Master Plan for Automotive Industry

2012 – 2016

By

Thailand Automotive Institute

Ministry of Industry

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Executive Summary

Automotive industry is one of the main industries of Thailand which generates economic value for the country. It accounts for 10% of gross domestic product originating from manufacturing and a source of employment for over 500,000 direct jobs of skill labor and above in 2012, not including value generated from related industries such as upstream industry, service industries such as financial, insurance and after sales service. Furthermore, Thailand is a leading regional and global automotive manufacturer, ranks the first among ASEAN countries and 15th in the world in 2012 and also a major regional production base for motorcycle and automotive parts.

The accomplishments are not accidental but resulted from the constant dedication of related government entities on the development of Thailand automotive industry through the administration of favorable policies for each period, the formulation of Thailand Automotive Industry Master Plan 2002 – 2006 and Thailand Automotive Industry Master Plan 2007 – 2011 and collaboration from the private sector. These are the major contributing factors to sustainable development of Thailand automotive industry and to Thailand position as one of the leading automotive production bases even some of the projects have not been fully implemented as planned e.g. technology and engineering capability enhancement, development of testing and research and development center.

However, future challenges must be taken into careful consideration in formulating development strategies for sustainable growth of the industry especially the global trends focus on environment and safety. Thence, Thailand automotive industry is required to develop technology and competency to meet these requirements. The goal for future product development is to strive for a green and safety vehicles in compliance with the international standards.

Moreover, the dynamic of automotive business on both supply and demand is in motion. The global economic center is shifting from West to East. Asia plays an increasingly important role as an increasingly important market and a major global production base changing the face of the competition e.g. former trade partners turned to competitors, production base relocation and competitive advantage development through business collaboration.

4 major factors in ensuring sustainable development of Thailand automotive industry in this dynamic environment; favorable government policy to promote investment and domestic market expansion through systematic integration, developments to accommodate technology changes by enhancing the capacity of green technology development, increase domestic value creation through productivity improvement for parts manufacturers and quantitative and qualitative human resource development.

Both government and private sectors have generated the vision advance towards the Development of Thailand Automotive Industry in year 2021 together, that is:

Thailand is a global green automotive production base with strong domestic supply chains which create high value added for the country.

To achieve the vision, 5-strategic action plans have been formulated which consist of 3 Center of Excellences (COE) and 2 Good Business Environment (ENV), as followed;

Strategy 1: Excellence in Research and Technology Development

To strive for excellence in research and technology development, Thailand Automotive Industry Master Plan 2012 - 2016 aims to enhance competitiveness of the automobile industry by developing appropriate technologies to accommodate the trends of

green technologies; clean, economical and safe technologies e.g. promoting the use of alternative and renewable energy, developing light weight vehicles, enhancing vehicle safety and production capability by employing advance production technology.

Strategy 2: Excellence in Human Resources Development

To strive for development of human resource competency and foster profound knowledge, understanding, increase efficiency and productivity in all levels; skilled labor, supervisors, testing, research and development engineer and executive. Thailand Automotive Industry Master Plan 2012 - 2016 aims to administer integrated sustainable automotive human resource development projects emphasizing on training, curriculum and lecturer development and promoting in house training center to accelerate human resource development throughout the industry. Furthermore, the master plan emphasize on creating a collaborative effort with education institute to prepare students for their future careers in the automotive industry.

Strategy 3: Entrepreneur Strength Enhancement

To strive for entrepreneur strength enhancement especially OEM and REM to be a part of the global parts supply chain. Thailand Automotive Industry Master Plan 2012 – 2016 aims to develop a total lean supply chain and green manufacturing system by implementing sustainable manufacturing development for automotive supply chain e.g. increase productivity with effective improvement tools, green manufacturing process development and cluster supply chain network development.

Strategy 4: Create good business environment via developing infrastructures to accommodate COE-1, COE2 and COE-3 strategic plan

This strategy is striving to develop sufficient infrastructures to accommodate the implementation of the action plans on research and development, human resource

development, automotive parts manufacturer development. Without these infrastructures, the possibility of accomplishing other strategic action plans is limited. The infrastructures required are testing and research and development center, automotive human resource development Institute and automotive information center.

Strategy 5: Create good business environment via policy integration

To strive for a favorable environment by improving and formulating integrated government regulations, policies and measures to support the accomplishment of the objectives of Thailand automotive industry development in becoming a major global green production base with advance technology development and adoption of international standard. A key success factor is the establishment of National Automotive and Parts Industry Policy Steering Committee to integrate the policies related to automotive and parts industry development, and to accommodate trends on future competition, technology and innovation. Furthermore policy research must be conducted to support various aspects of the industry development including branding, market penetration for REM.

To create a substantial impact, these 5 strategies must be systematically integrated with collaboration from all related parties in both government and private sectors. National Automotive and Parts Industry Policy Steering Committee will act as policy formulator and coordinator as well as providing support in the implementation to achieve the objectives.

The expected outcome of the Thailand Automotive Industry Master Plan 2012 - 2016 is to be a main contributor to Thailand economic growth. Not only affecting the economic development but also has an impact on society and environment. The key objectives of this master plan are:

1. To be a major global automotive production base by:
    1.1 Increase automotive and motor cycle production capacity to 3 million units by 2017
    1.2 Ensure eco-friendly, energy efficient and high pollutant emission and safety standard product development as well as clean production process with high productivity.
2. Establish a good automotive business environment by:
    2.1 Develop capability of automotive human resources. Increase in the percentage of skilled labor, mechanic and engineer in comparison to 2012.
    2.2 Establish a major automotive testing and research and development in Asia.
    2.3 Develop suitable infrastructure to sufficiently support development. Become a leader in standard, testing and human resource development among ASEAN countries.
3. To be one of the main industries rescuing Thailand from middle income trap (MIT) by:
    3.1 Increase value creation from domestic parts consumption over 50% by 2013.
    3.2 Increase production value creation of the automotive manufacturing over 10% of gross domestic product originating from manufacturing.
    3.3 Increase export value over 1 trillion baht by 2013.

Chapter 1

Introduction

The automotive industry[1-1] is one of the leading industries in Thailand with significant contribution to the economy, employment, value added and automotive technology development in Thailand as well as supply chain related industries. Since 1961, Thailand implemented continuity policy to support the industry development. The initial objective was to reduce import by develop the emerging automotive industry of Thailand. During 1977 – 1997, Thailand promoted investment to create value added and develop export capacity by implementing free trade policy, joining World Trade Organization (WTO) and taking part in ASEAN Free Trade Area (AFTA). Presently, Thailand is fully engaged in free trade agreements.

Due to consistent economic and industrial growth in Thailand and Asia, by 2014, Thailand automotive production capacity is expected to exceed 3 million vehicles each for automobile and motorcycles. There are automobile and motorcycle manufacturers from 3 continents. From Asia, the leader in this industry is Japan; Kawasaki, Suzuki, Toyota, Nissan, Mazda, Mitsubishi, Yamaha, Isuzu, Honda and Hino. From North America, is United States; General Motor and Ford. In Europe are BMW, Mercedes, Triumph and Volvo. The production capacity of Thailand automotive industry in 2012 is 2.75 million cars and 2.8 million motorcycles (Complete Knock Down or CKD). Total domestic and export sales accounts for 10% of gross domestic product (GDP) originating from manufacturing and creates over 500,000 jobs. The percentage of domestic parts used in production is 80% for pick-up truck, 45% for passenger cars and 90% for motorcycle. Total domestic to export ratio is 50:50.

[1-1] Automotive industry consists of automotive manufacturing industry i.e. passenger car, pick-up truck, van, bus, truck and motorcycle and automobile and motorcycle parts manufacturing industry, both Origin Equipment Manufacturer (OEM) and Replacement Equipment Manufacturer (REM).

Total export value is approximately 800 Billion Baht (26.7 billion USD). Automobile and motorcycle manufacturers also made substantial investment in research and development (R&D) which will enhance Thailand's competitive advantage as the regional center of the Asian automotive industry.

Automotive industry is a major industry with opportunity for growth and expansion. Along with growth in emerging markets and competitors such as China and Indonesia as well as global trend toward more environmental friendly vehicles and higher technical and safety standard requirements for vehicles and parts affecting automotive technology development, thus policy condition should enable the automotive industry to adapt to the market change is an essential element in developing and improving sustainable competitive advantages of Thailand automotive industry. Therefore, the strategic direction formulation for the development of automotive industry according to Thailand Automotive Industry Master Plan 2012 – 2016 has taken the following 3 key factors affecting competiveness into consideration:

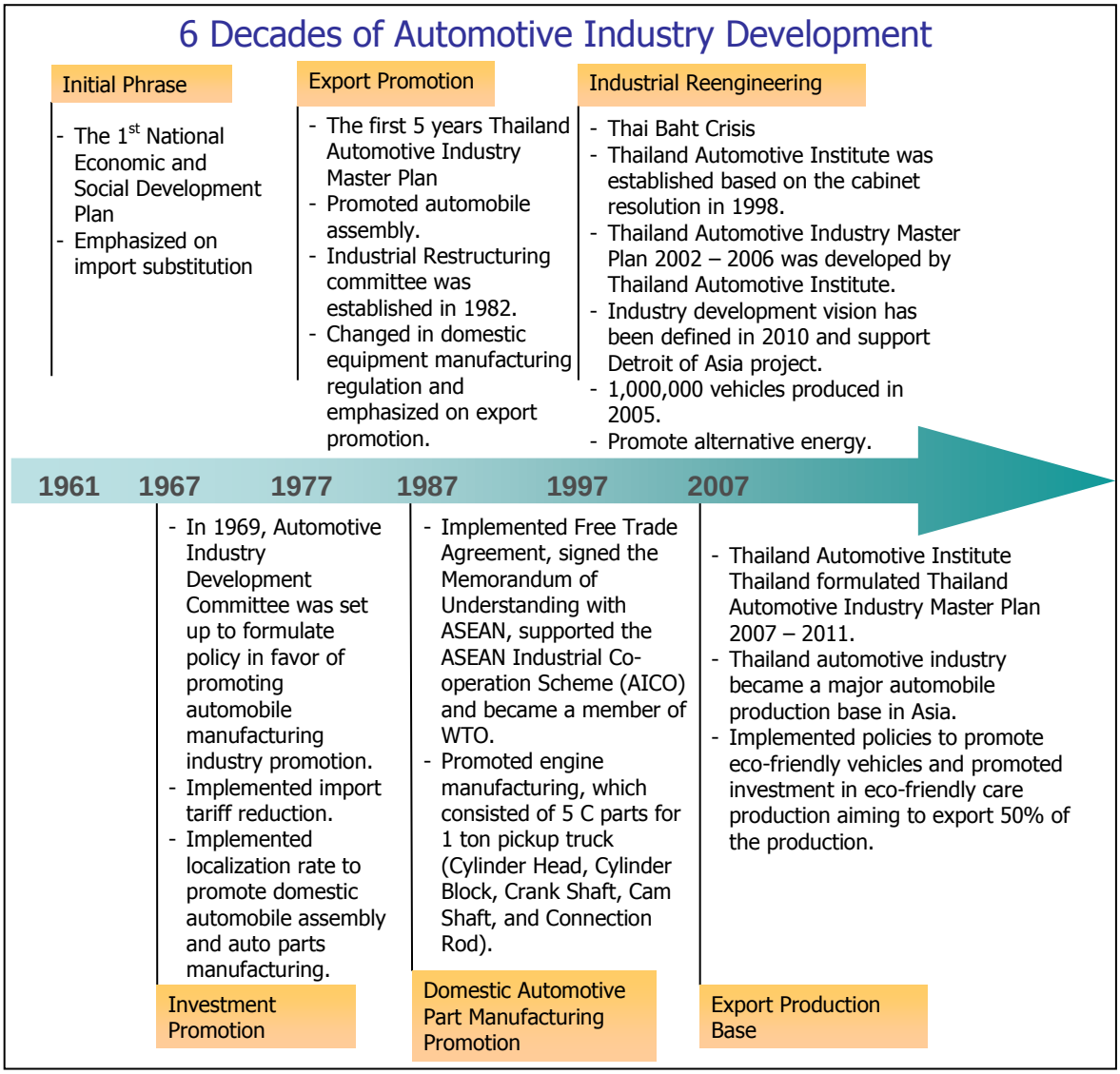
1. Global competition and the position of Thailand automotive industry in the international market.
2. Technology development trend affected by environmental issues, safety concerns and consumer behavior.
3. Effect from ASEAN Economic Community (AEC), which will be effective in 2015.

Previously, the strategic direction for the development of Thailand automotive industry was formed in correspondence with conditions and competition in each period. The main objective of Thailand Automotive Industry Master Plan 2002 – 2006 has been to strengthen the Thailand Automotive, which has been affected by the economic crisis caused by Baht depreciation in 1997. The plan has proven a success, over 1 million cars were produced in 2008 (1 year earlier than planned). Whereas, the main objectives of

Thailand Automotive Industry Master Plan 2007 – 2011 were to develop sustainable competitive edge of Thailand automotive industry as a major production base in Asia and enhance value creation by improving competitive advantages of the auto part manufacturing sector. As a result, the industry has witnessed substantial increase investment in research and development (R&D) and labor skill development as shown in figure 1-1.

The vision of 2002 – 2006 and 2007 – 2011 master plans are in line and formulated the 2011 vision, which is "To be the production base in Asia by enhancing domestic value creation with strong equipment manufacturing sector."

Figure 1-1 6 Decades of Automotive Industry Development



Source: Summarized by Thailand Automotive Institute

In order to strengthen the position and competitive advantages of Thailand automotive industry in the dynamic global market, Thailand Automotive Industry Master Plan 2012 – 2016 emphasizes on proactive development to achieve excellence, besides being a major global production base. Both government and private sectors will determine the vision and objectives for excellence in automotive industry which will be implemented for the next 10 years. The Implementation of Thailand Automotive Industry Master Plan 2012 – 2016 will provide guideline to government and private organizations on how to effectively achieve the 10 years goals and adapt to the dynamic global market, market condition and consumer insight.

Scope of the analysis and formulation of Thailand Automotive Industry Master Plan 2012 – 2016 consists of 5 parts:

Part 1: Situation and competitive advantage of Thailand automotive industry in chapter 2, which consists of:

(1) Analysis on future supply and demand trends and international automotive technology. The technology analysis includes environment and energy technologies as well as industrial and safety standards to reduce accidents and damages.

(2) Analysis on situation and trend of ASEAN automotive industry providing in depth analysis on major production bases with consistent growth and high potential such as Indonesia, Thailand, Malaysia, Philippines and Vietnam.

(3) Analysis on the potential of Thailand automotive industry.

(4) Analysis on key factors driven Thailand automotive industry.

Part 2: Evaluation of Thailand Automotive Industry Master Plan 2007 – 2011 in chapter 3. The evaluation is based on the strategic plan and objectives of the master plan; being a major production base in Asia, being the center of research, development and testing, development of world-class skilled labor, production network in the ASEAN common market, project management evaluation and overview evaluation.

Part 3: Automotive industry development strategies in Chapter 4 consists of the formulation of Thailand automotive industry development strategies based on the following 3 main challenges facing Thailand automotive industry.

(1) The position of Thailand automotive industry in the global market

(2) Changing in pollution and safety standard as well as automotive technology trend.

(3) ASEAN Free Trade Agreement (AFTA) will be in effect in 2015 which led to Vision 2021 and strategic plan for Thailand automotive industry.

Part 4: 5 years action plan in Chapter 5 consists of 5 Years Action Plan 2012 – 2016 to implement the strategic plan in order to achieve the development objectives; road map, plan/project, target group, responsible agency and qualitative goals.

Part 5: Conclusion in Chapter 6 consists of summary of Thailand Automotive Industry Master Plan 2012 – 2016, procedure and expected outcome.

Chapter 2

Situation and Trend of Automotive Industry

Thailand automotive industry has been established over 50 years ago with import substitution policy to becoming an export-oriented production base. In 2011, Thailand ranked the 15th largest automobile producer in the world, annual production was 1.5 million. Export comprised of over 50% of the volume. Therefore apart from fulfilling the need of the domestic market, the manufacturers have to anticipate the consumer preference in the international market. As Thailand automotive industry is highly collaborated with international automotive producers, the global, regional and domestic trend has to be taken in consideration in formulating development strategy for the next 5 – 10 years. Free trade agreements broaden competitive arena. Bilateral and multilateral free trade agreements will enhance the competitive edge of Thailand automotive industry.

Moreover, the increasingly rigorous pollution and safety standards imposed will impact automotive technology development as well as increase in price of fossil fuel, automobile assemblers decided to develop automotive technology using fuel replacement energy and alternative energy, such as ethanol, biodiesel and hydrogen, and motor driven automotive technology, e.g. hybrid car and electronic car. Thailand is in a strong position as a world class automotive production base and a major automobile exporter, not relying only on domestic market. No “Thai car” and neoliberalism policy promotes equal opportunity among investors has enable Thailand to become a major production base for passenger cars, one-ton pick-up trucks and motorcycles. The total annual production capacity is over 2 million vehicles (1 million vehicles for export). Situation and trend in this chapter of the master plan will demonstrate the production trend and technology trend in the international, regional and domestic level as followed:

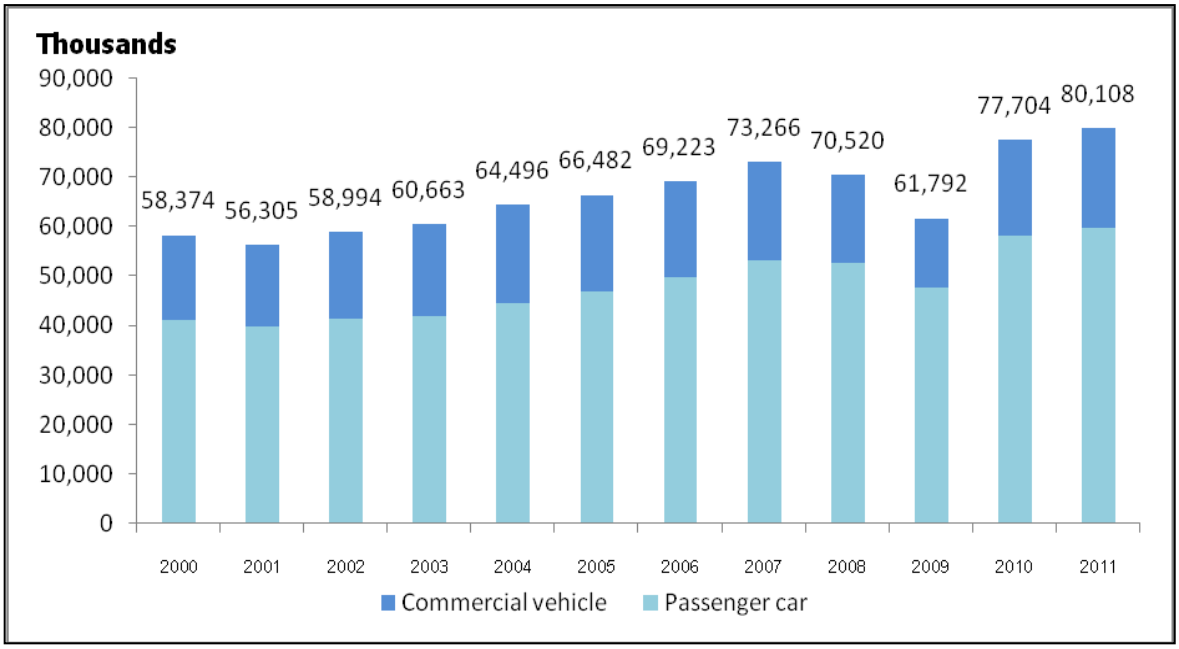
1. Global Situation and Trend of the automotive industry

1.1 Global production trend

During the past 10 years, the global production trend has been on the rise. In 2006, the total global production was 69.2 million units, 23% increase from 2001. In 2011, the total global production was 80.1 million units, 16% increase from 2006. The automotive industry is growing; despite saturated demand in the developed countries, the demand in developing countries is increasing rapidly as shown in figure 2-1.

According to 2011 production data, China ranked the 1st largest automobile producers in the world with 18.4 vehicles, the United States and Japan ranked 2nd and 3rd with 8.6 million and 8.4 million respectively. Thailand ranked the 15th with 1.5 million production capacity. 7 out of 20 top producers are in Asia with total production over 50% of the global production as shown in figure 2-2.

