

PESTLE Analysis on Toyota Prius

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Abstract

Toyota Prius Hybrid is using the Hybrid Synergy Drive (HSD) that perfectly optimizes power from both petrol engine and electric motor according to the driving condition. The electric vehicle (EV) which allows the vehicle run purely for low noise and zero fuel consumption [1]. The objective of our research paper is to investigate the factors that move Toyota Prius into production. The research is based on the PESTLE analysis (which is based on various factors like P-political, E-economy, S-social, T-technology, L-legal and E-environment) by using secondary data and qualitative analysis. In annual sales worldwide since 1997 until 2011, Toyota Prius is performed well and popular in global market. Based on the analysis, Toyota Prius did move into hybrid vehicle production which influenced by the factors that mentioned above (PESTLE).

Keyword: PESTLE, Toyota Prius.

1.0 Introduction

In this project are mainly do research on what are the rationales moves Toyota Prius into hybrid vehicle production. The purposes of this task are to investigate what are the rationales and to identify what are the factors that move Toyota Prius into hybrid vehicle production by using PESTLE analysis.

Toyota Prius is a compact sedan which manufactured and developed by Toyota. Prius was named with meanings “ahead or leading” and “the predecessor of cars to come”. The technology used by Prius is Hybrid Synergy Drive (HSD) which developed by Toyota. HSD is the technology that produces a full hybrid vehicle that allow car to run on the neither electric motor nor mechanical motor. The car design is using the alternator current generator and direct current motor which attached with the internal combustion engine (ICE). [2] The battery in the car

is only used to start car combustion engine and also run the accessories in the car. ICE is started by the motor-generator (starter) use when higher speeds, faster acceleration or more power for charging the batteries.

Quality (Policy), affordable price (Economy), comfort (Social), High technology-green technology (Technology & Environment) and safety (Legal) design are the factors that moved Toyota Prius into hybrid design. The first generation of Prius experienced great sales in US with 32% grow from 2001 to 2003. It became the world first mass-produced gasoline electric hybrid car with aimed to reducing air pollution and increasing fuel efficiency. The second generation was redesigned as a mid-size liftback, with the redistributed on interior design and mechanical space significantly increasing luggage room and rear-seat legroom. Besides, the all-electric A/C compressor was used for cooling; electric power steering system to further minimizes engine belt-drive engine accessories; the Smart Key System, DVD navigation on the MFD, Vehicle Stability Control and Bluetooth for hands-free calling. Prius has been tested on 2004 in NHTSA of U.S for crash testing and gets the five stars on overall testing and “good” overall on IIHS crash tests, which side curtain and torso airbags became standard on 2007 as American models. The third generation of the Prius is a 5 door hatchback with 1.8 Liter Dual VVT-I [3], which are the new body designs which are more aerodynamic.

There are three optional packages that offered by US Prius, the first package is a navigation package which includes a voice-activated touch-screen DVD-based navigation system and an 8-speaker JBL audio system. Second is a solar roof package includes the navigation package and adds a power tilt along with a solar powered ventilation system to prevent the interior's heated air with the outdoors. A new remote air-conditioning feature allows the driver to activate the air conditioner prior to entering the vehicle. The

third is an advanced technology package includes the Navigation Package while adding a Pre-Collision System, Dynamic Radar Cruise Control, Lane Keep Assist and Intelligent Parking Assist. In 2009, Prius plug-in hybrids (PHEV) is sent to limited geographical areas and contain special data tracking devices designed which allow Toyota to monitor the Prius usage for further development of the plug-in hybrid system. After that in the 2011, Toyota announced a target of retail sales for the PHEV which plans to sell tens thousands of Prius plug-in hybrid car to the public.

