysia regarding timber-based products in order to comply with these requirements and to gain access to these markets (Ratnasingam and Ioras, 2003).

Malaysia much focus on Peninsular Malaysia revealed that, lack of study in term of forecasting and the growth of timber-based industry. Although there are many international studies focussed on forecasting timber-based products (Malaty et al., 2007; Hetemaki and Mikkola 2005; Hetemaki et al., 2004; Schwarzbauer and Rametsteiner, 2001; Linden and Uusivuori, 2000), it is transparent to find specific forecasting study that anticipates the future trend of timber-based industry in Malaysia, particularly in Peninsular Malaysia cover production and consumption that incorporate with the scenarios under SFM practices.

However, to the extent of the researcher's knowledge, a few local studies focussed on the growth of timber-based manufacture and forest products industry in Peninsular Malaysia and Malaysia such as Islam, (2013) and Mohd Shahwahid, (1986). Few studies slightly resembled on the impacts of sustainable forest management (SFM) on timber-based industries in Peninsular Malaysia (Woon et al., 2001). But, the study only covered the level of timber productions under SFM and also assessed the timber requirement of individual sector of the timber-based industries. While in this study, primary timber-processing (sawn timber, veneer and plywood) are featured together with the effects of SFM practices to timber-based products in Peninsular Malaysia.

It is essential for timber-based industry in Peninsular Malaysia to do researches and investigations on forecasting especially in incorporating with the scenarios under SFM practices. Timber-based industry plays an important role as a productive medium of socioeconomic development, thus the timber-based products are very important because it create a dynamic growth in timber-based industry and other related industries (Wunder, 2005).

1.5 Objectives of Study

The general objective of this study is to analyse the impact of Sustainable Forest Management (SFM) practices on timber-based products from primary timber processing (sawn timber, veneer, plywood) in Peninsular Malaysia. Specific objectives are underlined as follow:

1. To develop a market model for primary timber-based products in Peninsular Malaysia.
2. To forecast the impacts of SFM practices towards timber-based products incorporate with several scenarios under SFM practices.



1.6 Significance of Study

At present, Malaysia is among the world's largest exporter of sawn timber and plywood to international market. Being an export-oriented country, Malaysia has been aggressively promoting downstream activities to become a manufacturer of higher quality and value added products. According to Third Industrial Master Plan (IMP3) period (2006-2020), Malaysian Government has identified timber-based as one of the 12 target growths in manufacturing sector for future development and promotion. From that, timber-based industry is strategically important in contributing a greater growth of manufacturing sector such as exports and strengthening sectorial-linkages.

By conducting this study, knowledge and information toward timber-based industry will be acknowledged and identified. Consumers will get information about the impacts of SFM practices on primary timber-based production and consumption. In addition, SFM practices will certainly affect stakeholders in timber-based industry as their interests require trade-offs from the environmental and natural resource.

Furthermore, the existence of market access from consumers whom consume only timber-based products produced by SFM practices will give timber-based producers some advantages. Therefore, stakeholders from the timber-based industry and other sectors that represent the society as a whole can at least have some mutual benefits.

Based on the first objective, the determinant of timber-based products market can be identified and recognised. So, every single change in the determinant will affect the production and consumption. On the other hand, the changes to the determinant will affect the producers and consumers. According to Abdul Rahim et al. (2013) in their study on the impacts of Sustainable Forest Management (SFM) practices on supply of sawn timber in Sarawak, Malaysia, harvested area revealed elastic responds towards the total production and became the determinant supply of sawn timber in Sarawak. Once the scenario under SFM practices imposed on harvested area, they found out that a decrease in harvested levels gave immerse impacts on forest products market than an increase in the operational costs due to SFM practices. These findings became comprehensive findings in designing optimal forest policies. Therefore, the enforcements in reducing the harvested area need to be reviewed again to find out solutions so that trade-off between sustainability of natural forest resources and profitability can be made.