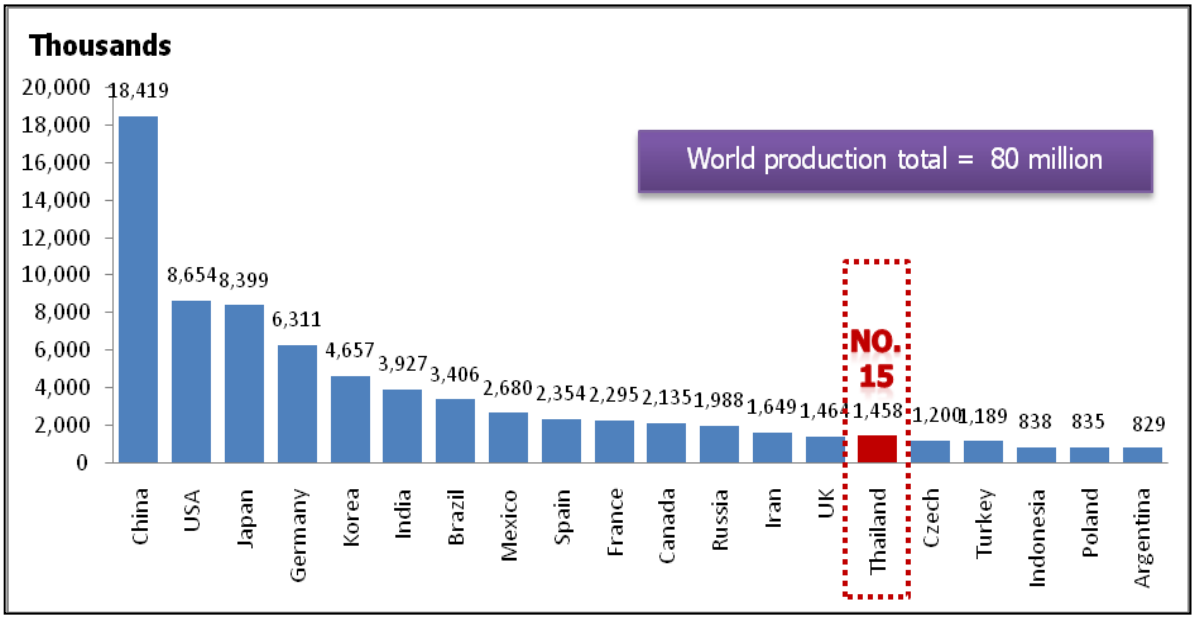
Figure 2-1 World Motor Vehicle Production



Source: The International Organization of Motor Vehicle Manufacturers (OICA) (2012)

Summarized by Thailand Automotive Institute

Figure 2-2 Total Production from Top 20 Motor Vehicles in 2011



Source: The International Organization of Motor Vehicle Manufacturers (OICA) (2012)

Summarized by Thailand Automotive Institute.

The global industrial trend is vehicle producers are relocating their factories closer to the markets which have lower production and transportation costs. Asia is an emerging market. With per capita income on the rise, as shown in figure 2-1, and low automotive ownership ratio, as shown in figure 2-2, there is a tendency toward shifting production from the Western countries to Eastern countries.

Furthermore, there will be stronger collaboration among automobile producers to achieve economy of scale on various aspects, e.g. research and development, to gain collaborative competitive advantage.

Table 2-1 Number and Share of the Global Middle Class

Region	2009		2020		2030	
	Middle Class (Million)	Middle Class (%)	Middle Class (Million)	Middle Class (%)	Middle Class (Million)	Middle Class (%)
North America	338	18	333	10	322	7
Central and South America	181	10	251	8	313	6
Europe	664	36	703	22	680	14
Asia Pacific	525	28	1,740	54	3,228	66
Africa	137	8	222	7	341	7
World	1,845	100	3,249	100	4,884	100

Source: David Ward (2011)

Table 2-2 Motor Vehicle Ownership Ratio: International Comparison

Country	Motor Vehicle Ownership Ratio No. of Persons per (Motor Vehicle)	Country	Motor Vehicle Ownership Ratio No. of Persons per (Motor Vehicle)
USA	1.3	South Korea	2.8
Australia	1.5	Russia	3.4
Italy	1.5	Mexico	3.7
Canada	1.6	Argentina	4.0
Austria	1.7	Brazil	6.1
France	1.7	South Africa	6.3
Japan	1.7	Thailand	6.5
Spain	1.7	Turkey	6.5
Germany	1.8	Indonesia	12.7
Netherlands	1.8	China	17.1
UK	1.8	India	58.9
Sweden	1.9	World Average	6.8

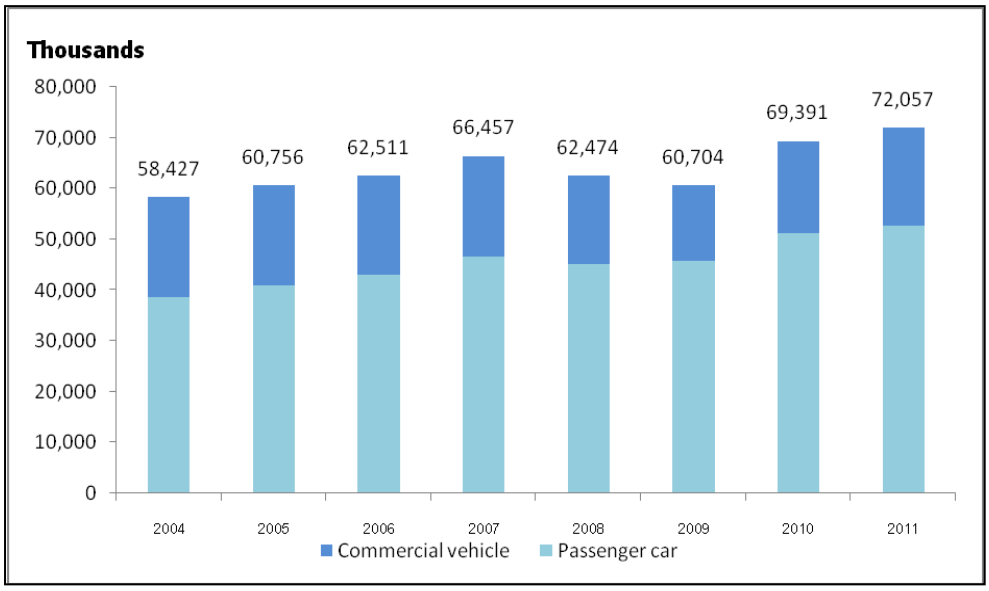
Source:Japan Automobile Manufacturers Association, Inc. (JAMA) (2012)

1.2 Global Trend of Automotive Demand

During 2004 - 2007, Global automobile sales experienced 5% average annual growth. In 2008, as a result of global economic crisis caused by Sub-prime lending in USA, the global automobile sales declined by 6%. Until the global economy started to pick up in 2010, the global automotive industry experienced 14% sales growth, amounted to 69 million vehicles as shown in Figure 2-3.

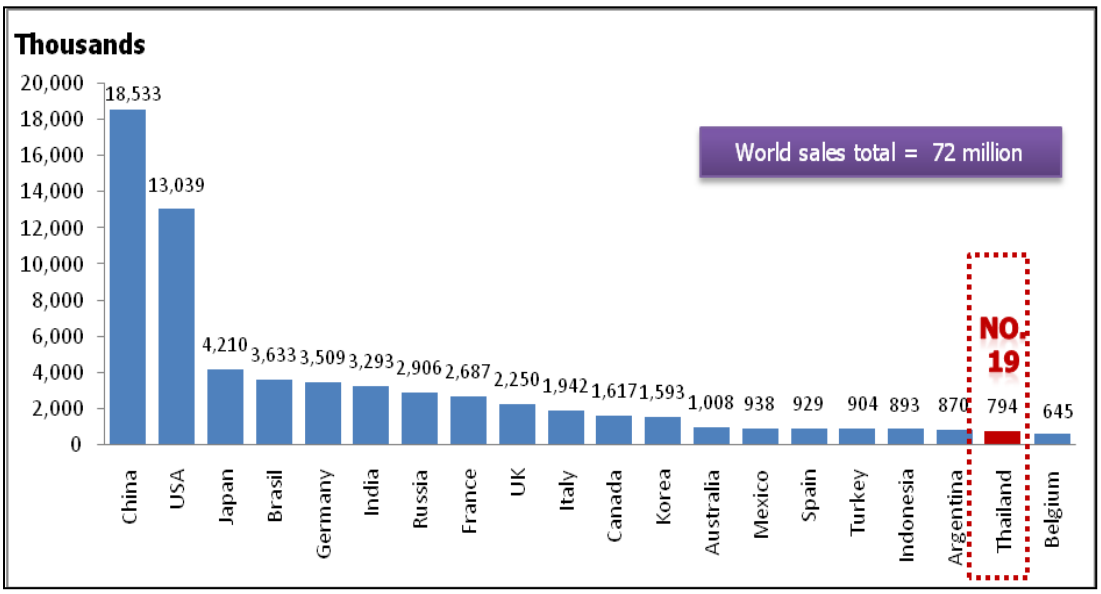
Analysis on sales figure revealed that China ranked the 1st place in automobile sales with 8.5 million units, USA and Japan ranked 2nd and 3rd with 13.0 million and 4.2 million units respectively. Thailand ranked the 19th with 0.79 million units as shown in Figure 2-4.

Figure 2-3 Global Automobile Sales



Source: FOURIN (2012)
Summarized by Thailand Automotive Institute

Figure 2-4 2011 Top 20 Highest Automobile Sales Worldwide

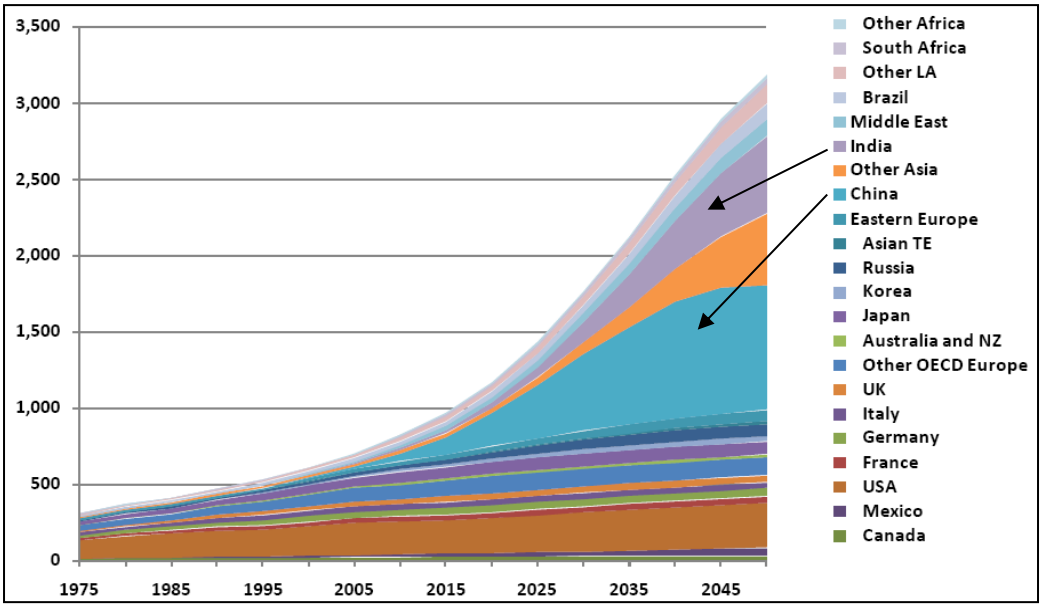


Source:FOURIN (2012)

Summarized by Thailand Automotive Institute

As shown in Figure 2-5, FIA Foundation projected motor vehicle in use worldwide will increase by 3 times by 2050 as well as a shift in the structure of motor vehicle usage ratio; the ratio for matured economies such as USA, Europe and Japan will decline, whereas the ratio for emerging economies such as China and India will increase. Thus automobile sales ratio for emerging economies will be higher than matured economies, conforming to low automobile ownership rate among emerging economies, which has greater room for growth.

Figure 2-5 Projection of Motor Vehicles Usage to 2050



Source:David Ward (2011)

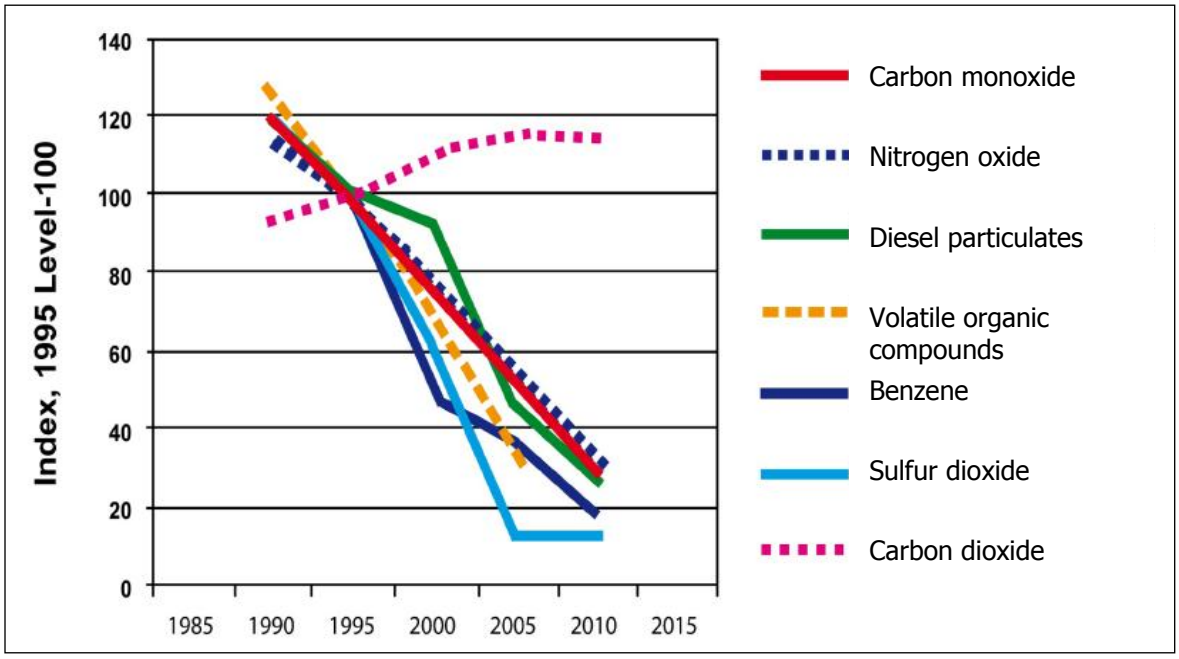
1.3 Global Automotive Technology Trend

Environmental issues have now become a wide-spreading concern as it affects all mankind. Motor vehicles cause environmental problems on energy consumption and air pollution. Moreover, rising fossil fuel price caused by excess demand from increasing number of motor vehicles in use prompted the automobile manufacturers to develop more environmental friendly, more energy efficient and higher safety standard automotive technologies.

1.3.1 Clean vehicle

The study on pollution caused by automobile in EU conducted by FIA found that new pollution reduction technologies will successfully reduce all pollutant emission, except Carbon dioxide (CO2) which is on a steady rise as shown in Figure 2-6. Furthermore, standard for End of Life Vehicles (ELVs) will be stricter, emphasizing on preventing the use of certain heavy metals such as cadmium, lead, mercury and hexavalent chromium and waste reduction by reuse, recycle and recovery.

Figure 2-6 Motor Vehicle Emissions in EU



Source: David Ward (2011)

CO_2 emission causes greenhouse effect, which accounts for global climate change; thereby FIA Foundation, International Energy Agency (IEA), International Transport Forum (ITF) and United Nations Environment Programme (UNEP) have been working in partnership as the Global Fuel Economy Initiative (GFEI). The purpose of GFEI is to improve the fuel economy capacity of the global car fleet aiming to reduce CO_2 emission.

- The average fuel economy of new cars in OECD[2-1] countries could be improved 30% by 2020 (compared to 2005).
- The average fuel economy of the global new car fleet could be improved 50% by 2030 (compared to 2005).
- The average fuel economy of the global car fleet could be improved 50% by 2050 (compared to 2005).

Currently, many countries are promoting more environmental friendly vehicles by implementing emission standard. European emission standards are widely used. EURO 5 is the highest standard which has already applied in EU.

1.3.2 Energy Efficient or Alternative Energy Vehicles

As gasoline price is constantly on the rise, automobile manufacturers are developing more efficient automotive technology such as:

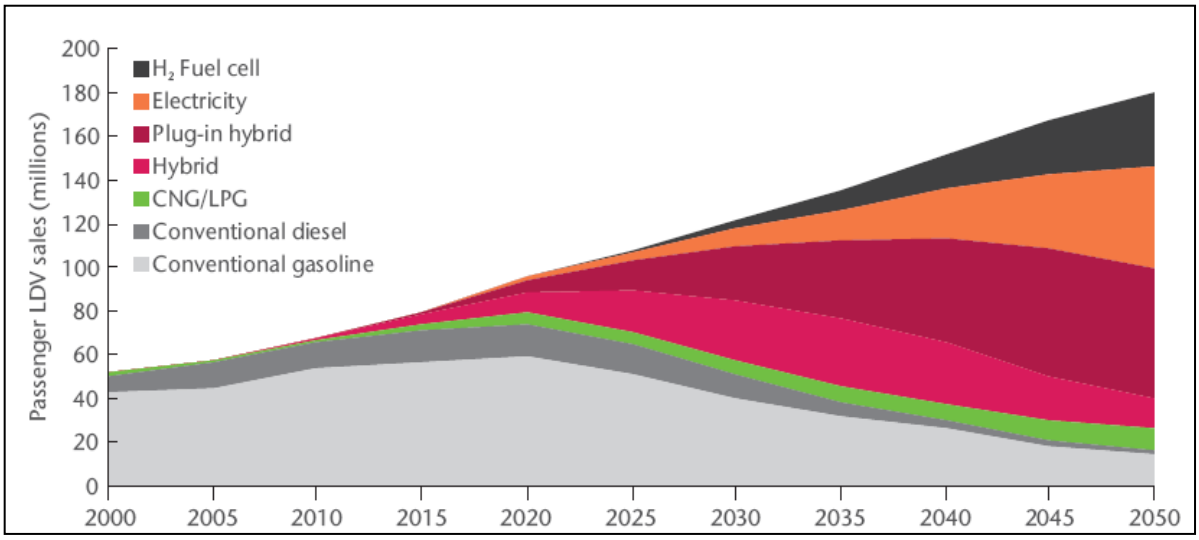
- Using more environmental friendly and lighter materials without compromising the strength e.g. Nanotechnology.
- Developing more compact vehicles and parts without compromising safety thus economize material as well as improve fuel consumption rate. This principle is also applied to Eco Car.
- Improving engine and transmission system to reduce consumption rate e.g. idling stop system or common rail for diesel engine.

Not only improving vehicle efficiency, automobile manufacturers are also developing non-fossil fuel vehicles such as ethanol, biodiesel and hydrogen, and electric motors, e.g. hybrid car and electronic car.

[2-1] **OECD = Organization for Economic Co-operation and Development**

Figure 2-7 shows a significant increase in sales of electronic and hybrid vehicles from 2020. Whereas fossil fuel vehicle sales will slowly decline but only marginally when compare with electric motor vehicle sales.

Figure 2-7 Light Duty Vehicles Sales Forecast by fuel type (2000 – 2050)



Source:International Energy Association (IEA) (2011)

1.3.3 Vehicles that Meet Safety Standard Requirement

FIA study found that 1.3 million people are killed and 50 million injured annually in road crashes worldwide. Without additional preventive and corrective measures, by 2030 road crashes are forecast to become the fifth leading cause of death rising to 2.4 million fatalities per year. World Health Organization (WHO) forecast shows that road traffic injuries will be the fifth leading cause of death (increase to 3.6% of total) by 2030. Road accidents are caused by commuters and substandard vehicles. Automobile manufacturers are concerned of the importance of producing safe vehicles.

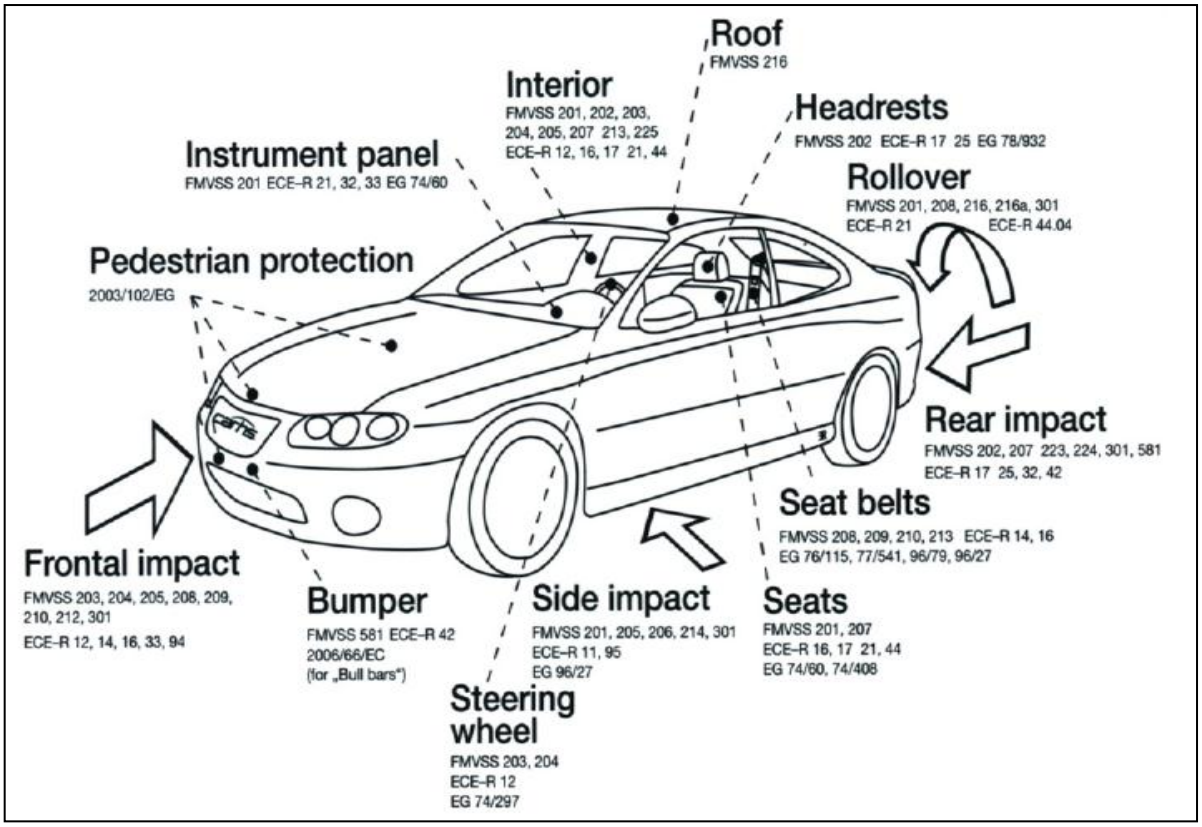
United Nation Economic Commission of Europe (UN ECE) is an international safety standard as shown in Figure 2-8. The standard consists of 2 categories:

(1) Active Safety Standard refers to technology assisting in the prevention of a crash e.g. Brake standard, signal lights and wing mirror.