Table 1: Sales of Toyota Prius from 1997 until 2011

Annual sales worldwide and by region (in thousands) [4]						
Year	World	Japan	North America	U.S.[5]	Europe	Other
1997	0.3	0.3				
1998	17.7	17.7				
1999	15.2	15.2				
2000	19.0	12.5	5.8	5.6	0.7	0.01
2001	29.5	11.0	16.0	15.6	2.3	0.2
2002	28.1	6.7	20.3	20.1	0.8	0.2
2003	43.2	17.0	24.9	24.6	0.9	0.4
2004	125.7	59.8	55.9	54.0	8.1	1.9
2005	175.2	43.7	109.9	107.9	18.8	2.9
2006	185.6	48.6	109.0	107.0	22.8	5.3
2007	281.3	58.3	183.8	181.2	32.2	7.0
2008	285.7	73.1	163.3	158.6	41.5	7.7
2009	404.2	208.9	144.3	139.7	42.6	8.4
Jan-Sept 2010	401.3	254.2	105.9	103.3[6]	35.5	5.8
Total through Sept 2010	2,011.8	826.9	939.1	917.5	206.1	39.7
2010		315.7[7]		140.9[5]		
2011		252.5[8]		136.5[9]	26.4[10]	
Cumulative Total through Dec 2011		1,1140.9		1,091.6		

Source: Various

2.0 Literature Review

Along this research, the tool that we used is the PESTLE analysis. The PESTLE analysis is a tool that is used to identify and analyze the key drivers of change in the strategic or business environment. (Johnson et al., 2008) [11] The abbreviation stands for Political, Economic, Social, Technological, Legal, and Environmental factors. The tool allows the assessing of the current environment and potential changes. [12]

The PESTLE analysis tools are listed in table below.

Table 2: PESTLE analysis tools and its components.

Analysis Tools	Components
Political	This refers to government policy such as the usage of renewable energy. Political decisions can

	impact on many vital areas such as the environment of the workforce, the humans' health and the quality of technology such as hybrid system.
Economic	This includes interest rates, taxation charges such as the road tax, insurance tax, economic growth, inflation and tax incentive. In other words, the costs have to pay more for car users.
Social	This factor takes into consideration all events that affect the market and community socially. Thus, the advantages and disadvantages to the people of the area in which the project is taking place also need to be considered. These events include cultural expectations, norms, population dynamics, healthy consciousness, career altitudes and global warming.
Technology	New technologies create new products and new processes. Technology can reduce costs, improve quality and lead to innovation. These developments can benefit consumers as well as the organizations providing the products.
Legal	Organizations also have to adjust their products and ways of operating to the different regulatory and legislative framework that govern each of the products areas and countries in which they are active. Other than that, the programs also need to take into consideration. [13]
Environment	Environmental factors include the weather and climate change. With major climate changes occurring due to global warming and with greater environmental awareness this external factor is becoming a significant issue for firms to consider. [14]

Source: summarized from various literature

3.0 Research Methodology

Our research methodology is using the secondary data analysis. Secondary data analysis can be literally defined as “second-hand” analysis. It is the analysis of data or information that was either gathered by someone else (e.g., researchers, institutions, other NGOs, etc.) or for some other purpose than the one currently being considered, or often a combination of the two (Cnossen 1997). Besides that, Secondary data can be a valuable source of information for gaining knowledge and insight into a broad range of issues and phenomena. Review and analysis of secondary data can provide a cost-effective way of addressing issues, conducting cross-national comparisons, understanding country-specific and local conditions, determining the direction and magnitude of change trends, and describing the current situation. It complements, but does not replace primary data collection and should be the starting place for any research activity (McCaston, 1998). [15] Therefore, the secondary data also know as the re-use of the qualitative data.

The reason for choosing secondary data analysis as our research methodology due to the secondary data analysis can be carried out rather quickly when compared to formal primary data gathering and analysis exercise in our research paper. Besides that, whenever it is a good secondary data is available, we can save time and money by making good use of available data rather than collecting primary data, thus avoiding duplication of our effort.

Most of the secondary data is collected from the reference books, technical report, scholarly journals and the World Wide Web¹. After the confirmation of using the secondary sources, there are few steps that will take into consideration. The steps that had been undergo are formulating our research problem, extensive the objectives, developing research objectives, collecting the information, analysis of information, generalization and interpretation and finally preparation of the paper.

4.0 Discussion

In this section, we will discuss each of the factors, PESTLE accordingly.