In addition, the enforcements in production cost by using environmental machine and the implementations of minimum wages in timber-based sector have to be discussed not only among policy makers, but also the producers in timber-based industry. They need to gather in order to get the best result that can satisfy both parties. The price premium in timber-based products should be revised again since based in this research finding (as this research has found out that) the domestic consumers are less sensitive to the domestic price and they would buy in whatever price that are being offered by the domestic producers. In order to upsurge the revenue, the price can be increased to maximize the revenue in timber-based sector.

This study will also look upon forecasting that incorporates with several scenarios under SFM practices in order to identify the availability and consumption of primary timber-based products in Peninsular Malaysia. Suppliers will be motivated to produce the products because there is other economic factor such as price is being included in the model. In many profit based sectors like timber-based industry, forecasting is an important element to recognise and predict changes. Forecasting has become one of the most critical factors in developing foresight, formulating corporate strategies, planning effectively and succeeding in business as a whole (Makridakis, 1996). A few scenarios under SFM practices need to be analysed in order to know whether the changes in production and consumption under SFM practices are effective enough to timber-based industry in the future.

In terms of the production of timber-based products, forecasting studies enable the industry to produce and keep in inventory enough units of timber-based products to meet the consumption from domestic and international markets (Makridakis, 1998). However, without this information, the timber-based industry in Peninsular Malaysia might fail to meet the demand of consumers and might lost the change in export transactions to many other competitors, resulting in financial losses as well as gaining negative reputations.

Thus, the ability to anticipate the future consumptions of timber-based products from Peninsular Malaysia is an essential element in timber-based industry to fulfil the needs and wants of the customers. Forecasts are very useful in helping us to understand that timber-based industry will always change over times resulted from rapid development throughout the world (Hetemaki et al., 2004; Hanninen, 2004).

Therefore, this study is very important and useful to many parties who are involved either directly or indirectly with primary timber-based industry. This is to ensure the continuity of industrial growth. This study is sufficient as it represents the total availability and consumption of primary timber-based products from Peninsular Malaysia for domestic and international consumptions. For example, based on the findings in forecasting of export demand of plywood, the forecast result indicates that the export demand of plywood will be decreased. Even though the NATIP (2009) targets have been achieved due to substitution of plywood to value added products, but still the government's intervention is needed insofar to secure the export of plywood as the second largest contribution after furniture in export earnings.

Implicitly, the output of this project can be used to help policy makers and parties to be involved in timber-based industries since this research will provide future information on primary timber-based products. This information is useful for mills in planning their business strategies. Strategic planning is important as business organizations will only survive if they can manage change, maintain a degree of stability, minimize confusion and establish a sense of direction in their operations (Mohd Shahwahid et al., 1995; as quoted from Hellriegel and Slocum, 1992). They are able to sustain their raw material sources. If the source of primary timber-based products is declining, they will have ample time to find other sources to complement deficiency such as to import from other countries (WRT, 2006). Same goes to the information regarding consumption of primary timber-based products in the future. It

helps mills to match their production in accordance to the market demand and plan for expansion of industrial capacity (Norini et al., 2009).

1.7 Organization of the Study

This study will focus on the market impacts of SFM practices on timber-based products from primary timber-processing in Peninsular Malaysia. Detailed explanations about concepts, techniques, results and conclusions of this study will be presented in five chapters. Chapter 1 introduces the introduction of several elements related to this study, such as an overview regarding SFM practices, the implementation of MC&I, stages of timber processing and contributions of timber-based products in the economy of Malaysia. Chapter 2 provides a review of literature about past and present studies on SFM practices impacts of SFM on timber-based product markets and the modeling approaches. Chapter 3 shows the methodology which comprises methodology frameworks, empirical models and data descriptions. Chapter 4 discusses the results of the study. Chapter 5 summarizes the findings of market and economic impacts under SFM practices. Finally, several recommendations for future researches will be suggested.

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