(2) Passive Safety Standard refers to technology to protect occupants during a crash e.g. standard of buckling, anchorage strength and head restraint strength, frontal collision and lateral collision and airbag.

Moreover, Intelligent Transportation System (ITS) is a system in which information and communication technologies are applied in the field of transportation and traffic management e.g. collision avoidance system so motorists may opt to alternative routes, changeable speed limit sign.

Figure 2-8 Parts Safety Standard



Source:David Ward (2011)

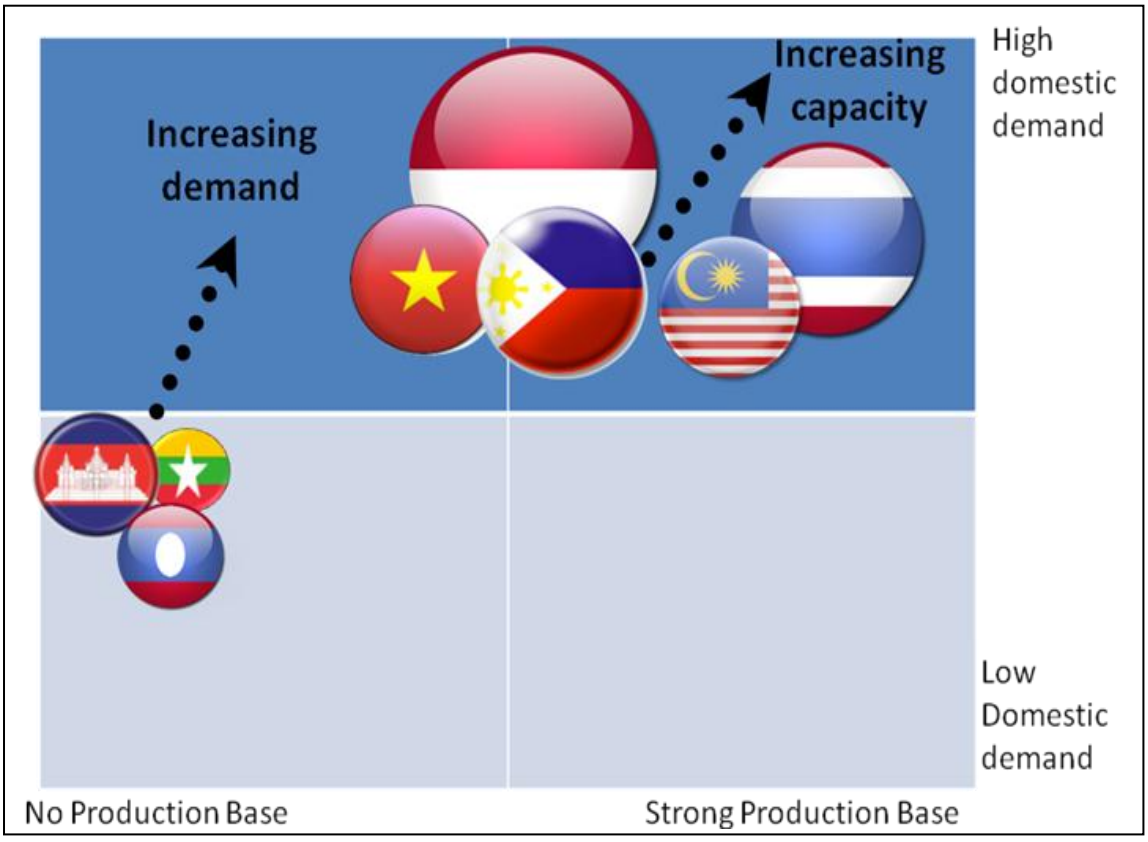
2. Condition and trend of Asian Automotive Industry

ASEAN members[2-2] have different characteristics of automotive production and domestic market which can be classified in to 2 categories as followed:

(1) Production base countries with consistent growth and potential such as Indonesia, Thailand, Malaysia, Philippines and Vietnam.

(2) Non-production base countries with potential for growth and development such as Cambodia, Laos and Myanmar.

Figure 2-9 Correlation of Automotive Production and Domestic Market among ASEAN Members



Source: Summarized by Thailand Automotive Institute

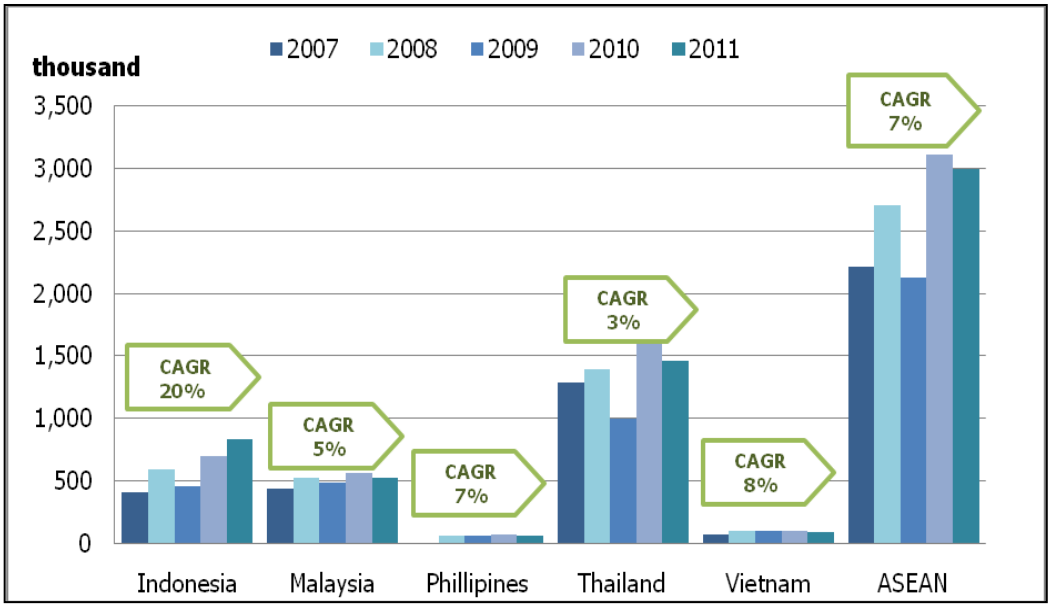
[2-2] Except Singapore and Brunei with no domestic production base and domestic markets amounted to only 1% of total sales in ASEAN which is insignificant. Thus were not taken into consideration.

2.1 ASEAN Automotive Production and Sales

The 5 production base countries in ASEAN are Indonesia, Malaysia, Philippines, Thailand and Vietnam. The compound annual growth rate (CAGR) during the past 5 years (2007 – 2011) was 7%. Thailand is the largest production best in the region, whereas Indonesia experienced the highest CAGR at 20%.

ASEAN total production increased during 2007 – 2008. The total production declined in 2009 as a result of global economic crisis caused by financial crisis in USA. In 2010, the production level resumed to normal. Due to Tsunami in Japan and severe flood in Thailand, ASEAN total production was 3 million units, reduced from 3.1 million units in 2010. The disaster crippled many part manufacturer and automobile manufacturers, thus had negative effect on Thailand production capacity. Even some countries, e.g. Indonesia, increased their production, could not offset the production loss as Thailand is the largest producers in ASEAN.

Figure 2-10 ASEAN[2-3] Motor Vehicles Production by Country (2007 – 2011)

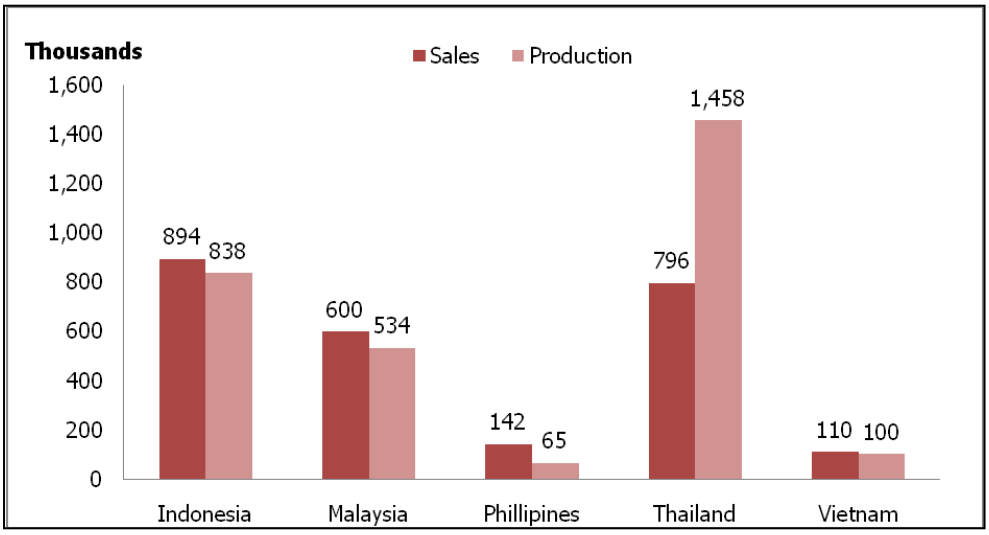


Source: ASEAN Automotive Federation (AAF) (2012)
Summarized by Thailand Automotive Institute

[2-3] Excluding Cambodia, Laos and Myanmar.

An analysis on 2011, ASEAN production and sales revealed that apart from Thailand, domestic sales of other ASEAN members exceeded production, which indicated insufficient production capacity to meet domestic demand.

Figure 2-11 ASEAN Motor Vehicles Production and Sales by Country in 2011



Source: ASEAN Automotive Federation (AAF) (2012)

Summarized by Thailand Automotive Institute

2.2 ASEAN Automotive Industrial Development

2.2.1 Industrial Promotion Policy for Automotive Industry

Although ASEAN members are located in geographical proximity, there are economic, social and cultural gaps among the members. Therefore, the state of automotive industry varies from country to country in terms of demand, consumer preference and supply which are determined by production capacity. These in turn affected the promotion policy for automotive industry of each country as summarized below:

Indonesia With large family social context, Indonesians prefer large family cars. Indonesian government promotes Multi-purpose vehicle (MPV) production was well as small low-priced passenger car, in order to promote the automotive parts industry in the country.

Malaysia is the only one country in ASEAN that has national car projects. In 1985, the government aimed to make the automotive industry to symbolize the change from agricultural to industrial age as well as promoting the development of domestic automotive and parts industry. So, Proton, the first national car project, was established in 1983. Perodua, the second project, was launched in 1994. Perodua mainly produces compact cars. In an effort toward sustainable development, Malaysian government implements policy to promote eco-friendly via Green Initiative Program.

The Philippines is a disaster-prone country along with economic and political instability, hence lack of promotion policy on any particular type of vehicle. However, the Philippines is an automotive production base for some parts such as manual transmission for pick-up trucks[2-4].

Thailand Previously was an agricultural country; the primary demand was for transportation of agricultural products. Thus pick-up truck was the product champion. Overtime the demand shifted to sedan. Thailand aspires to become regional center of the Asian automotive industry. As urbanization has taken place among Thai population, the government realized that promoting pick-up truck production alone may not be sufficient to meet consumer demand. Therefore, international standard energy-efficient vehicle (Eco-car) became the second product champion.

[2-4] Pick-up truck in this context refers to one-ton pick-up truck.

Vietnam Low per capita income combined with automobile speed limit has made motorcycle a more popular choice. Thereby, the industry emphasizes on producing low-price small motorcycle.

2.2.2 ASEAN Agreement on Automotive Standardization and Product Certification

ASEAN members have implemented automotive standard harmonization. Working Party on the Construction of Vehicles 29 (WP29) was established by the UN to create a uniform system of regulations. The Forum's work is based around 2 major agreements as followed:

(A) 1958 Agreement forms a legal framework wherein participating countries (contracting parties) agree a common set of technical prescriptions and protocols for type approval of vehicles and components. Each contracting party's type approvals are recognized by all other contracting parties. Not only EU members but many non-European countries are now also contracting parties to the agreement. In 2006, Thailand became a contracting country, UN code E53. Since Thailand has not grants any type approval, so the agreement is not in effect yet.

(B) 1998 Agreement is a technical regulation. A member of WP29 that accedes to adopt a Global Technical Regulation (GTR) according to 1998 Agreement has authority to make amendment or addition to that GTR. Currently, there are 31 participants.

The ASEAN Mutual Recognition Arrangement (MRA) framework on motor vehicle standard and certification is an important framework in integrating ASEAN as a single market in accordance with ASEAN Economic Community (AEC) framework agreement toward full

implementation by 2015. ASEAN Consultative Committee for Standards and Quality (ACCSQ) was formed to facilitate trade and progressive reduction towards elimination of non-tariff barriers. ACCSQ established the Automotive Product Working Group (APWG) to harmonize standardization and certification measures and eliminate technical trade barriers to motor vehicle trade. APWG is in the process of harmonizing standards and technical regulations based on UN ECE standards and MRA on test result according to UN ECE guideline. The initial target is set for 19 regulations by 2015.

2.2.3 Foreign Investment

Japan is the biggest investor in ASEAN automotive industry. Table 2-3 shows that during 2006 – 2010, Thailand ranked the largest destination of Japan's FDI in the automotive industry. Indonesia ranked second. Both the Philippines and Vietnam are in the same range around 20 billion Yen. Malaysia has the smallest share.

Table 2-3 Japanese Foreign Direct Investment in ASEAN countries in automobile sector

(Unit: million Yen)

Country	2006	2007	2008	2010	Total
Indonesia	34,271	40,731	24,008	16,638	115,648
Malaysia	7,537	2,376	816	5,645	16,374
The Philippines	3,096	8,653	13,562	1,207	26,518
Thailand	90,945	114,343	70,301	87,155	362,744
Vietnam	3,824	5,738	10,589	1,264	21,415

Source: ASEAN-Japan Centre (2012)

Remark: Data for 2009 was unavailable

During the past few years, automotive producers are expanding more their production bases in ASEAN countries e.g. Suzuki Motor expanded their annual production capacity in Thailand by 50,000 units per year. Moreover, automotive producers are relocating their production bases among ASEAN countries. Due to low domestic demand in The Philippines and better manufacturing readiness in Thailand, Ford Motor is moving their entire production base from the Philippines to Thailand by 2012. The move will in turn make Thailand the only Ford's production base in ASEAN.

3. Situation and Trend of Thailand Automotive Industry

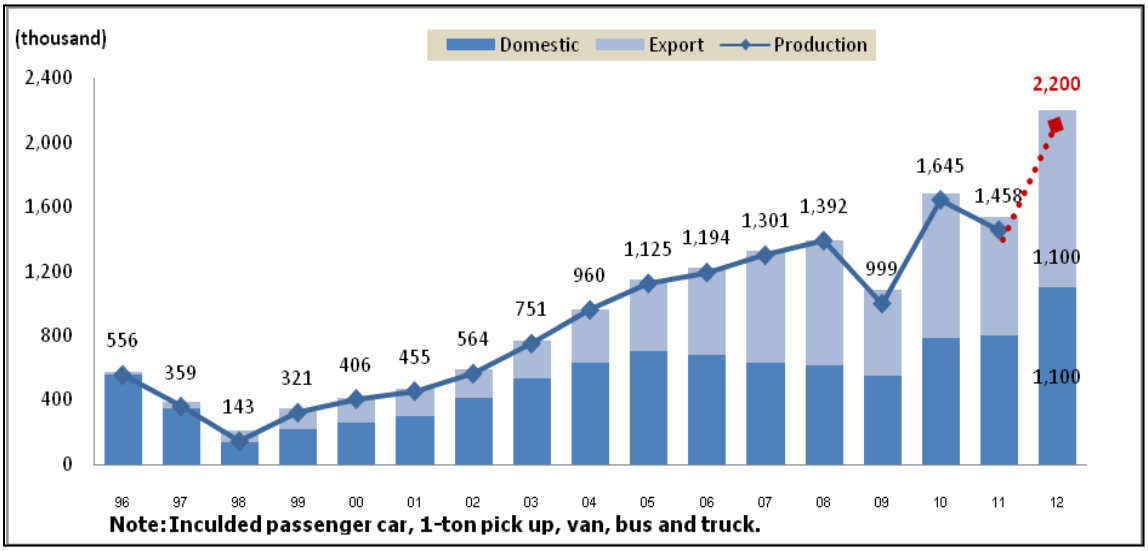
3.1 Production and Market Situation in Thailand

(1) Automobile

After Thailand's economic crisis in 1998, automotive production in Thailand has been experiencing ongoing growth. In 2005, Thailand's automobile production reached the one million units milestone in 2005. The production continued to grow till experienced a decline in 2009 due to financial crisis in USA. In 2010, Thailand automotive industry was on a rebound. However, the flood disaster in 2011 crippled many part manufacturers and some automotive producers thus production dropped from 1.6 million in 2010 to 1.45 in 2011. For 2012, the production forecast is 2.2 million vehicles, the highest since the birth of Thailand automotive industry.

During 2000 – 2006, the production structure of Thailand automotive industry was mainly to satisfy domestic demand. Domestic sales to export ratio was 65:45. Since 2007, the ratio shifted to 50:50 revealed that Thailand is a major global automotive production base as shown in Figure 2-12.

Figure 2-12 Automobile Production, Domestic Sales and Export of Thailand

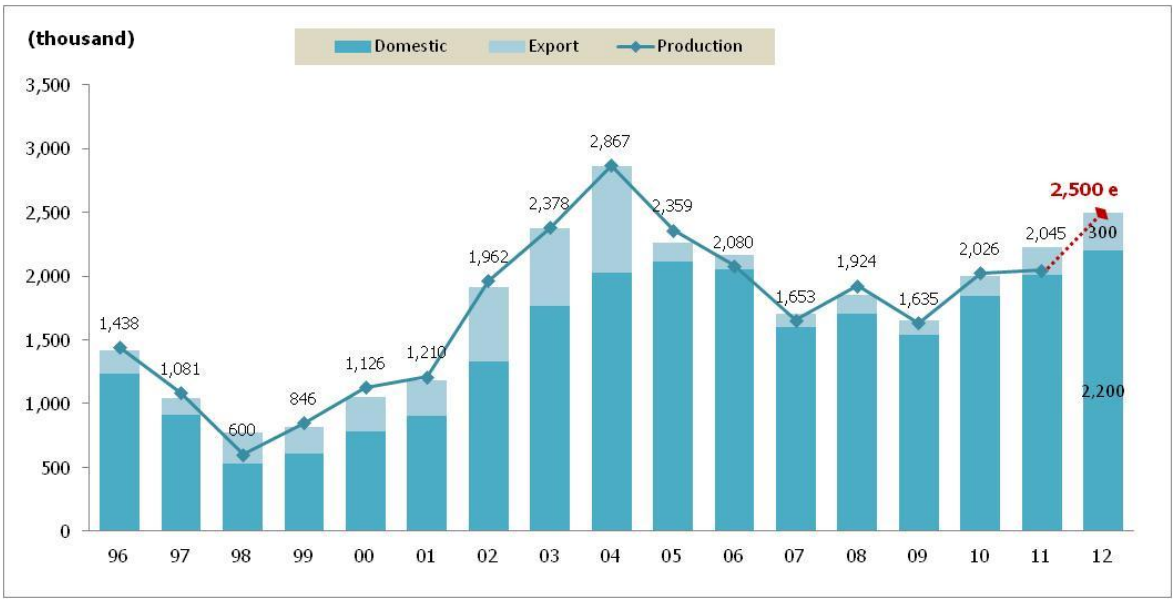


Source: Summarized by Thailand Automotive Institute

(2) Motorcycle

Motorcycle production in Thailand is in line with the automobile production that is the production was on the rise after the economic crisis. In 2004, the production peaked at 2.9 million units. Nonetheless, the production significantly decreased in 2005. Importers such as Vietnam, which previously imported motorcycles from Thailand, started their own motorcycle assembly factories. Thus reduced complete build-up units (CBU) import from Thailand and switched to Complete Knock Down units. Since 2005, motorcycle production has been stable at 2.0 million units, primarily for domestic sales. Demand is mainly for replacement of end of life vehicles as shown in Figure 2-13.