¹ Toyota cooperate website

4.1 Political Factors

Based on our research, Toyota Prius have positive political impact. By producing the environmental friendly cars which use less gasoline and reduce dependency on petrol, Therefore, the country itself reduce the dependence of the petrol (import from other country) especially U.S government and western country which does not produce oil and need to focus on the way to obtain oil from the foreign countries. President of U.S Obama stated that he wants to end America’s addiction to foreign oil which encourages the people to use the hybrid car and contribute on his plan to decrease U.S reliance on foreign oil.

Based on the result of U.S survey which conducted by Hudson Institute are 75% of Americans prior to reducing their reliance on foreign oil and gas. Secondly, about 83% of Americans agree that the top for the next administration must be focus on the reducing our dependence on foreign oil. Moreover, the 91% of Americans believe that when come to energy, they must relies that on its own ingenuity and innovation but not depend on Saudi royal family.

The dependence of the natural gas and oil from the foreign source will directly and indirectly affect one country economy growth and also the national security. In the past decade, the dependence on oil and gas has cost many western country economy dearly until the alternative energy vehicles start become more commonplace. For U.S in 1979 to 2000, U.S cost around 7 trillion on natural gas and oil which as much as spent on national defense in the same period. Nowadays, the oil price keep raise and the transportation of this country become more and more expensive.

Therefore, Government Policy such as the degree of using the renewable energy should be focus so that the environment and economy of country were protected.

We also found that the international and national policies moved Toyota into hybrid vehicle production is United State Federal Law. The energy Policy Act of 2005 established a federal income tax credit up to \$3,400 for the new hybrid vehicles, purchased or placed into service. Vehicles purchased after December 31, 2010 are not eligible for this credit. The law limited the tax credit to the first 60,000 eligible vehicles per carmaker. Why the energy

policies want to do so? It is because this energy policy act encourages the purchase of low emission vehicles. Besides that, the Energy Independence and Security Act of 2007 expanded these incentives to include emerging electric vehicles and plug in hybrid, technology.

Besides that, Toyota Earth Charter notes four principles:

(a) Contribution towards a prosperous 21st century

Aim for growth that is in harmony with the environment, and to challenge achievement of zero emissions throughout all areas of business activities and set as a challenge the achievement of zero emissions throughout all areas of business activity.

(b) Pursuit of environmental technologies

Pursue all possible environmental technologies, developing and establishing new technologies to enable the environment and economy to coexist harmoniously.

(c) Voluntary actions

Develop a voluntary improvement plan, not only based on thorough preventative measures and compliance laws, but one that addresses environmental issues on the global, national and regional scales, and promotes continuous implementation.

(d) Working in co-operation with society

Build close and cooperative relationships with a spectrum of individuals and organizations involved in environmental preservation including governments, local municipalities as well as with related companies and industries [16].

Furthermore, according to Corporate Average Fuel Economy (CAFE), the purpose is to reduce energy consumption by increasing the fuel economy of cars and light trucks. NHTSA administers the CAFE program, and the Environmental Protection Agency (EPA) provides the fuel economy data. NHTSA sets fuel economy standards for cars and light trucks sold in the U.S. while EPA calculates the average fuel economy for each manufacturer. This site contains an immense amount of information about the CAFE program including a CAFE overview, rulemaking actions, fleet characteristics data, compliance activities, summaries of manufacturers' fuel economy performances since 1978, and related studies [17].

CAFE has special standards for alternative and dual fuel vehicles. These will increase the manufacturer's rating which make hybrids a good deal for everyone because it offsets those low-economy, high-profit trucks and SUVs [18].

Other than that, according to the Energy Policy Act (EPAct 1992) of 1992, it aims to reduce U.S. dependence on imported petroleum and improve air quality by addressing all aspects of energy supply and demand, including alternative fuels, renewable energy, and energy efficiency.

EPAct 1992 encourages the use of alternative fuels through both regulatory and voluntary activities and approaches the U.S. Department of Energy (DOE) carries out. It requires federal, state, and alternative fuel provider fleets to acquire alternative fuel vehicles.

EPAct 1992 also defines "alternative fuels" as: methanol, ethanol, and other alcohols; blends of 85% or more of alcohol with gasoline (E85); natural gas and liquid fuels domestically produced from natural gas; propane; hydrogen; electricity; biodiesel (B100); coal-derived liquid fuels; fuels, other than alcohol, derived from biological materials; and P-Series fuels, which were added to the definition in 1999.