Figure 2-13 Motorcycle Production, Domestic Sales and Export of Thailand



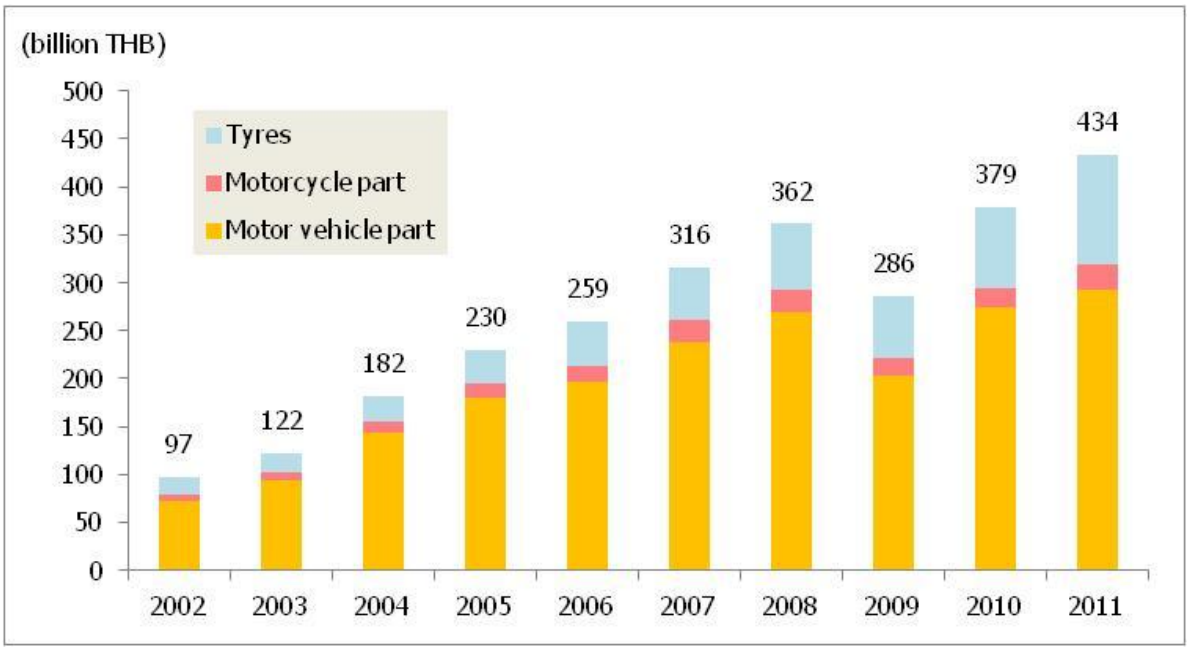
Source: Summarized by Thailand Automotive Institute

(3) Parts

Apart from being a major international automobile and motorcycle manufacturers, Thailand is a major part producer. The part production is also in line with automobile and motorcycle production. In 2011, the export value of automotive part was 400 billion baht; 68% automobile parts, 6% motorcycle parts and 26% auto tires as shown in Figure 2-14.

Engine and part had the highest share in parts and component export at 36% as shown in Figure 2-15

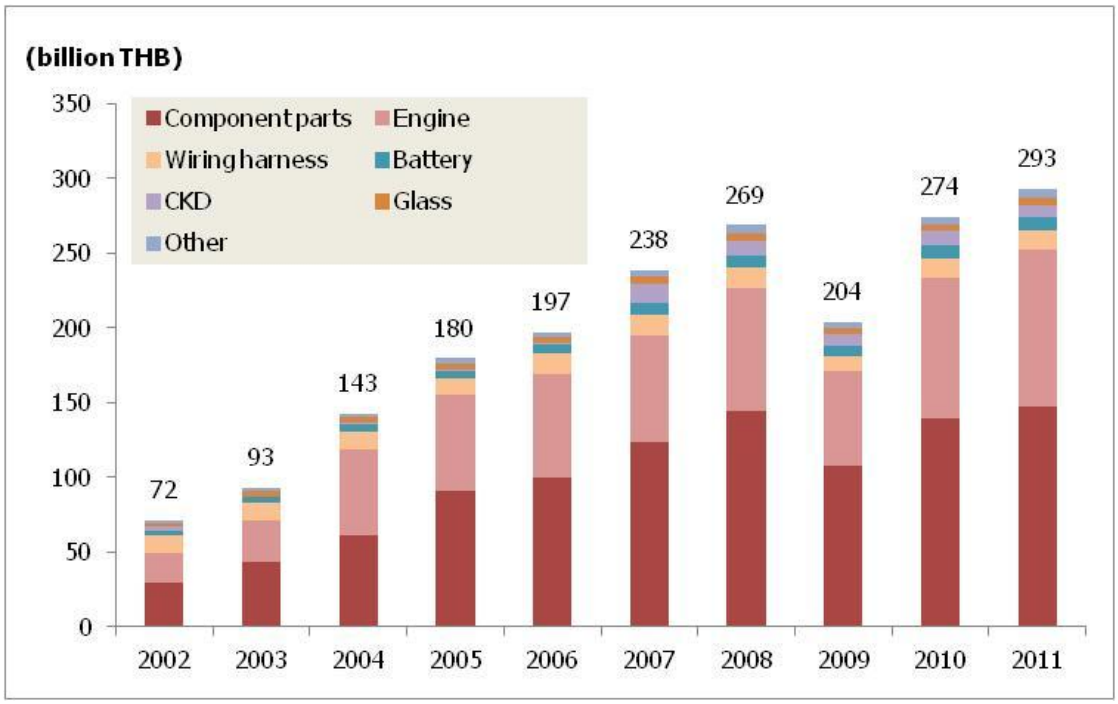
Figure 2-14 Thailand Export Value of Automotive Part



Source: Department of Trade Negotiations

Summarized by Thailand Automotive Institute

Figure 2-15 Thailand Export Value of Automotive part by Part Type



Source: Department of Trade Negotiations

Summarized by Thailand Automotive Institute

3.2 Analysis on Competitiveness of Thailand Automotive Industry

3.2.1 Global Context

The future trend of the automotive industry will focus on 3 features; clean and environmental friendly, energy efficiency and safety.

Firstly, on clean vehicles production, Thailand implemented EURO4 emission standard on diesel and gasoline fuel and EURO3 emission standard on diesel truck and motorcycle, the most progressive standard among ASEAN countries. Thailand also defined the maximum CO_2 emission standard for international standard energy-efficient vehicle at 120 gram per kilometer. Eco car is also subjected to EURO4 standard.

Secondly, on production of energy efficient or alternative energy vehicle, the most clearly defined concept is promoting international standard energy-efficient vehicle or Eco car. Eco cars defined as small light weight vehicles with fuel consumption higher than 20 km./liter in compliance with the National Economic Development Council (NEDC) Driving Mode. Thailand also promotes the use of alternative energy such as ethanol and biodiesel. Currently, the majority of automobile produced in Thailand can use Gasohol E20. Diesel fuel must contain at least 4.5 – 5%[2-5] of biodiesel. Furthermore, compressed natural gas (CNG) is increasingly in use in buses and trucks.

Thirdly, to ensure production of safe vehicles, Thai Industrial Standards Institute (TISI) and Department of Land Transport (DLT), government entities, intend to impose UNECE safety standard and adopt ASEAN MRD in accordance with ASEAN Economic Community (AEC) Agreement starting with 19 regulations by 2015. Along with established the Vehicle

[2-5] As of October 22, 2012

Information and Communication System Centre for Traffic and Safety Improvement to enhance the Intelligent Transportation System.

3.2.2 ASEAN Context

Assessing the impact of ASEAN Economic Community on Thailand automotive industry:

Opportunity

- Increase in population, thereby larger market.
- An opportunity to improve production from low-cost industry to a more automated industry.
- Utilize domestic research and development (R&D) and connect to ASEAN network.
- Become a logistic hub of ASEAN, thereby a substantial increase in demand for trucks.

Challenge

- Increase in competition among ASEAN countries especially Indonesia, which is a larger market than Thailand. It's likely that Indonesia will increase their production and investors may relocate their production bases from Thailand to Indonesia.

On ASEAN Framework Agreement on Mutual Recognition Arrangement, Thai Industrial Standards Institute and Department of Land Transport imposed vehicle standard in compliance with 19 regulations on MRA annex. Moreover, Thailand is developing testing and technical service center and set up a task force to monitor automotive standard. The testing and technical service center will enhance Thailand's competency on standard and

certification among ASEAN countries, which is a key element in becoming a leader in Asia and worldwide.

4. Key Factors influencing Thailand Automotive Industry

Thailand automotive industry has developed over the past 50 years and became a major industry in Thailand. It is obvious that the industry has made a significant contribution to the development of Thai economy as well as generates income and jobs. However, the competition in international and regional market will be more intense, the strategies which have served well in the past may not be suffice to ensure sustainable growth of the industry. Therefore, for the next phase of development, factors affecting competitiveness must be explored in order to ensure sustainable development.

4.1 Appropriate Government Policy

Thailand has successfully become a major production base in Asia and developed parts manufacturers with competitive edge according to the vision in Thailand Automotive Industry Master Plan 2007 – 2011. Thailand is the largest production base for one-ton pickup truck, a major production base for passenger cars and successfully developed highly experienced Thai parts manufacturer who have been in business for over 50 years.

However, China, India and Indonesia experienced tremendous growth and development during the past 5 years. Other countries also embarked on foreign investment promotion policies in production of high technology environmental friendly vehicles e.g. Malaysia, Indonesia, Taiwan and China. Furthermore, the flood crisis in Thailand affected investor's confidence and impact of ASEAN Economic Community in 2015 have prompted the necessity of a clearly defined set of conforming policies among various policy makers, preventive measure and recovery plan for natural disaster to restore investor's confidence,

building infrastructure for future environmental friendly automotive technology, promote and encourage human resource development to enhance competitive edge, increase productivity, enhance industrial standard. All of these are essential to maintain and support Thailand position as a major production base over the next 10 years.

4.2 Preparation for Technology Advancement

Future automotive technology trend is heading toward clean, energy efficient and safety for motorists and commuters as mentioned earlier. The development of body of knowledge and research and development on technologies which will enhance the competency of Thailand automotive industry are vital to ensure that the development of the automotive industry comply with technology requirements, particularly environmental conservation and safety enhancement technologies e.g. energy efficiency, alternative and renewable energy and lighter body and parts, parts development to meet safety standard, production process development to utilize new technology. Since parts manufacturing sector an important foundation of Thailand automotive industry, improving technological competency of these manufacturer is an exigency. However, without infrastructures for research and development such as automotive testing and research center, technology development will not take place. Firstly, the automotive testing and research center must be able to provide international standard certification in compliance with ASEAN MRA framework. Secondly, the center must provide certification for research and development of anticipated technologies and provide testing and certification services mainly to part manufacturers and assisting the government in stipulating and managing national standards.

4.3 Domestic Value Creation

Evidently, the automotive industry is one of the major contributors to Thailand economic development. The automotive industry is ranked as the largest export industry in

Thailand, with 400 billion baht and 30% growth. The industry involves long and continuous supply chain from raw material industries e.g. iron and steel, petrochemical, plastic, electric and electronic and rubber, to supporting industries e.g. die industry as inputs of parts manufacturing. Over 2,000 businesses in automotive and auto parts industry are driving Thailand automotive industry towards continuous growth. By the fully implementation of AEC in 2015, Thailand production forecast is at 3 million units. However, Thailand will not be able to capitalize value creation to create real contribution to the development of the nation by merely assembling imported parts.

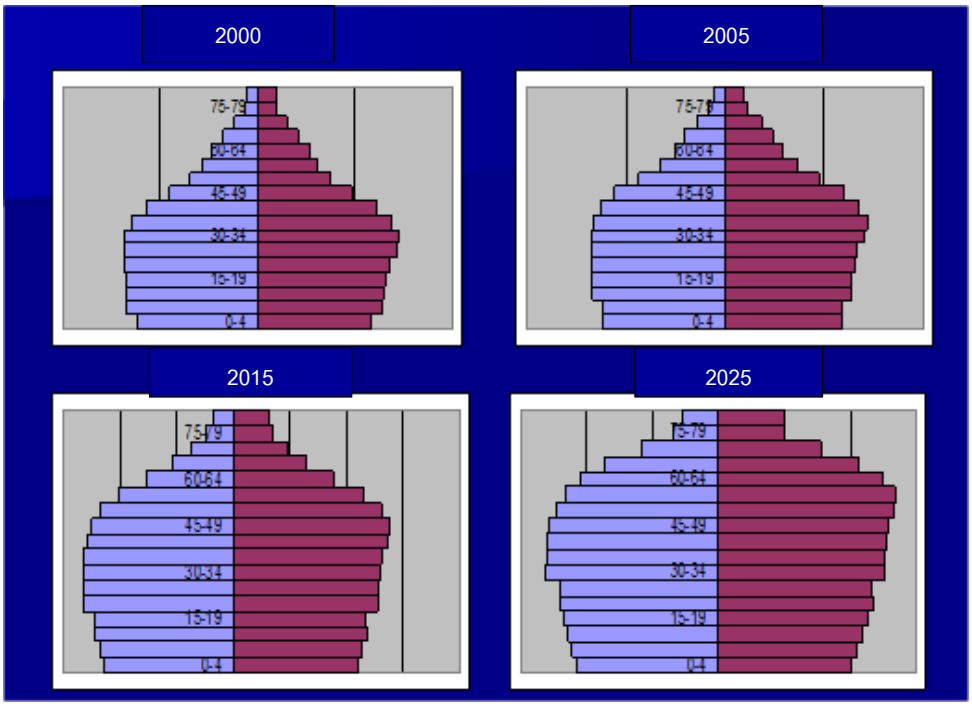
Therefore, the essential issue of Thailand automotive industry is to strengthen part manufacturers as the foundation of sustainable competitive advantages. Due to intense global competition, production cost management is essential for part manufacturers to manage increasing cost of production and to adapt to economic, social, environmental changes including technology advancement. In preparation for ASEAN economic community which will be fully implemented in 3 years, Thailand automotive industry must improve its efficiency and productivity, develop green manufacturing technology, enhance collaboration with government and academic sectors and supply chain cluster/network in the automotive industry to utilize knowledge, competency and experience in order to reduce cost, joint market penetration to offer product variety and meet customer demand, research and development for a stream of ground breaking innovations to capitalize on the body of knowledge to promote open competition and stimulate ongoing efficiency and quality improvement in order to survive and maintain competitive edge. These require the collaboration from the government and private sectors to strengthen and develop the manufacturers in Thailand automotive industry toward becoming ASEAN and global automotive production base according to the vision and objectives of the Thailand Automotive Industry Master Plan.

4.4 Preparation of Human Resource for Future Expansion and Development of Thailand Automotive Industry

Thailand automotive industry has been experiencing an ongoing expansion and among the key factors for the industry growth is Thai labor are highly skilled in comparison to the neighboring countries. However, as the growth prolongs, Thailand will face an increasingly serious problem of labor shortage as Thailand population structure is shifting towards an aging society as shown in Figure 2-13.

As demand for workforce in all level is increasing rapidly, training is essential to ensure that the new entrants is well equipped to work in the industry and also improve the competency of the existing workforce by developing their skills and productivity not only for operative personnel but also artisans and specialists e.g. engineer, researcher including world-class executives to empower Thailand toward being the production base of Asia and strengthen our competitive edge in the international market.

Figure 2-16 Thailand Population Structure in 2000, 2005, 2015 and 2025



Source: Office of National Economic and Social Development Board (2003)

Chapter 3

Evaluation on Thailand Automotive Industry Master Plan 2007 - 2011

1. Objective Review of Thailand Automotive Industry Master Plan 2007 - 2011

Thailand Automotive Industry Master Plan 2007 – 2011 defined objectives, strategies for development and competition as well as strategy implementation to facilitate ongoing growth of Thailand automotive to the maximum advantage of Thailand with collaboration from all parties: government, private sectors and academic/research. The 2011 vision has been defined successively from Thailand Automotive Industry Master Plan 2002 – 2006:

> **"Thailand is a production base in Asia**
>
> **which creates more value added to the country**
>
> **with strong automotive parts industry"**

The purpose of this master plan is to enable Thailand automotive industry to become a major production base of Asia, especially as ASEAN production hub, and a leading production base for specific vehicles such as one-ton pickup truck and highly efficient small green passenger cars, and a hub for product, design, engineering and production process development in this region, in hoping that the emerging markets might grow at high level. Therefore, various products have been exported from Thailand into automotive production system, or for replacement parts, which will strengthen Thailand economy, thereby making Thailand automotive industry a key element for sustainable development. The objectives are as followed:

(1) In 2011, Thailand automotive industry is recognized as major production base in Asia with strong competitiveness. Supply chain of automotive industry in

Thailand has developed into an industry-wide lean supply chain, both in original equipment manufacturing (OEM) and replacement equipment manufacturing (REM). Gain competitive advantages from high efficiency throughout the supply chain in automotive and parts production, thus Thailand will be a major supplier of auto parts.

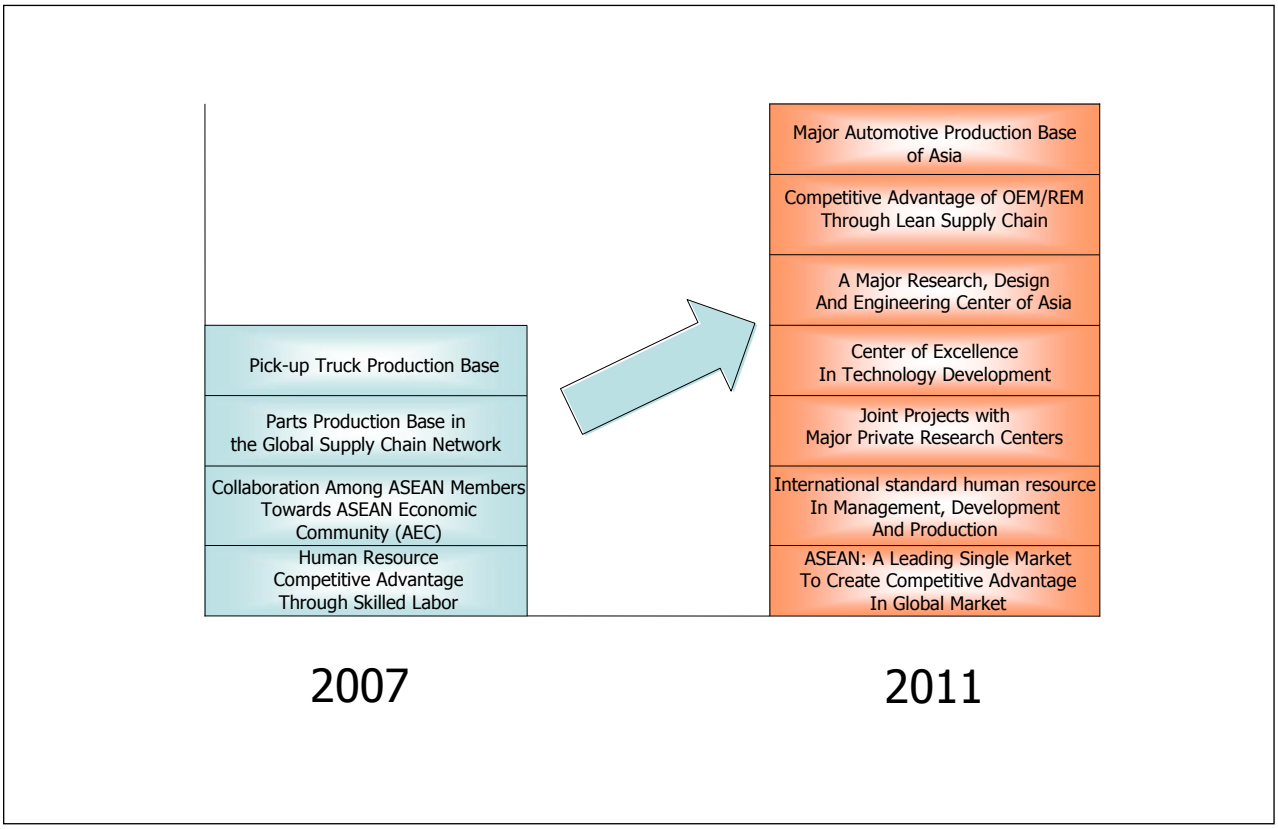
(2) Thailand is a major hub for research, design and engineering of Asia/Pacific complete with Center of Excellence (COE), established in accordance with the technology development master plan framework. There are collaboration projects with private centers to ensure developments which will be beneficial to both the government and private sectors. COE will provide invaluable resources and testing services to the industry.

(3) International standard human resource in the automotive industry in all aspects; management, development and production.

(4) ASEAN will be a single market with systematic production network among member countries and an important market with integrated standard to strengthen competitive edge on production capacity and export of motor vehicles and parts to the global market.

The vision of Thailand Automotive Industry Master Plan 2007 – 2011 according to these objectives is shown in Figure 3-1.

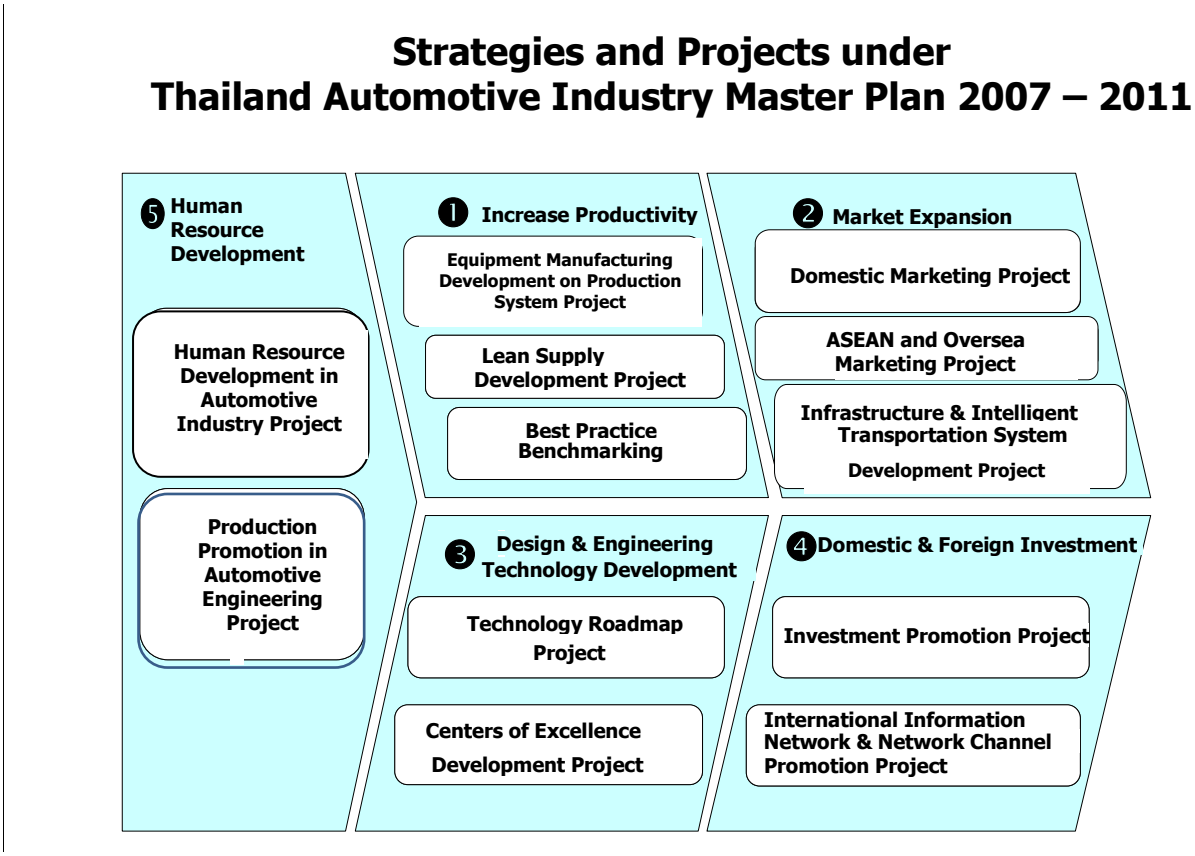
Figure 3-1 Vision of Thailand Automotive Industry Master Plan 2007 - 2011



Source: Summarized from Thailand Automotive Industry Master Plan 2002 – 2006 and Thailand Automotive Industry Master Plan 2007 – 2011 by Thailand Automotive Industry

From this vision proceeding to 5 thrusts in the development of Thailand automotive industry; productivity thrust, market thrust, technology and engineering thrust, human resources thrust and investment and linkages promotion thrust. These 5 thrusts underpinned the success of the vision. Thereby, the master plan formulated 5 operating strategies consisted of 12 projects as shown in Figure 3-2.

Figure 3-2 Strategies and Projects under Thailand Automotive Industry Master Plan 2007 – 2011



Source: Thailand Automotive Industry Master Plan 2007 – 2011

Strategy 1: Increasing Productivity by develop Thailand automotive industry to an industry-wide lean supply chain and creating production supply chain network to enable comparison of competitive advantage, thereby make Thailand automotive industry highly competitive.

Strategy 2 Expanding domestic and ASEAN markets by developing small passenger car together with maintain Thailand position as the production base for pick-up truck. Also develop infrastructures to increase efficiency in transportation.

Strategy 3 Develop design and engineering technology as a foundation of sustainable and systematic competition and value creation, using technology roadmap as an essential tool to enable collaboration on research and development and testing projects.

Strategy 4 Develop human resource by industry-wide development of human resource in management and production. Human resource development is a key factor in creating competitive advantage for Thailand automotive industry emphasizing on formal education system, training system that meet the industry demand.

Strategy 5 Promote domestic and foreign investment to promote the industry growth and linking to international level.

2. Evaluation Framework

The master plan has defined a complete set of objectives and indicators for each project; nevertheless, the master plan was not fully administered. The follow up and evaluation on each individual project has been difficult and could not reflect on true indication of success for the plan. Thereby, strategy map and objectives of the master plan will be used to evaluate the success of master plan, as shown in Figure 3-3:

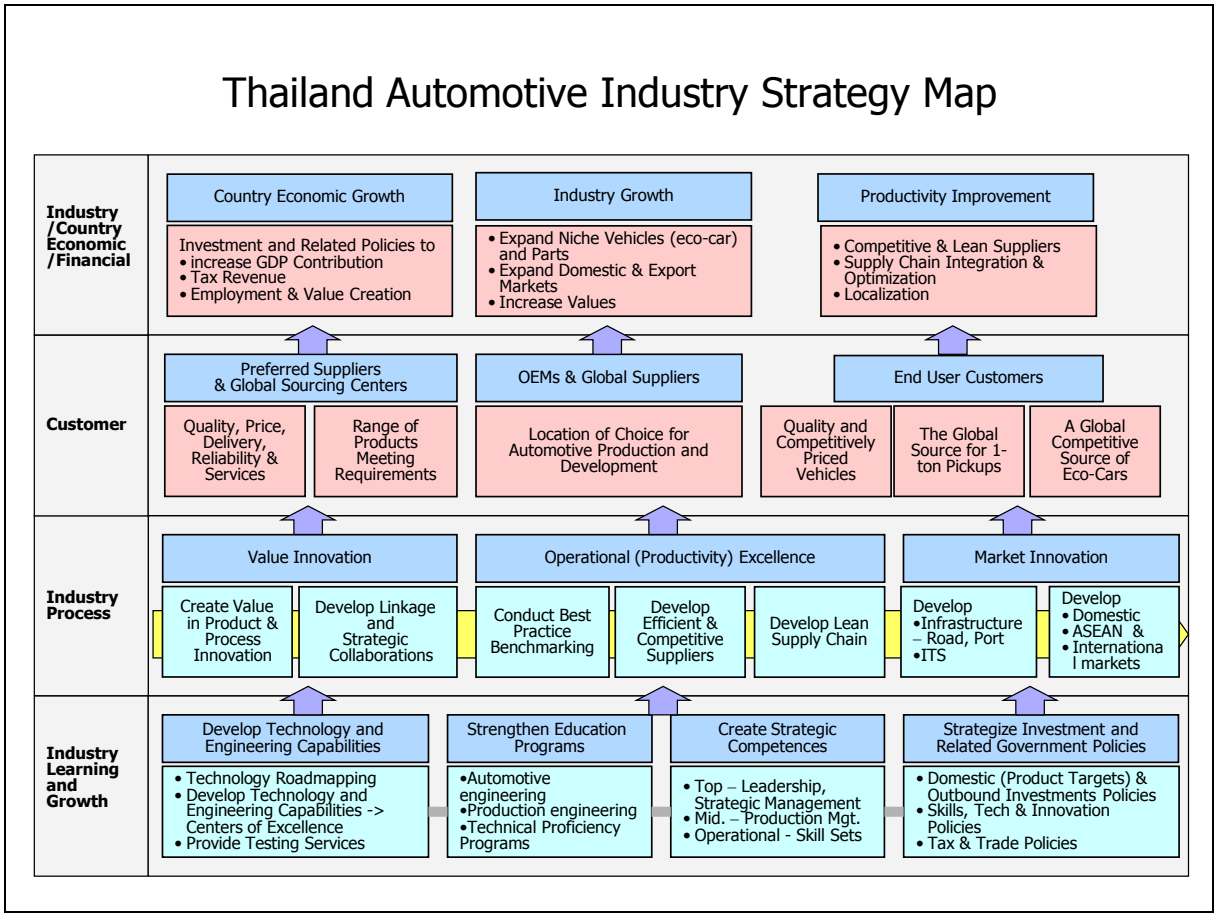
(1) To be a major production base of Asia

(2) To be the center of research, development and testing

(3) Internationally qualified human resource

(4) To create production network in ASEAN integrated market

Figure 3-3 Thailand Automotive Industry Strategy Map



Source: Thailand Automotive Industry Master Plan 2007 - 2011

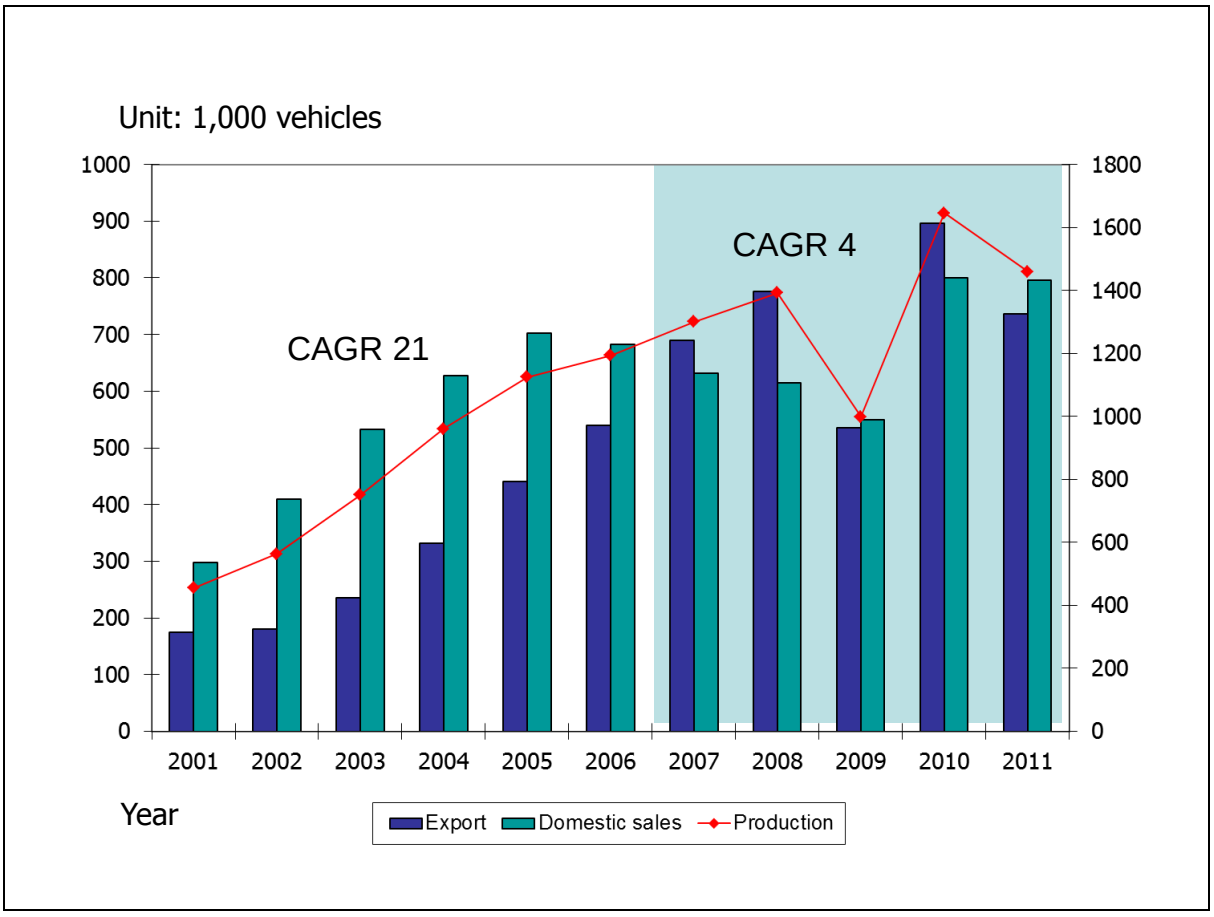
3. To be a major production base in Asia

Thailand automotive industry has been growing simultaneously in production, and domestic sales and export. Domestic motor vehicle production increased substantially as a result of the government's promotion policy on investment expansion in automotive industry with various incentives. During 2002 – 2006, compound annual growth rate (CAGR) was as high as 21% since it was during the economic recovery period after Thailand economic crisis. During the period of the master plan in 2007 – 2011, the industry experienced a slow pace of growth at 4% as a result of multiple crisis arose during that time such as global economic crisis. In 2010, US sub-prime mortgage crisis had led to the global economic crisis. In 2011, the 2 natural disasters, tsunami in Japan and flood crisis in

Thailand, had led to global supply shortage of parts. However, Thailand automotive industry was on has been on a strong rebound. The production is estimated to reach 2 million milestones in 2012 as shown in Figure 3-4.

As of 2011, Thailand ranked the first among ASEAN countries in automobile production. Thailand has been promoting production of passenger cars in addition to the production of pick-up trucks which has been experiencing simultaneous growth. Thereby, Thailand is still a major production base in ASEAN with a wide product variety.

Figure 3-4 Automobile: Production, domestic sales and export

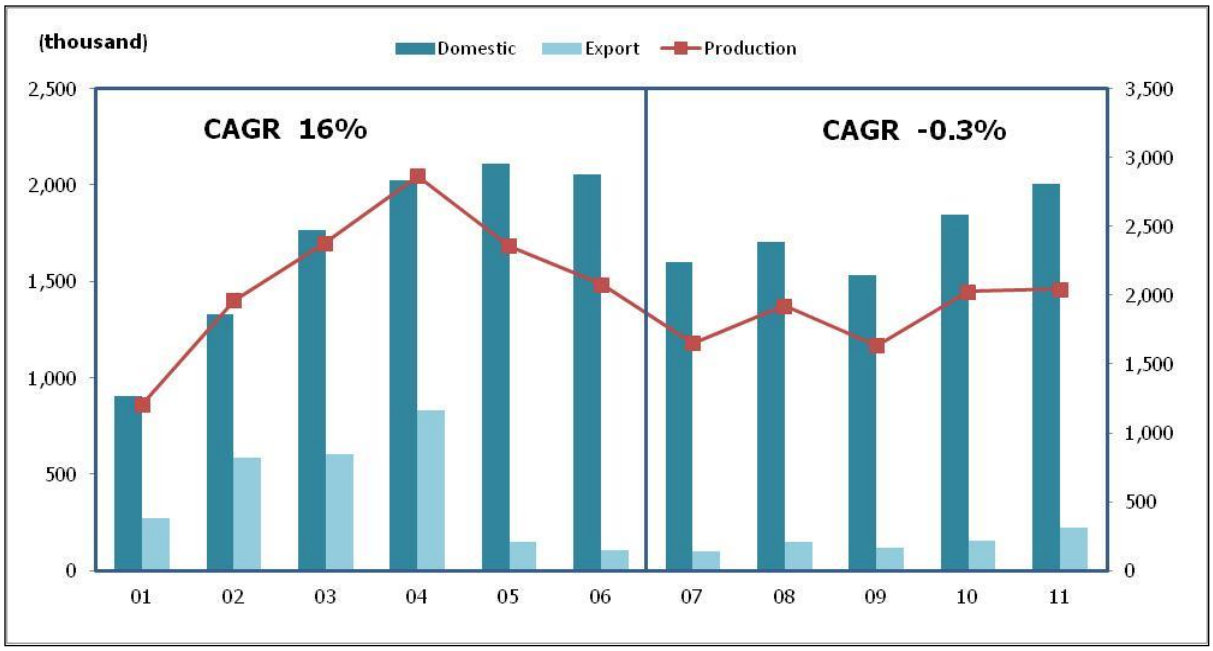


Source: Summarized by Thailand Automotive Institute

For motorcycles, in 2002 – 2006, CAGR was 16% as a result of high economic growth in Thailand as well as growth in foreign markets in ASEAN region. After that domestic market

became saturated. The market size is in stable condition. Foreign market expanded and reached the point where it was feasible to expand the production bases in those countries thus exported declined. As a result of these factors, CAGR decreased by 0.3%.

Figure 3-5 Motorcycle: Production, domestic sales and export



Source: Summarized by Thailand Automotive Institute

Key factors driving the automotive industry growth during critical periods are:

(1) International Energy-efficient and Safety Standard Vehicle (Eco car) Promotion Project International energy-efficient and safety standard vehicle or Eco car was originated by Automotive Strategic Committee. The initiative was originally called Agile, Clean, Economical and Safe car (ACEs car). In 2007, the Council of Ministers approved the Eco car policy an assigned the responsibilities to the following government entities:

- The Ministry of Industry issued the specification of Eco car[3-1] including the international technical standard for energy efficient vehicles and also responsible for testing and approval of each model according to the specification declared. –
- Board of Investment Promotion issued an investment promotion notification and grant investment benefits to manufacturers of Eco car of the standard issued by the Ministry of Industry.
- The Ministry of Finance issued a notification of excise tariff on Eco car specifying suitable rate. The notification has taken effect from October 1, 2009.

As a result of the investment promotion campaign, 6 companies submitted their application and were approved. However, 5 companies submitted their promotion acceptance forms, total investment 36 billion baht, annual production capacity 585,000 units.

[3-1] Eco car specification issued by the Ministry of Industry

- Energy consumption over 20 km./liter (Test method: UN ECE R101 Rev. 1)
- Meet Euro 4 standard on Carbon dioxide emission which is below 120 gram/km. (Test method: UN ECE R83 Rev.2)
- Meet the Frontal Collision Standard according to UN ECE R94 and Lateral Collision Standard according to UN ECE R95.

Table 3-1 Investment in Eco-car Campaign

Company	Investment (million baht)	Production Capacity (unit/year)
Honda Automobile (Thailand) Company Limited	6,700	120,000
Suzuki Motor Corporation Company Limited	9,500	138,000
Siam Nissan Automobile Company Limited	5,500	120,000
Mitsubishi Motors (Thailand) Company Limited	6,600	100,000
Toyota Motor Thailand Company Limited	7,700	107,000

Source: Office of the Board of Investment of Thailand

Summarized by Thailand Automotive Institute

The implication of international energy-efficient and safety standard vehicle or Eco car policy on the success of the automotive industry master plan is to enable Thailand automotive industry to increase the production capacity to 2.7 million units per year in 2012 from 1.8 million units in 2010 and to 3.1 million unit in 2014 from 5 business in the promotion campaign. Not only Eco car will contribute to the economic success of the master plan, but Thailand will also benefited from technology transfer, domestic parts manufacturer development, value creation and domestic parts consumption, increase employment and develop many related businesses and industries.

(2) Part Manufacturing Industry Competency Development

The Ministry of Industry supported several projects especially efficiency and productivity improvement projects of the Office of Industrial Economics under the master plan, to enhance competency of part manufacturers emphasizing on 2nd tier part

manufacturers and below to create a lean supply chain. The projects were carried out by Thailand Automotive Institute and Thai Auto parts Manufacturers Association e.g. Production Management System Development Project, ISO TS: 16949 Promotion Project and Productive Maintenance for Machine Efficiency Improvement Project. These projects enable part manufacturers to improve efficiency of the production system, reduce loss and improve product quality which enhance the efficiency of the supply chain. These projects were carried out in addition to the development of 1st tier part manufacturers owned by the vehicle manufacturers. It could be said that the majority of part manufacturers achieved certain level of development. However, to expand the development throughout the industry requires continuity. Thus even the development projects have been implemented, there is a lack of in-depth development to enhance sustainable competency of part manufacturers.

(3) To be a major part production base

As Thailand is one of a major motor vehicle production base in the region, equipped with skilled parts manufacturers and infrastructures, Thailand is one of the key destinations for investors not only among motor vehicles producers but also major global part manufacturers are convinced that Thailand is fully equipped to be their motor vehicle production bases. In 2011, 58 companies among top 100 of global suppliers have chosen Thailand as a production base; as shown in Figure 3-6.

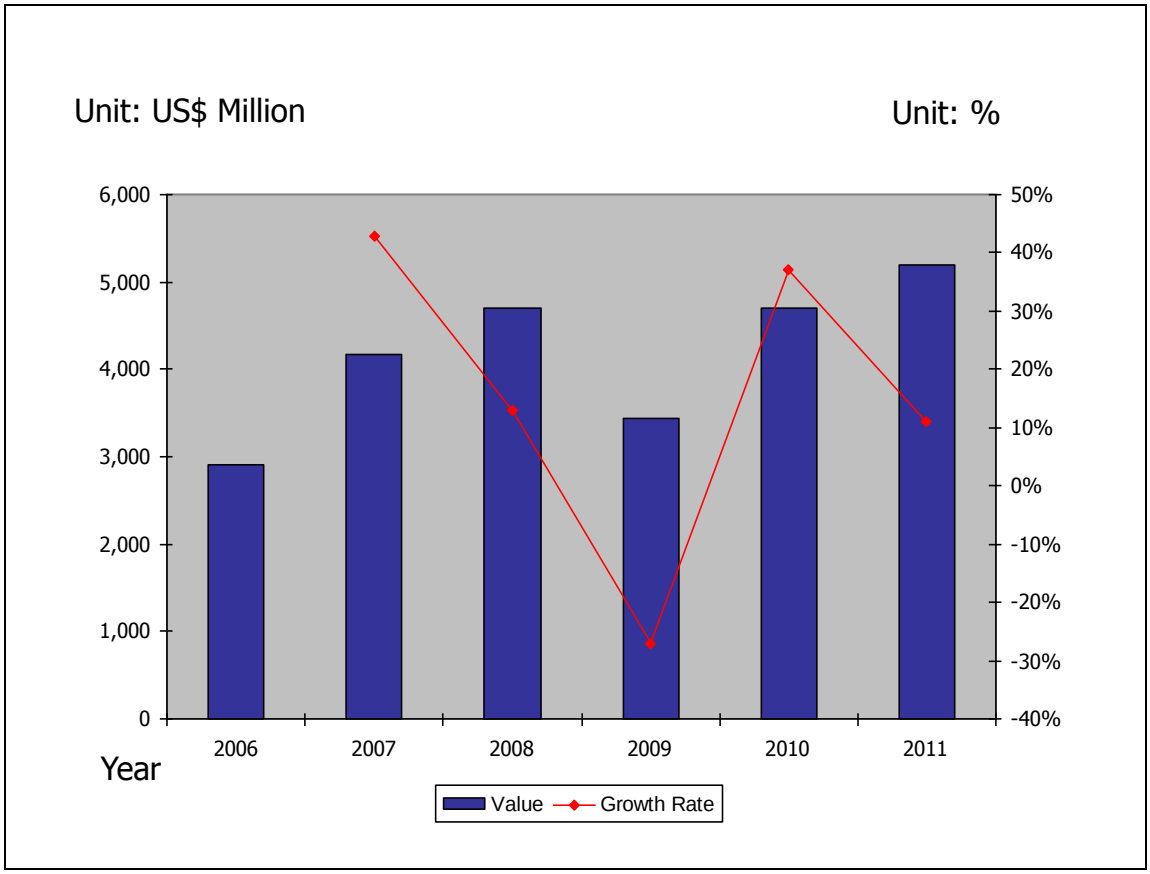
Figure 3-6 Top 100 of Global Suppliers Active in Thailand

Source: Automotive News

Summarized by Thailand Automotive Institute.

Another measure of the strength of the part manufacturing industry is consistent growth in the export sector at 12% on the average as shown in Figure 3-7. The flood crisis stressed Thailand position as a top motor vehicle production base, not only Thailand automotive industry was affected but motor vehicle production in many countries around the world were also affected due to shortage of parts supply for Thailand.

Figure 3-7 Vehicle Parts Export Growth



Source: Summarized by Thailand Automotive Institute

4. To be the center of research, development and testing

The aim of Thailand being the center of research, development and testing is a major goal for body of knowledge of technology transfer and development. This in turn is essential for value creation of Thailand automotive industry as well as future competency enhancement. In the automotive industry, technology develops at a fast pace and also involve environmental and safety conditions, thus research, development and testing are key factor for sustainability in this industry. The Thailand Automotive Industry Master Plan 2007 – 2011 included the following projects and measures contributing to the development of automotive industry both ongoing and new projects:

(1) The Board of Investment provided incentives for research and development activities.

(2) The Royal Revenue Department under the Ministry of Finance granted double deductible on income tax for research and development expenses.

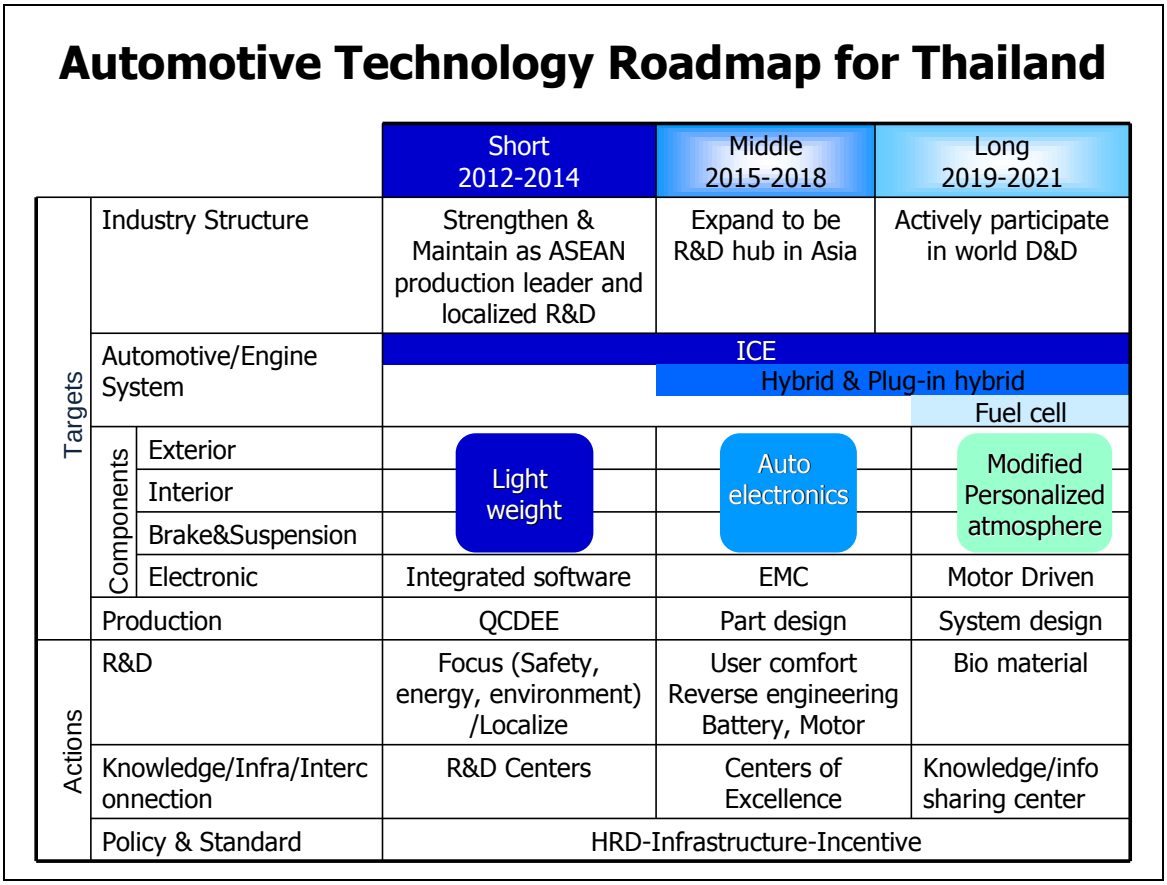
(3) The Ministry of Science and Technology has been allocated budget for research and development including automotive research and development.

(4) The Ministry of Education has been allocated the budget for research and development and organized projects with collaboration from overseas e.g. King Mongkut's Institute of Technology North Bangkok is in collaboration with Aachen University in Germany.

(5) The Ministry of Industry supported the improvement of automotive testing centers enabling the testing centers to conduct testing according to international standards as well as testing related to non-tariff measures to trade e.g. End of Life Vehicle (ELV) management and Volatile Organic Compounds (VOCs).

The Ministry of Industry through Thailand Automotive Institute in collaboration with National Metal and Materials Technology Center (MTEC), National Science and Technology Development Agency (NSTDA), Ministry of Science and Technology, developed a technology roadmap, as shown in Figure 3-8, as a framework for joint research and development. The roadmap consists of 3 parts; short-term plan, intermediate-term plan and long-term plan. However, there has been no solid research and development project developed from the roadmap.

Figure 3-8 Technology Roadmap for Thailand automotive Industry



Source: Technology Roadmap for Thailand automotive Industry by National Metal and Materials Technology Center (MTEC), National Science and Technology Development Agency (NSTDA), and Thailand Automotive Institute

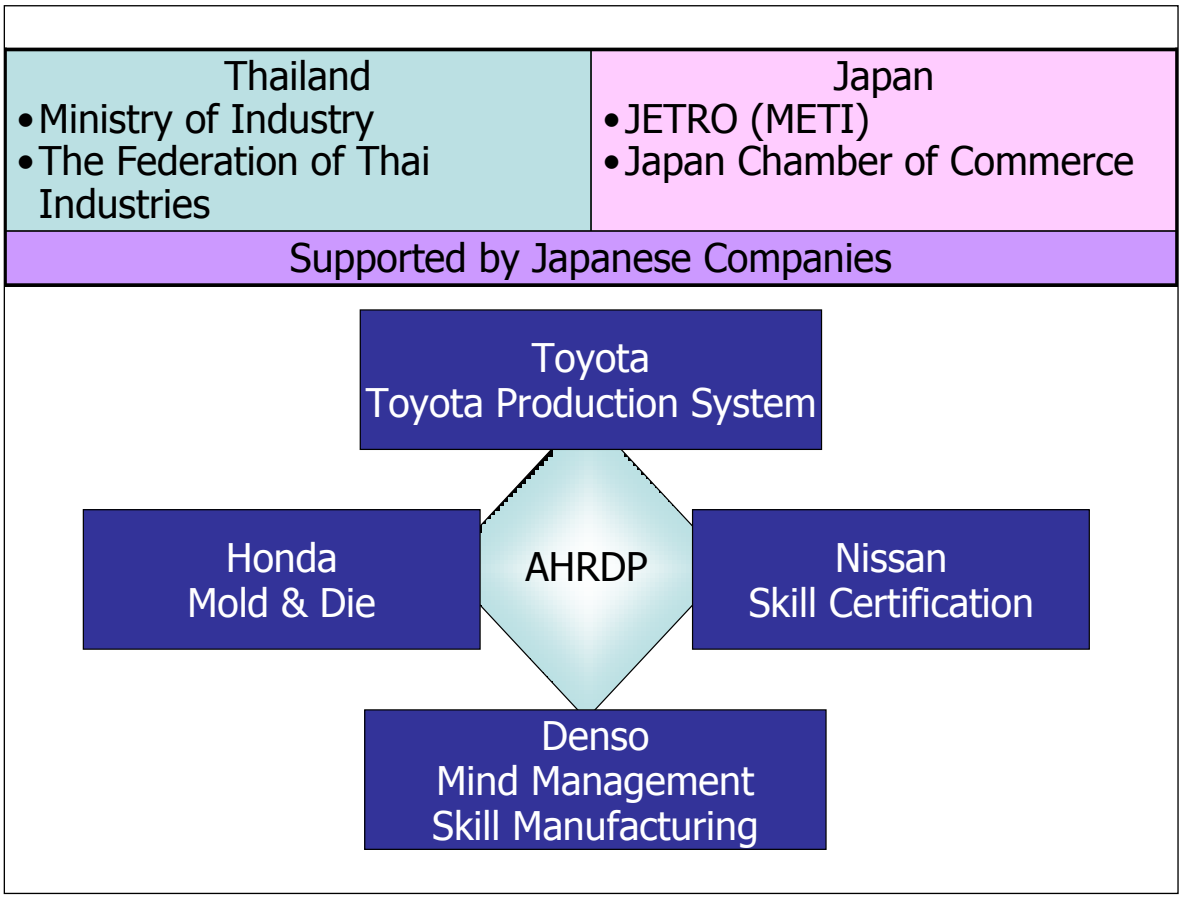
These activities have led to establishment and expansion of research, development and engineering by the business sector. The first step was Thailand has been designated by automobile manufacturers as the research, development and engineering of ASEAN. Then the major part manufacturers started to increase their activities by establishing research and technology centers in Thailand. Thus reflex Thailand position as the leader in technology in ASEAN.

However, Thailand has not been able to establish Center of Excellence (COE) to accommodate the demand of parts manufacturers due to lack of integrated plan among various entities and prioritization of activities towards being the center of excellence of the desired technologies.

5. Internationally qualified human resources

The Ministry of Industry places on the development of human resources in the automotive industry, by allocating budget to various entities and appointed Thailand Automotive Institute as the lead entity in human resource development in the automotive industry together with automobile assemblers and Thai Auto parts Manufacturers Association, as shown in Figure 3-9. The aim is to empower human resources in the automotive industry by enhancing their knowledge, skill and ability. Automotive Human Resource Development Project (AHRDP) in collaboration with Japan enabled the transfer of crucial technologies and standard emphasized on developing the body of knowledge which consists of programme and expert training in 4 areas to enable industry-wide development in order to support the growth of Thailand automotive industry.

Figure 3-9 Automotive Human Resource Development Project (AHRDP)



Source: Summarized by Thailand Automotive Institute

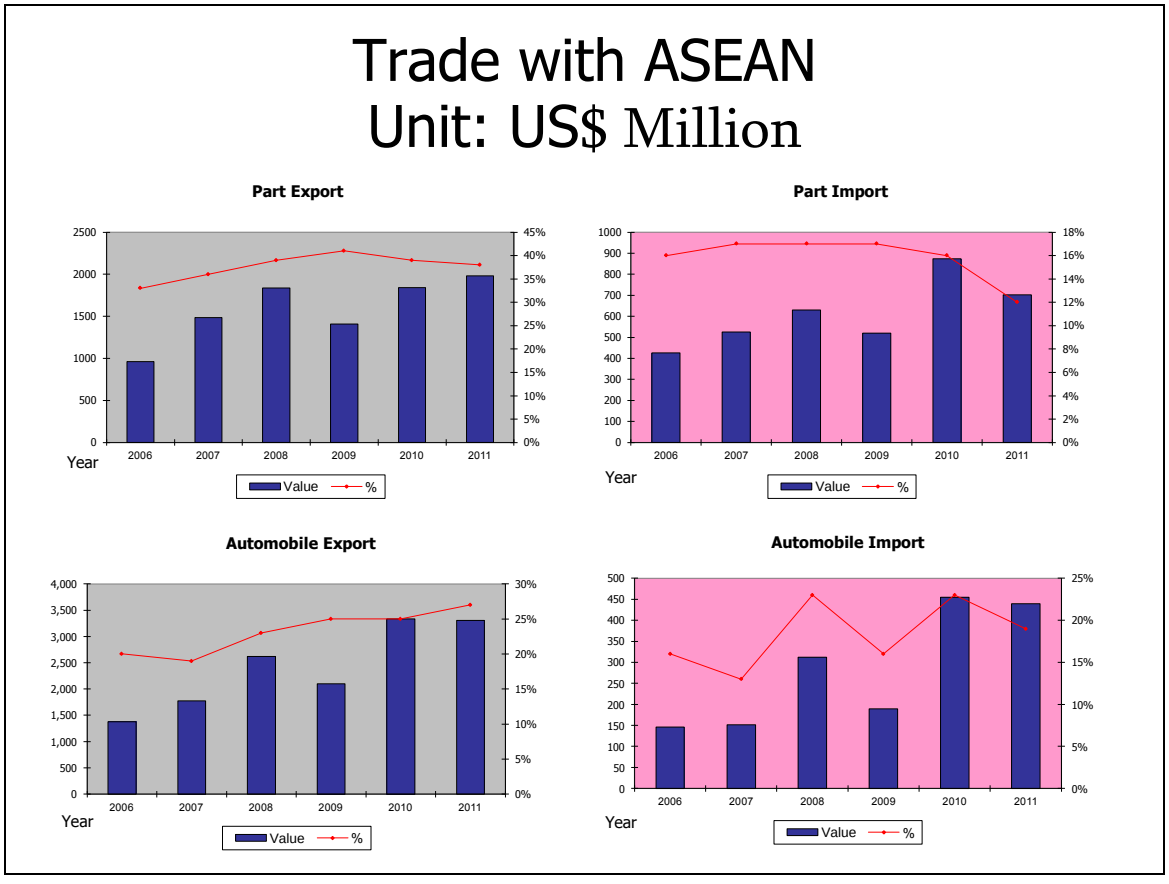
However, the project focused on line workers. In order to become a production base with greater value creation, it is necessary for Thailand develop higher level personnel e.g. engineers and researcher as well as international business management to accommodate upstream industry thus enhancing value creation.

Nevertheless, there has been no solid project on the development of future workforce in the education system, only co-operation between automobile assemblers and educational institutions on automotive maintenance training or automotive mechanic as most educational institutions offer general education to give graduates wider career options. However, a few institutions started offering automotive engineering degrees.

6. Production Network in ASEAN single market

The ASEAN Economic Community emphasized on the three pillars, one of which is economic integration to promote equitable economic development in the region. Since the foundation of AEC, ASEAN members have reduced trade barriers among them, especially by lowering import duties to promote the free flow of goods among ASEAN. Significant progress has been achieved on the automotive industry, since most import duties have been exempted which promote regional trade. As shown in Figure 3-10, total export volume among ASEAN countries has increased and interdependence rate between Thailand and ASEAN countries is high.

Figure 3-10 Value of Thailand's Motor Vehicle Export to ASEAN



Source: Global Trade Atlas

Summarized by Thailand Automotive Institute

7. Evaluation on Project Management

The evaluation on project management is based on 2 key performance indicators in Thailand Automotive Industry Master Plan 2007 – 2011:

(1) Establish a joint committee on automotive industry development between the government and private sector. Thailand Automotive Institute has been appointed as supporting agency

(2) Define Specific goals and indicators with regular evaluation

Although the joint committee on automotive industry development between the government and private sector has not been established as prescribed in one of the two key performance indicators, the government has established the National Industrial Development Committee (NIDC) to supervise the industrial development plan of all industries in order to achieve harmonization and integration of management. NIDC has approved the Automotive Industry Development Project which consists of 2 subsequent projects; Sustainable Automotive Human Resource Development Project and Automotive Testing Center Development Project

8. Evaluation Overview

The planning of various projects during the implementation of Thailand Automotive Industry Master Plan 2007 – 2011 (government's fiscal year) might not have referred to the master plan. The Ministry of Industry has implemented the industrial development strategic plans during the timeframe. Emergency plans were selected according to their priorities. The majority of projects with and without budget implemented were in line with the master plan. The major contributor to the development of Thailand automotive industry is policy

integration e.g. Eco car which is a crucial project to the development of Thailand automotive industry.

Although the key projects in the master plan have been implemented to a certain extent, the testing center project is unable to accommodate the growth of the industry and demand of the private sector. This project is an essential infrastructure supporting standard certification and research and development. The project requires high investment and has been stalled due to the lack of fund. The Automotive Human Resource Development Project has also unable to establish a system for developing high level personnel. Both projects are the foundation of development and crucial for the increase in production capacity to 3.1 million units in 2014.

Chapter 4

Automotive Industry Development Strategy

1. Challenge Facing Thailand Automotive Industry

The automotive industry is facing a challenge on sustainable development in the major global trends which consist of environmental, technology, safety standard and pollution standard trends. These trends are dynamic factors affecting changes and development in the automotive industry in the international, regional and national levels. Thereby the analysis on Thailand automotive industry position in global and regional context revealed that pollution and safety standard trends and free trade agreement among members of the ASEAN Economic Community, which is expected to be fully in effect in 2015, will be the key factors in enhancing Thailand competency in the international market. A 10 years vision must be taken into consideration for the formulation of the automotive industry development strategy.

3 Challenges facing Thailand automotive industry:

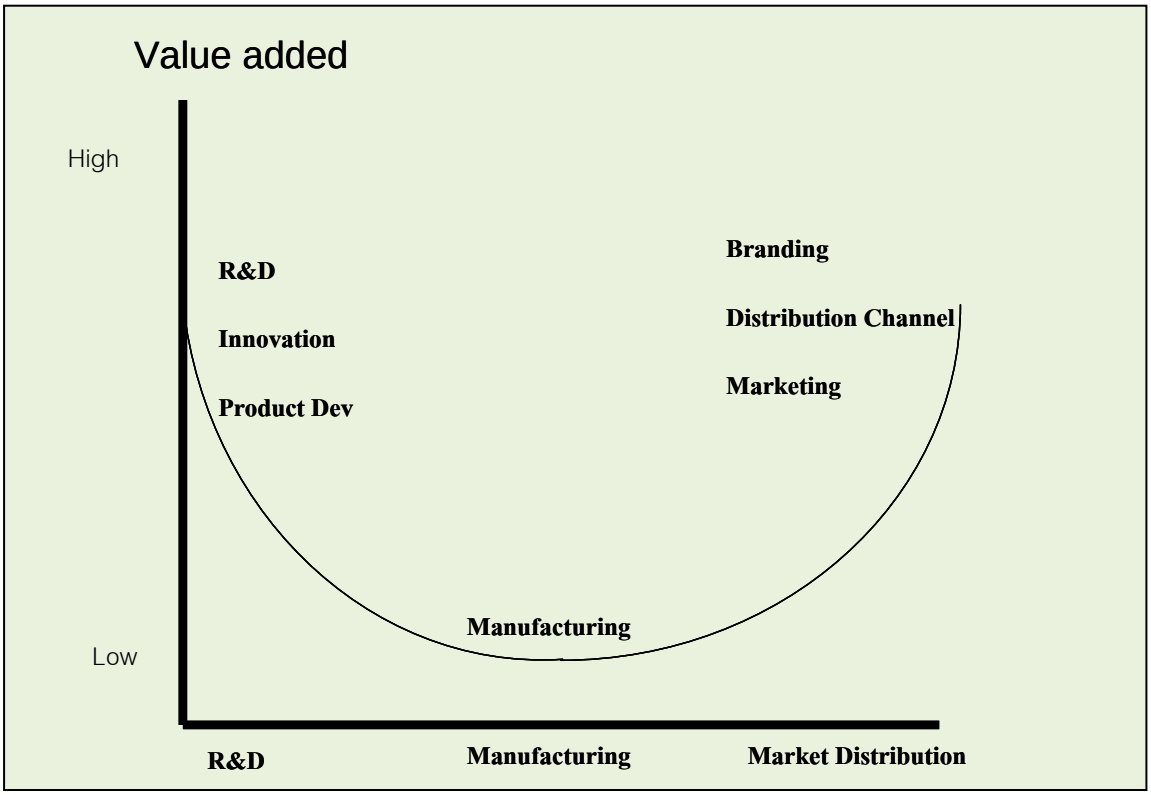
Challenge 1: Thailand automotive industry's position in global and regional context

In 2011, the global motor vehicle production amounted to 80 million units. The top 3 motor vehicles manufacturing countries were China, USA and Japan. Thailand ranked the 15th (1.4 million units) after UK and Iran. Thailand motor vehicle forecast is expected to reach 3 million units within 5 years thus will likely advance to the 10th largest motor vehicle manufacturer in the world. In 2011, Thailand ranked the 5th largest commercial vehicle producers in the world after Mexico and Canada. The top 3 manufacturers are China, Japan and Canada. The success is a result of the success of the government's policy promoting pick-up truck as a top production champion of Thailand, creating confidence among foreign

investors. 6 automotive manufacturers who pledged to establish their major production bases and invest in research and development in Thailand are Toyota, Isuzu, Mitsubishi, Nissan, Ford and GM. Thereby, Thailand has become a major pick-up production base ranked 2nd after USA.

As Thailand automotive industry aspired to be among the top 10 of the world, global competition is the challenge. Currently, Thailand is a major production base of one-ton pick-up truck, passenger car and motorcycle. To enhance the competitive advantage, Thailand must become a production base completed with research and development to internationalize the industry on safety and pollution standard, environment, technology, product quality, management, supply chain and production cost management in order to maximize profit. Government mechanisms must be emphasized on progressive development of Thailand automotive industry, accelerate the improvement research and development and marketing capability which will create more value added to the industry than from being a mere production base according to the Smiling Curve concept proposed by Stan Shih as shown in Figure 4-1. This will lead to the role of government mechanism in formulating integrated competitive strategies such as investment in crucial infrastructure, trade and investment regulation adjustment based on competition and to facilitate business operation and development of Thailand automotive industry under these conditions. Thereby, these are the key factors affecting competency development of Thailand automotive industry towards becoming one of the top 10 manufacturers in the global market.

Figure 4-1 Stan Shih's Smiling Curve



Source: Stan Shih's Smiling Curve theory

Summarized by Thailand Automotive Institute

Challenge 2: Change in pollution and safety standard and automotive technology trends

The Fuel Replacement Energy and Alternative Energy Plan formulated the Ministry of Energy has summarized the energy and environmental challenges facing Thailand. Firstly, the energy security such as rising energy cost and increase in dependency on imported energy. Secondly, increase in pollutant emission especially Carbon dioxide (CO_2). These challenges are directly affecting the automotive industry, thus it is necessary to develop vehicle using fuel replacement energy and alternative energy to develop environmental friendly automotive technology in order to reduce and improve product quality in compliance with the safety standard. The conclusion gathered from brain storming session

and information from automotive manufacturers is that future automotive technology development trends will emphasize on the following aspects:

1. Green products to reduce CO_2 emission and internationalize the pollutant emission standard. The UN ECE standards have been adopted.
2. Energy efficient and using more eco-friendly, lighter and smaller material, improve engine and transmission efficiency to reduce fuel consumption as well as develop transmission technology using alternative energy e.g. electric energy from battery.
3. develop vehicles that compile with the safety standard such as active safety equipment, passive safety equipment and Intelligent Transportation System (ITS)

The international automotive industry is now developing more efficient automotive technologies as well as new approaches on utilizing alternative energy e.g. Ethanol and biodiesel and motor-driven vehicle to replace fossil fuel energy such as hybrid and electric vehicles. These vehicles are under development and subjected to usability and technology constraints. However, the adoption rate of alternative energy vehicles is expected to increase significantly by 2020.

Challenge 3: Free trade agreement among members of the ASEAN Economic Community, which is expected to be fully in effect in 2015

The ASEAN Economic Community, which will be effective in 2015, envisages ASEAN as a single market and production base promoting free flow of raw materials, products, services, capital, investment and labor. The challenges of Thailand automotive development posed by the ASEAN Economic Community in 2015 are as followed:

1. Motor Vehicle Standard: standard harmonization according to the ASEAN mutual recognition agreement (MRA). All ASEAN countries agree a common set of technical prescriptions and protocols for type approval of vehicle components. Currently, ASEAN members have reached an agreement on 19 types. However, the standard of components and testing equipment for the 19 types among ASEAN countries has not been harmonized. Therefore, this is a challenge for Thailand to enhance the competitive advantage and resolve weakness before ASEAN MRA come in effect by improving domestic standard and develop the ability to test these 19 types of component.
2. Marketing: Once ASEAN become a single market, ASEAN will become a major global production base. In 2011, the total motor vehicle production of ASEAN was 2.9 million units, 5 years average compound annual growth rate (2007 – 2011) was 7.23%. In 2011, Thailand ranked 1st among ASEAN countries with 1.4 million units for domestic sales and export. Export is facilitated by international free trade agreement mechanism both bilateral agreement between Thailand and trade partner and multilateral agreement among ASEAN and trade partner. Thereby, ASEAN is a stepping stone of Thailand automotive industry in the international market.
3. Competition among ASEAN countries: as a result of ASEAN Economic Community, automotive manufactures from all over the world such as Japan, China, USA, Europe and India are intended to use ASEAN as a production base for international market. Currently, Indonesia and Malaysia are Thailand's major competitors. Indonesia's economy is growing at a substantial rate. Marketing opportunity arises from increasing domestic demand. Indonesian government also announced investment promotion policy on small passenger cars, green vehicles and alternative energy vehicles following the global technology trend. Malaysian government also came up with Green Initiative, a new policy, to promote investment in eco-friendly and energy

efficient vehicle such as hybrid and electric cars. Nevertheless, ASEAN countries have differentiated strength. Thailand emphasizes on one-ton pick-up trucks and international energy-efficient and safety standard vehicles. Indonesia emphasizes on multi-purpose vehicles and small passenger cars 1,200 cc and below. Malaysia emphasize on medium passenger cars and above. The Philippines has strength in transmission system production.

To overcome 3 challenges in becoming one of the top 10 in the world, Thailand automotive industry must adapt to the global supply chain competition. Not only competing to maintain the position of major global production base but emphasizes on product research and development to stay ahead of the automotive technology trends as well as focuses on energy efficiency, eco-friendliness, and safety standard. As for the last challenge, the effect of ASEAN Economic Community Agreement is both an opportunity and a threat to Thailand automotive industry. The opportunity is in larger market. The threat is from pollution and safety standard, competition among ASEAN countries on foreign direct investment and more intense competition for the same products in the same market.

Taken the 3 challenges in to consideration, the direction of automotive industry development 2012 – 2016 emphasizes on developing Thailand automotive industry to an international production base completed with infrastructures that enhance Thailand competitiveness according to the future automotive technology trends; eco-friendly, energy efficient and safety, by utilizing the advantage of having automotive research and development testing center, human resources capability, open regulations to facilitate competition. These conditions will enhance Thailand position from the regional automotive production base according to the vision of Thailand Automotive Industry Master Plan 2002 – 2006 to being a major global production base.

These objectives contributed to the formulation of vision 2021 and the strategic action plan of Thailand Automotive Industry Master Plan 2012 – 2016 as followed:

2. Vision for Thailand Automotive Industry 2021 (VISION 2021)

Vision for Thailand Automotive Industry 2021 defined direction of automotive industry development by capitalizing from the success of Thailand Automotive Industry Master Plan 2007 – 2011. The vision 2011 was "For Thailand to be the automotive production base of Asia, thus enhancing domestic value creation by strengthening the vehicle parts industry." The vision of Thailand Automotive Industry Master Plan 2012 – 2016 focuses envision the next 10 years in 2021. Vision 2021 emphasizes on developing competitive advantages to promote Thailand automotive industry from Asian production base to an eco-friendly global production base and maximized the benefits for Thailand by value creation in the supply chain of automotive industry. The Vision 2021 emphasizes on being Green automotive production base which consists of 2 characteristics; 1. Eco-friendly 2. International standard especially in the aspect of safety. Thus the Vision 2021 is defined as;

"Thailand is a global green[4-1] automotive production base

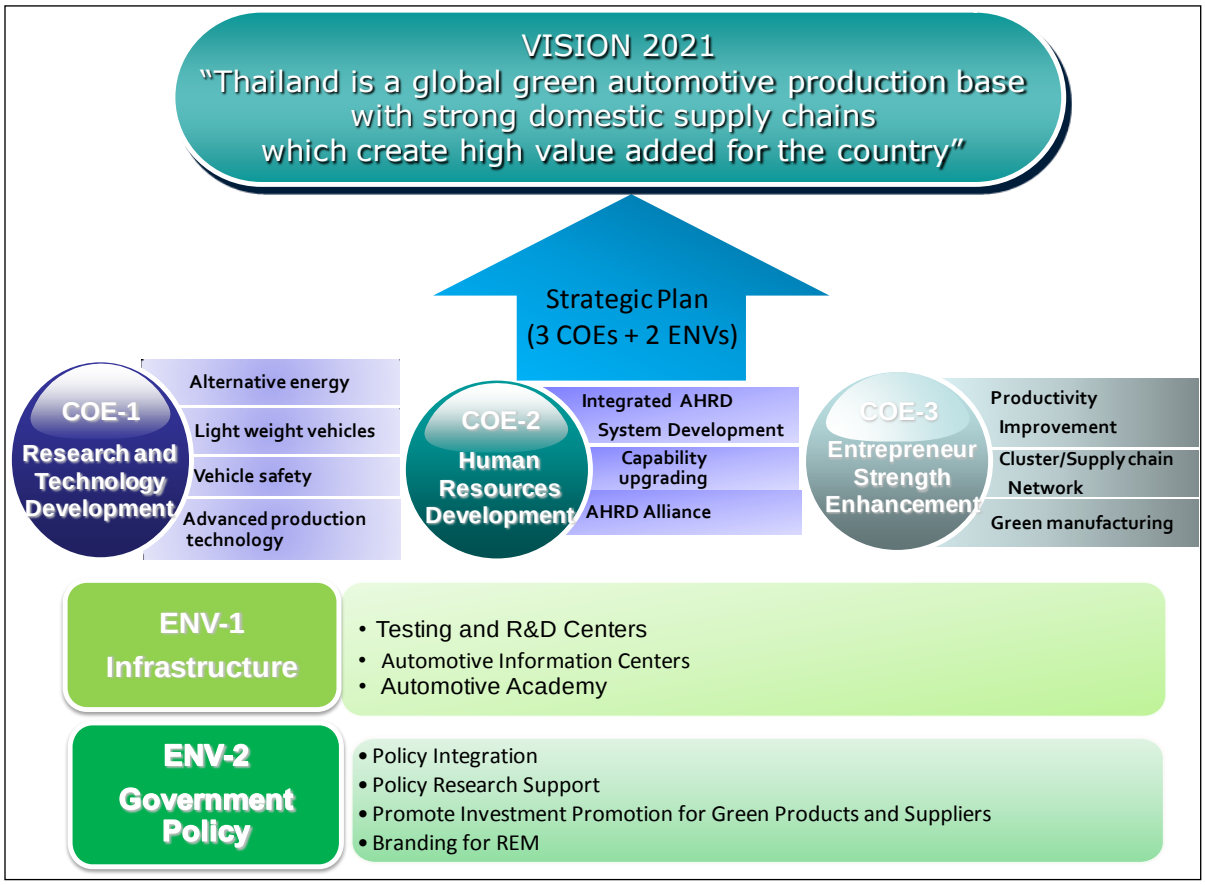
with strong domestic supply chains

which create high value added for the country"

[4-1] Green = Environmental friendliness & International standard

3. Strategic Plan

The strategic plan towards the vision consists of 3 Centers of Excellence (COEs) and 2 Environments (ENVs) as followed:



[COE: Center of excellence ENV: Good Business Environment]

Source: Thailand Automotive Institute and CEO Forum on July 31, 2012

Consolidated by the Working Group on Drafting of the Master Plan

COE-1: Research and Technology Development

To enhance Thailand competiveness through technology development by emphasizing on technology development and additional research from production engineering, to enhance the automotive industry competitiveness. Unless Thailand is able to conduct product research and development to keep up with new technologies, Thailand will not be able to increase the competitiveness in the Asia or global market and will be at risk of losing the top position in ASEAN. Therefore, Thailand should promote research and development in the business sector.

Purpose of COE-1

Towards the excellence in technology and research development which enhances competitiveness of the automotive industry by developing technology in line with the direction of development, that is green technology which consists of clean, economical and safe technologies. The target technologies include;

(1) Alternative and renewable energy

Alternative energy is essential due to possibility of oil depletion and oil price is on the rise. Renewable energy offer such as ethanol and biodiesel offers an interesting alternative, since Thailand is capable of producing these from agricultural products which is in line with replacement energy development plan by the Ministry of Energy. Furthermore, other energy sources such as various types of vehicles that use one or more electric motors for propulsion e.g. hybrid vehicles, plug-in hybrid electric vehicles (PHEV) and electric drive vehicles, along with other fuel types e.g. fuel cell which the future trend. Thailand automotive industry must keep up and develop with these technologies. The key is breakeven point in comparison with internal combustion engine which is still under constant development, efficiency and end-of-life battery management.

Thailand has realized that the importance of alternative energy development. Apart from reducing petroleum import, alternative energy improves energy stability. Thereby, further research on alternative energy vehicles is crucial especially parts adaptation to accommodate various types of alternative energy.

(2) Light weight vehicle

The trend of future motor vehicles is using light weight raw material. Light weight vehicles reduce the pressure exerted on the road; thereby it can reduce tractive force of engine and transmission system, and also reducing fuel consumption and improving engine performance. Reducing weight by using lighter raw materials is a challenge for motor vehicle manufacturer. Safety and durability is the key. Nanotechnology is a leading technology for vehicle weight reduction.

(3) Vehicle safety

Death toll from road accidents is on a rise partly due to more vehicles on the road. The other part is lack of international standard for vehicles components and internal system. Therefore, it is necessary to produce vehicles with acceptable safety standard. Safety technology for motor vehicle and parts consists of 3 major aspects; 1) active safety standard refers to technology assisting in the prevention of a crash e.g. brake system, rear view mirror, audible warning 2) passive safety technology refers to technology to protect occupants during a crash e.g. crash safety, airbag or seatbelt 3) Intelligent Transportation System Technology – (ITS) Technology acts as a virtual assistant to enhance road safety.

For Thailand, the development of safe vehicles must follow international standard such as UN ECE. ASEAN MRA, effective in 2015, will also use UN ECE as the main standard. However, in product development and testing requires testing, research and development center in response to motor vehicle and parts development in compliance with the

international standard and maintain Thailand's position as the leading production base in ASEAN. The safety standard should include all class and type of motor vehicles i.e. motorcycle, passenger car, pick-up truck, truck, bus and other specialized vehicles.

(4) Advance production technology

Increase in production volume, more complicated and advanced components and more delicate parts and increase in the use of electronic system require advance production technology. Advance production technology promotion must be integrated in the development of Thailand automotive industry to ensure that Thailand has the capability to become a leading production base in ASEAN and in the world.

COE-2: Human Resources Development

To enhance Thailand competiveness through highly skilled labor, engineers and management personnel in the automotive industry to accommodate 3 million vehicles production forecast by 2015 and the aim of becoming a major global production base. COE-2 strategy comprised of strategic plan to develop human resources capability in the entire automotive industry from integrating human resource development system, which involves curriculum and education system design, training for skilled and unskilled labor, to developing a collaborative human resource development network with domestic and oversea organizations in order to accommodate trends and growth of the automotive industry.

Purpose of COE-2

To enhance human resource capability in all levels; skilled labor, supervisor, testing and research and development engineer as well as management to enhance their knowledge and understanding, efficiency and productivity. The full range of human resource development at all levels.

COE-2 will support and connect with ENV-1 in developing infrastructures required for the foundation of human resource development institute for the automotive industry, which aim to create a good environment completed with infrastructure to accommodate future growth and development of the automotive industry.

COE-3: Entrepreneur Strength Enhancement

To enhance Thailand competiveness through the development of highly experienced parts manufacturers, with years of experience in this industry for a long time. Future automotive technology trends and international trade competition will require higher standards as well as non-tariff trade barriers will be more intense, the strategic plan towards sustainable production process excellence will emphasize on improving efficiency and productivity in production management, developing green technology in production process and establish collaborative network among businesses in the automotive supply chain to create integrity in joint competitive advantage development thus increase value creation throughout the supply chain.

Production process management in automotive industry is a key factor affecting the automotive manufacturer's decision on parts purchasing thus the decision to expand the production capacity in the country or relocate to another country. In the free trade era with modern communication technology is bringing parts procurement towards global sourcing and module. Therefore to secure Thailand's position as a major production bases, reengineering must be undertaken by businesses to maintain competitive benchmarking with international trade partners by establishing productive and green production process throughout the supply chain to accommodate customer and social demand.

Purpose of COE-3

To enhance business competitiveness especially for automotive parts manufactures to take part in the global automotive parts supply chain by creating a lean supply chain throughout the domestic supply chain and establishing green manufacturing process.

ENV-1: Creating suitable environment with complete infrastructure to facilitate COE-1 COE-2 and COE-3 strategic plans.

To enhance infrastructure development to accommodate the development of centers of excellence in various aspects. To support the implementation of COE-1, COE-2 and COE3 strategic plans. It is necessary for Thailand to establish automotive testing, research and development center, automotive information center and human resource development institute specialized in automotive industry to facilitate the development and promote collaboration between government and private sectors.

The objective of this master plan is to be a major global green motor vehicle production base. The keys of technology development to stay ahead of the automotive technology trends are research and development capability, infrastructures to accommodate directional change in future automotive technology, relevant data to conduct analysis on trend and capability of domestic and oversea automotive manufacturers to perform gap analysis comparing Thailand automotive industry with the competitors, information on development policy of the competitors, information on supply and demand which is crucial for an analysis to adjust development strategies as well as establishing human resource development institute specialize in automotive industry in connection with COE-2 enhancing excellent in human resource development. These crucial projects in ENV-1 require collaborative support from the government and private sector and the demand for private sector to drive the operations.

Propose of ENV-1

To develop infrastructure to provide sufficient support to various activities on research and development, human resource development and parts manufacturing development. The necessary infrastructures are as followed:

(1) Testing and research and development center

(2) Institute of automotive human resource development

(3) Automotive information center

ENV-2: Creating suitable environment with policy integration

To enhance competitive advantage in order to develop competitiveness of the automotive industry and to be a major global production base through favorable policy and regulation environment, enhancing Thailand automotive industry image and promoting brand building to establish Thai brands to be recognized in the international market for quality products and international standard.

Propose of ENV-2

ENV-2 emphasizes on creating a suitable environment by improving and issue integrated regulation, and supporting measures in favor of achieving the objective in developing Thailand automotive industry to become a global green production base with high technology development and international standard National Automotive and Parts Industry Policy Steering Committee.

4. Strategic integration with other related projects

The 5 automotive industry development strategies are in accordance with macro strategic plan, National Industrial Development Master Plan 2012 – 2031[4-2]. The industrial

[4-2] Source: Ministry of Industry (2011), National Industrial Development Master Plan 2012 – 2031

development master plan emphasizes on infrastructure and supporting structures to facilitate industrial development to create a strong foundation for development in each industrial sector. 4 guidelines on automotive industry developments are as followed:

(1) Labor skill development to improve productivity and accommodate future technology

(2) Product and production process development to improve Thailand

(3) Create industrial network to ensure upstream raw material security to support the growth of automotive and parts industry.

(4) Develop supporting structure to enhance competitiveness.

COE-1 (Research and Technology Development) and COE-3 (Entrepreneur Strength Enhancement) are in line with Product and production process development, whereas COE-2 (Human Resources Development) is in line with labor skill development.

Furthermore, the Automotive Industry Vision 2021 to become a global green production base is in line with the energy utilization strategic plan, Thailand 20-Year Energy Efficiency Development Plan 2011 – 2030[4-3]. The targets of 20-Year Energy Efficiency Development Plan are to reduce energy intensity by 25% and final energy by 20% by 2030 (compared with consumption in 2005). The economic sectors with priority for undertaking energy conservation are the transportation sector and the industrial sector. The energy efficiency development plan specified mandatory measures, via rules and regulations, and supportive/promotional measures on energy conservation. Measures related to the automotive industry include promoting the use of highly energy-efficient vehicles, e.g. enforcement of MEPS and tax measures.

[4-3] Source: Ministry of Energy (2011), Thailand 20-Year Energy Efficiency Development Plan 2011 - 2030

Chapter 5

5-Year Action Plan 2012 - 2016

The strategic development defined the visions which consist of 3 centers of excellence and 2 good business environments, which formulated the 5 year action plan 2012 – 2016 to facilitate the strategic plan as followed:

Strategy 1: COE-1

Excellence in research and technology development

Guidelines

(1) Survey automotive industry related research and technology development topics to be in line with the direction of technology development in the regions, green technologies which consist of clean, economical and safe technologies with cooperation from domestic and oversea research network centers and the private sector to satisfy the needs of the industry (current and future).

(2) Establish a collaborative network for technology research and development with domestic and oversea organizations.

(3) Review technology roadmap for the automotive industry.

(4) Formulate long-term plan as a guideline on research and development on green motor vehicle technologies.

(5) Conduct research and technology development according to joint plan in network organizations.

Plans/Projects

(1) Green motor vehicle technologies research and development projects consists of clean, economize and safety technology. The examples of target technologies are as followed:

- To promote alternative and renewable energy usage.
- To develop light weight vehicles.
- To enhance vehicle safety on the roads.
- To develop advance production technology.

Target Groups

(1) Automotive manufacturers of passenger car, pick-up truck, truck, bus, motorcycle and special purpose vehicle.
(2) OEM/REM
(3) Academic sector and research institutes

Primary responsible unit

Ministry of Industry (Thailand Automotive Institute)

Other responsible units

(1) Ministry of Industry: Office of Industrial Economics (OIE), Thai Industrial Standards Institute (TISI) and Department of Industrial Promotion (DIP)
(2) Ministry of Energy: Department of Alternative Energy Development and Efficiency (DEDE), Energy Policy and Planning Office (EPPO) and Department of Energy Business (DOEB)
(3) Ministry of Transportation and Communication: Department of Land Transport (DLT)
(4) Ministry of Science and Technology: National Science Technology and Innovation Policy Office (NSTIPO), National Science and Technology Development Agency (NSTDA) and National Innovation Agency (NIA)
(5) Institutes for higher education
(6) Businesses and associations

Indicators

(1) Research on development of green, economical and safe technology and compile to the safety standard. The research must be related to target technologies, commercially applicable, enhance value creation for motor vehicles and parts and enhance future competitiveness of Thai parts manufacturers.

(2) Excellence research and development network with domestic and overseas organizations.

Qualitative Outcomes

(1) Develop sufficient body of knowledge to support green vehicle product development to enable Thailand to become a leader of research and development in Asia.

(2) Contribute to development of future national automotive industry.

(3) Contribute to domestic value creation enhancement and increase value creation in export.

Without the implementation of COE-1 strategic plan, Thailand will lack of research and development competitiveness which will have a negative impact on sustainable automotive industry development and domestic value creation.

Strategy 2: COE 2

Excellence in Human Resources Development

Guidelines

(1) Formulate human resource development plan for automotive industry to formulate a long-term plan

(2) Survey data and design standard academic and CPD curriculum with academic cooperation from domestic and oversea institutions together with the private section to develop and improve curriculum in order to satisfy industry demand (current and future)

(3) Develop Automotive Human Resources Development (AHRD) Operating Work System to develop human resources in all level; skilled labors, supervisor, testing and research and development engineer by integrating all entities involve in automotive human resource development toward sustainable development of the automotive industry

(4) Develop body of knowledge for further development such as standard curriculum and lecturer development as well as establish collaborative experts' pool to co-develop human resource in all area

(5) Develop integrated networking for AHRD Single system among government units, academic sector and private sector

Plans/Projects

(1) Sustainable automotive human resource development project

(2) Collaborative projects with academic institutes

- Human resource development in the workplace for both new and current employees via Continuing Professional Development (CPD) programmes
- Develop senior students or new graduate through preparation course before starting their career in the automotive industry

Target groups

(1) Human resource in automotive and parts industry and other supporting industries

(2) Human resource in the government sector and academic sector

(3) Interested students and personnel

Primary responsible unit

Ministry of Industry

Other responsible units

(1) Ministry of Industry: Office of Industrial Economics (OIE), Department of Industrial Promotion (DIP) and Thailand Automotive Institute (TAI)

(2) Ministry of Labor: Department of Skill Development (DSD) and Institute of Skill Development (ISD)

(3) Automotive and part entrepreneurs

(4) The Federation of Thai Industries (FTI), Thai Autoparts Manufacturers Association (TAPMA)

(5) Institutes of higher education and vocational education

(6) Thailand Professional Qualification Institute (TPQI)

Indicators

(1) Establish integrated AHRD System Development, curriculum development and certify body of skill development center and automotive training network accredit center.

(2) Develop human resource capability upgrading for skill labors, supervisors, testing engineers and researchers.

(3) Significant increase in private training centers

Qualitative Outcomes

(1) Skill labors, supervisors and testing and research and development engineers are able to perform skilled and high technology tasks. Increase in efficiency and productivity

(2) Networks are equipped with body of knowledge to provide further human resource development to satisfy the needs of the industrial sector

(3) New graduates are well prepared before starting their career in the automotive industry

Strategy 3: COE-3

Entrepreneur Strength Enhancement

Guidelines

(1) Survey overall productivity and green production process of businesses in the automotive supply chain, including research and development of technology and other resource e.g. body of knowledge, human resource, machinery and equipment.

(2) Mapping and formulate an integrated and systematic plan to develop businesses in the supply chain.

(3) Collaborate and connect with other entities involved; the government sector, businesses in the industry and education institute to form a cluster/network to establish collaborative network for unified supply chain development.

(4) Automotive supply chain development to enhance productivity and ensure systematic and efficient green manufacturing process.

Plans/Projects

(1) Sustainable Manufacturing Development for Automotive Supply Chain consists of 3 projects;

- Productivity enhancement with effective improvement tools subproject
- Green technology development subproject
- Cluster supply chain network subproject

Target groups

(1) Automotive manufacturers

(2) OEM/REM

Primary responsible unit

Ministry of Industry

Other responsible units

(1) Ministry of Industry: Office of Industrial Economics (OIE), Department of Industrial Promotion (DIP), Department of industrial works (DIW) and Department of Primary Industries and Mines (DPIM)

(2) Education institutes

(3) Businesses and associations

Indicators

(1) Implementation of productivity improvement in the automotive supply chain has been accomplished through effective tools

(2) Development green production process in the automotive supply chain

(3) Systematic development of automotive supply chain development network

Qualitative Outcome

Improvement of competitive advantage throughout the automotive supply chain to satisfy customer and social demand with green manufacturing leading to sustainable business operation in dynamic environment.

Strategy 4: ENV-1

Infrastructure development for suitable environment

Guidelines

(1) Establish automotive testing and research and development according to the following steps

- Conduct a study on establishing testing and research and development center and related standards to comply with green technology; clean, economize and safe technologies.
- Formulate a plan to establish automotive testing and research and development center.
- Establish the automotive testing and research and development center.
- Provide systematic services on testing, research and development to the automotive industry.
- Establish a collaborative technology research and development network with domestic and oversea organizations.

(2) Establish the automotive information center as followed:

Create and develop automotive database as well as publish automotive research to support government policy, and making business plan adjustment of the private sector emphasizing on data for analysis on competitive advantage, international, regional, domestic and other competitor automotive industry

market condition and policies, regulations, standards and trade measures implemented by each country. This project, in collaboration with automotive information project of the Ministry of Industry, will be an automotive information center completed with essential, up to date, accurate and reliable information.

(3) Establish the automotive human resource development center as followed:

The Ministry of Industry in collaboration with other responsible units establish an automotive human resource development center, to be an automotive human resource development center and network by formulating an action plan to establish the automotive human resource development center regarding location, machines and equipment, personnel, experts and specialists, curriculum, lecturer development system and auditor and establish automotive human resource development information center to support COE-2 strategic plan emphasizes on human resource development excellence.

Plans/Projects

(1) Establish automotive testing and research and development center with the following capacities:

- To support green automotive technology research and development.
- To be a testing center for ASEAN MRA and international type approval.
- To be a testing center to support research project of the government sector and other related entities.

(2) To be an automotive information center.

(3) To establish automotive human resource development institute.

Target groups

(1) Automotive manufacturers such as passenger cars, pick-up trucks, trucks, buses, motorcycles and special purpose vehicles

(2) OEM/REM

(3) Human resource in the automotive and parts industry and supporting industries

(4) Human resource in the government and education sectors

Responsible units

(1) Ministry of Industry: Office of Industrial Economics (OIE), Department of Industrial Promotion (DIP) and Thailand Automotive Institute (TAI)

(2) Ministry of Labor: Department of Skill Development (DSD) and Labor Development Institute

(3) Businesses in the automotive and parts industry

(4) The Federation of Thai Industries (FTI), Thai Autoparts Manufacturers Association (TAPMA) etc.

(5) Institute for higher education and vocational education

(6) Thailand Professional Qualification Institute (TPQI)

Indicators

(1) An green automotive technology testing and research and development center to support green technology research and development, center of ASEAN and international type approval, and testing center to accommodate research projects of the government sector and other related units completed with body of knowledge and domestic and oversea network.

(2) Information center armed with crucial body of knowledge for green technology development and competitiveness development, which consist of domestic and

oversea data base to support government policy formulation and business operation of the private sector in response to competition trends.

(3) An automotive human resource development institute to provide services supporting COE-2 strategic plan which emphasizes on human resource excellence.

Qualitative outcomes

(1) Enhance Thailand capability in testing research and development of green technology and become the center of automotive technology research and development of ASEAN.

(2) Contribute to domestic value creation and increase export value.

(3) Support the development of future motor vehicle technology innovation.

(4) Provide data and research supporting planning and policy formulation of government and industrial sectors.

(5) Establish suitable infrastructure to provide one-stop service to the industrial sector which is a key factor to attract investment in order to become a major global production base.

Without the implementation of COE-1 strategic plan, Thailand will lack of crucial infrastructures for systematic development.

Strategy 5: ENV-2

Government policy integration for suitable business environment

Guideline

Review current government policies and regulations, summarize parts that are obstruct or contradict to the direction of automotive industry development according to the master plan, and consider making change to obstructive government policies and

regulations, formulate regulations and policies to match the direction of the automotive industry development by National Automotive and Parts Industry Policy Steering Committee to carry out the policy integration with the master plan as the guideline.

Plans/Projects

(1) Establish National Automotive and Parts Industry Policy Steering Committee to integrate the policy regarding automotive and parts industry development to be in the same direction and in line with competition, technology and innovation trends to accomplish the objectives of automotive industry development.

(2) Conduct policy research to support automotive industry development by emphasizing on the following key issues:

- To promote investment in green automotive products and to be a major global automotive production base. Promote research and development.
- To stimulate government incentives supporting eco-friendly product and safe production process.
- To stimulate rail transportation policy.
- To stimulate regulations on international standard quality and safety of motor vehicle and parts.
- To stimulate an update and integration of related laws to promote green motor vehicles and parts.

(3) To promote branding, and new market penetration for REM.

Target groups

(1) All types of green motor vehicle manufacturers

(2) OEM

(3) REM

Primary responsible unit

Ministry of Industry

Other responsible units

(1) Ministry of Commerce: Department of International Trade Promotion

(2) Ministry of Transportation and Communication: Department of Land Transport (DLT)

(3) Ministry of Science and Technology: Pollution Control Department (PCD)

(4) Ministry of Finance: Fiscal Policy Office (FPO), Excise Department, the Revenue Department and the Customs Department

(5) Ministry of Energy

Indicators

(1) Accomplish integration, good management, and steering of automotive industry development policies by establish a joint committee with representatives from the government and private sectors.

(2) New investment promotion policies to develop green automotive technologies; clean, economical and safe, according to the objectives.

(3) Accomplish internationalization of product standards.

(4) New government measures to promote eco-friendly vehicles and transportation system development.

(5) New motor vehicle brands which are recognized in the domestic and oversea markets.

Qualitative outcome

Increase in investment by automotive manufacturers, development and investment in new environmental friendly and international standard products, Thai brands become

internationally recognized which will enhance confidence in using automotive products from Thailand thus increase in export.

Chapter 6

Conclusion

Thailand automotive industry has been a major contributor to development of Thailand for over 50 years; thereby the government has prioritized the industry as a main industry, and ensures that a development strategy is in place to accommodate changes in trends and related factors from both domestic and overseas. Thailand Automotive Industry Master Plan 2002 – 2006 and Thailand Automotive Industry Master Plan 2007 – 2011 have been formulated. The evaluation of both master plans revealed that 2007 – 2011master plan has made a major contribution in enhancing the capability of Thailand automotive industry in addition to the success of 2002 – 2006 master plan as listed below:

1. 4 successes of Thailand Automotive Industry Master Plan 2002 – 2006:
   (1) Thailand is a major global pick-up truck production base.
   (2) Thailand is part of the global supply chain.
   (3) Develop collaboration among ASEAN countries.
   (4) Develop human resource competitiveness in labor skills.

2. 4 Additional successes contributed by Thailand Automotive Industry Master Plan 2007 – 2011:
   (1) Thailand is a major motor vehicle production base of Asia.
   (2) Gain competitive advantage on parts production both on OEM and REM from lean supply chain.
   (3) Thailand is a major research, design and engineering center of ASEAN with major private research centers.
   (4) Develop competent human resource in management and production functions.
   (5) Supported ASEAN to gain competitive advantage in the global competition

arena.

However, the evaluation in 2012 – 2016 master plan revealed that many projects were not directly originated from the master plans, but contributed to the success of the plan. Many major projects in the master plans which were implemented and emphasized on but could not keep up with the growth of the automotive industry and the demand of private sector such as automotive testing center project which is crucial in supporting internationalization of standards, research and development and automotive human resource development project which has not reached the stage to lay the system to develop human resource in management level. On project management, essentially the operation that the private sector has requested, this is a joint automotive industry development committee between the government and private sectors. However, the government has established National Industrial Development Committee (NIDC) which supervise integrated urgent strategic development for all industries not only the automotive industry. The committee has approved 2 automotive industry development projects; sustainable automotive human resource development project and automotive testing center testing project. However, both projects were not implemented during the period of the plan.

An analysis of the evaluation of success and implementation of the Thailand Automotive Industry Master Plan 2007 – 2011 revealed errors or weaknesses of the drafting of the master plan. The findings will be used to improve the implementation of Thailand Automotive Industry Master Plan 2012 – 2016, especially on key issues to satisfy the demand of the private sector such as establishing a national automotive industry development committee. Taken current global and regional situation and trends into consideration, as mention in Chapter 4 of this master plan, provided an analysis on future

challenges facing Thailand automotive industry which affects sustainable development of Thailand automotive industry such as environmental, technology, safety and pollutant standard trends. These 3 issues are the driving factors to future change and development of global, regional and national automotive industry. Thailand has a possibility to become one of the top 10 automotive production bases of the world with annual production capacity of 3 million units by 2017, and one of the top 5 special purpose vehicle production bases of the world and also investment in research and development made by automotive, motorcycle and parts manufacturers which is crucial in value creation from automotive industry development.

To develop Thailand automotive industry to the world class standard, the major factor to be considered is the global trends and regional competition, especially technological trends such as energy efficiency, eco-friendly and safety or clean, economical and safe for short. Clean involves reducing carbon dioxide (CO_2) emission. Economical involves engine efficiency and performance improvement to reduce fuel consumption or use replacement energy; ethanol and biodiesel. As well as develop transmission system using alternative energy such as battery generated electricity. Another future automotive technology development is using replacement raw materials to reduce the weight. Safe involve enhancing safety standard to reduce road accident and provide protection for motorist and commuters.

By 2020, IEA forecast estimated that the adoption rate for motor vehicle using replacement energy and alternative energy will increase. Therefore, other countries in ASEAN such as Malaysia and Indonesia have implemented investment promotion policy for eco-friendly vehicles as well. The ASEAN Economic Community agreement promoting free trade among member countries will be in effect by 2015. AEC will enable free flow of raw

materials, products, services, investment, capital and labor. This will be an opportunity as well as a threat of Thailand automotive industry. The automotive standards and regulations will be tighter, more open market and increase in variety in demand and competition from high growth and development countries.

These 3 challenges contributed to the formulation of strategic action plan of Thailand Automotive Industry Master Plan 2012 – 2016. The key success factor is to manage the implementation the strategic plans and create sufficient developments to ensure achieving the objectives within the timeframe. Therefore good governance, integration, followed up, evaluation and supervision are crucial to ensure the implementation of the key success plan. The guideline is as followed:

- Implement the plan with collaboration and mutual development.
- Utilize the resource to the maximum benefits. Analyze and utilize existing resources for the benefits of all stakeholders, acquire more resources according to the priority and resource planning prior to implementation.
- Manage and supervise responsible units of each plan to ensure integrated implementation on objectives and schedule to ensure effective and prompt development.
- Regular followed up and evaluation. Ready to review and adjust the plan in response to competitive environment.

From these guidelines, National Automotive and Parts Industry Policy Steering Committee have been proposed to support, encourage and manage the implementation of the master plan to achieve the objectives.

Expected results

As mentioned earlier, automotive and parts industry is one of a major industry that contributing to Thailand economic growth. Not only affect the economic development but also has an impact on society and environment. The key objectives of this master plan are:

1. To be a major global automotive production base by:
    1.1 Automotive and motor cycle production capacity to reach 3 million units by 2017
    1.2 Development of Eco-friendly, energy efficient, high pollutant emission and high safety products as well as clean production process with high productivity.
2. To be a suitable automotive business environment center by:
    2.1 Develop capability of automotive human resources. Increase in the percentage of skilled labor, mechanic and engineer in comparison to 2012.
    2.2 Establish a major automotive testing, research and development center in Asia.
    2.3 Develop suitable infrastructure to sufficiently support development. To become a leader in standard, testing and human resource development among ASEAN countries.
3. To be one of the main industries rescuing Thailand from middle income trap (MIT) by:
    3.1 Increase value creation from domestic parts consumption over 50% by 2013.
    3.2 Increase production value creation of the automotive manufacturing over 10% of gross domestic product originating from manufacturing.
    3.3 Increase export value over 1 trillion baht by 2013.

By implementing the strategic and action plans in Thailand Automotive Industry Master Plan 2012 – 2016, in accordance to the technology and global automotive industry competition trend, will enhance the development of Thailand automotive industry from being a major production base of Asia to being a sustainable major global production base. This will benefit the national development in all aspects; economy, employment, technology development, development of supporting industry and domestic part manufacturers, innovations for future automotive industry which will support Thailand to be in the higher income nation.

Focus Group

The Thailand Automotive Industry Master Plan 2012 - 2016 team has organized the following focus groups with the government and private sectors to review and improve the analysis, strategic and operational plan:

1. CEO Forum on Thailand Automotive Industry Master Plan 2012 – 2016 was held on Tuesday, July 31, 2012, 8:30 – 14:00 at World Ballroom, 23 floor, Centara Grand, Central World, Bangkok with 260 participants
2. Stakeholders Meeting was held on Friday, August 24 2012 at Boardroom, Queen Sirikit National Convention Center with 65 participants to gain expert opinion of executives in automotive industry including equipment manufacturing industry on Thailand Automotive Industry Master Plan 2012 – 2016 proposed in the CEO Forum.
3. Held a meeting to present the draft of Thailand Automotive Industry Master Plan 2012 – 2016 (Complete) to the experts, on Tuesday, November 6, 2012, 14:00 at Choonhavan Meeting Room, Ministry of Industry of Thailand with 30 participants.

Glossary and List of Abbreviations

AAF	=	ASEAN Automotive Federation
ACCSQ	=	ASEAN Consultative Committee for Standards and Quality
Active safety	=	Active safety standard refers to technology assisting in the prevention of a crash e.g. Brake standard
AEC	=	ASEAN Economic Community
ASEAN	=	Association of South East Asian Nations
ASEAN MRAs	=	ASEAN Mutual Recognition Arrangement
APWG	=	Automotive Product Working Group
CAGR	=	Compound Annual Growth Rate
CNG	=	Compressed Natural Gas
COEs	=	Center of Excellences
COE-1	=	Center of Excellences in research and technology development
COE-2	=	Center of Excellences in Human Resources Development
COE-3	=	Center of Excellences in Entrepreneur Strength Development
CO_2	=	Carbon dioxide
CO	=	Carbon monoxide
CPD	=	Continuing Professional Development
Eco Car	=	Ecology Car, officially called international energy-efficient and safety standard vehicle. Eco car includes vehicles with fuel consumption higher than 20 km./liter, releasing CO_2 less than 120 g./km. and meet Euro 4 standard, the Uniform Provisions Concerning the Approval of Vehicles with Regard to the Protection of the Driver Against the Steering Mechanism in the

Event of a Frontal Collision (UN ECE R 94) and the Uniform Provisions Concerning the Approval of Vehicles with Regard to the Protection of the Driver Against the Steering Mechanism in the Event of a Lateral Collision (UN ECE R 95).

ENV = Good Business Environment defined as a pro-investment environment.

EURO = EURO Standard stands for European Emission Standards which define the acceptable limits for exhaust emissions of new vehicles sold in EU member states. The emission standards are defined in a series of European Union directives staging the progressive introduction of increasingly stringent and environmental friendly standards. By the end of 2012, EURO 4 standard will be applied to gasoline and small Diesel vehicles.

EV = Electric Vehicle uses one or more electric motors for propulsion

FCV = Fuel Cell Vehicle uses a fuel cell using hydrogen to produce electricity.

FIA = FIA Foundation

Fuel cell = A device that converts the chemical energy from a fuel directly into electricity through a chemical reaction between hydrogen and oxygen without combustion. Therefore, fuel cell engine produces no air pollution and 1 - 3 times more efficient than combustion engine depending on the type of fuel cell and fuel.

GFEI = Global Fuel Economy Initiative

GTR = Global Technical Regulation

HEV = Hybrid Electric Vehicle combines a conventional internal combustion engine (ICE) propulsion system with an electric propulsion system.

ICE = Internal combustion engine

IEA	=	International Energy Agency
ITF	=	International Transport Forum
ITS	=	Intelligent Transportation System
Passive safety standard	=	Active safety standard refers to technology to standard protect occupants during a crash e.g. Seatbelts Standard, Frontal Collision Standard and Lateral Collision Standard
JAMA	=	Japan Automobile Manufacturers Association, Inc.
MPV	=	Multipurpose vehicle
MRA	=	Mutual Recognition Agreement
NOx	=	Nitrogen oxide
NEDC	=	National Economic Development Council
OECD	=	Organization for Economic Co-operation and Development of the European Union and other developed countries such as Australia, Canada, New Zealand, the United States of America and Japan
OEM	=	Origin Equipment Manufacturers
OICA	=	The International Organization of Motor Vehicle Manufacturers
PHEV	=	Plug-in hybrid Electric Vehicle is a hybrid vehicle having an internal combustion engine an electric motor with a plug to connect to a residential power outlet. Most PHEVs on the road today are passenger cars, but there are also PHEV versions of commercial vehicles and vans, utility trucks, buses, trains, motorcycles, scooters, and military vehicles. All-electric mode is also available.
Pick up	=	Pickup truck is a light motor vehicle with a standard cab and an open-top, rear cargo area.

PPV	=	Pick-up Passenger Vehicle is a passenger vehicle built on a pick-up truck platform.
R&D	=	Research and Development
REM	=	Replacement Equipment Manufacturers manufacture spare parts for automobile part store, service center and repair shop.
SO_2	=	Sulfur dioxide
SUV	=	Sport Utility Vehicle
UN ECE	=	United Nation Economic Commission for Europe
UNEP	=	United Nations Environment Programme
VOC	=	Volatile organic compound
WHO	=	World Health Organization
WTO	=	World Trade Organization
WP 29	=	Working Party 29
DSD	=	Department of Skill Development, Ministry of Labor
DPIM	=	Department of Primary Industries and Mines, Ministry of Industry
DIW	=	Department of industrial works
DIP	=	Department of Industrial Promotion
DEDE	=	Department of Alternative Energy Development and Efficiency
TPQI	=	Thailand Professional Qualification Institute
TISI	=	Thai Industrial Standards Institute
FPO	=	Fiscal Policy Office
OIE	=	The Office of Industrial Economics
NIA	=	National Innovation Agency
EPPO	=	Energy Policy and Planning Office

ISD	=	Institute of Skill Development
TAI	=	Thailand Automotive Institute
STI	=	National Science Technology and Innovation Policy Office
NSTDA	=	National Science and Technology Development Agency

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The Thailand Automotive Industry Master Plan

2012 - 2016

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