Under EPAct 1992, DOE has the authority to add more alternative fuels to the list of authorized alternative fuels if certain criteria are met. DOE's Clean Cities initiative was established in response to EPAct 1992 to implement voluntary alternative fuel vehicle deployment activities [19].

4.2 Economic Factors

Economy is also another impact to almost all country around the world. The consumers start to choose the hybrid car based on the benefits of fuel savings over time which means the "paid back". Moreover, the cost of insurance and road tax for hybrid car are much lower than a gasoline-car. Due to the oil fuel become higher and higher nowadays, this means that the hybrid car users can save more money.

The inflation of fuel prices causes the negative effect on the nation's gross domestic product. The higher the fuel efficiency offered by hybrid cars shields families and business from fluctuating oil prices and leaves more money available to circulate through economy.

In year 2008, oil prices raised to \$120 per barrel, as a result oil responsible for 75 percent of the U.S. trade deficit, according to RCF, a Chicago-based economic consulting company. Anything that reduces oil imports has a positive net effect on the trade imbalance because domestic supplies have peaked and environmental and cost concerns make extraction of the more difficult to reach reserves untenable. Broader market permeates of hybrid vehicles will eliminate the oil imports, which are the single biggest driver of the trade deficit no matter what the price of oil is. [20]

Moreover, we will discuss the extension and enhancement of tax incentive application period hybrid cars. Due to the decrease in the excise duty by 50%, so the price of Toyota Prius in the market will lower than the previous price in the market. With the reasonable price, the people are affordable to buy a hybrid car. As a result, the reduction in the tax incentive will become an encouragement for Toyota into hybrid vehicles production.

4.3 Social Factors

The social factors that moved Toyota into hybrid vehicle production will be discussed. Due to the climate change become a serious topic nowadays, so Toyota should produce a vehicle which it will not bring pollution to the environment.

Moreover, fossil fuel is a non renewable energy which it will exhaust at one day, so to overcome this problem, Toyota need to produce a vehicle which it will not only depend on fossil fuel. After hybrid car technology has been invented, high demand from those country which are not producing fossil because they do not need to depend on the country which producing the fossil fuel.

Conventional cars are significantly cheaper than the hybrid cars due to the high technology used on the hybrid cars. This reflects on the new technologies developed during the early of the 21st century. However, the price of the hybrid car should decline accordingly after the hybrid car's technology become more familiar.

A hybrid car has an electric battery which serves as fuel cell for the car. However, because of the complex electronic configuration of hybrid cars, they are often heavier than conventional gasoline engines cars. These factors must be counted with the fuel savings for hybrids once they make it onto the road.

The potency and number miles which hybrid car will go on a single battery has result battery-powered cars manufactured largely in early of 21st century for highway driving in United States. However, the limitation can be reduces when the battery charging station become common at every places.

However, a more serious environmental problem is the disposal of spent battery packs in hybrid and electric cars. Car manufacturers are aware of this issue; as a result they make research and develop less toxic battery packs for electric and hybrid cars. [21]

4.4 Technological Factors

The technology used in Plug-In Hybrid Electric Vehicles (PHEV) is the idea of using the battery powered car. The recharging time is 1.5 hours for 240V AC or 3 hours for 120V AC and the maximum of the electric vehicle cruising range is approximately 15 miles at a speed of up to 62 miles per hour. Beyond that, the plug-in will switch to hybrid mode, providing an estimated 49 miles per gallon. [22]

Toyota Prius using a 1.8 Liter displacement engine which able to generate higher output and torque. Another advantage of Toyota Prius is the elimination of the drive belt along with using an electric drive water pump to reduce the supplemental of engine load. Moreover, the engine also has a Cool-EGR system which able to recalculate exhaust temperature as well as recirculation system that reuses heat to help the Prius warm up faster.

Besides that, the Toyota Prius also using the advanced of the aerodynamics to reduce drag. When driving on the freeway, most of the work of the Prius engine does goes into pushing the car through the air.

For the Toyota Prius, low-rolling resistance tires were used. The tires on cars are optimizing to give a smooth ride with the minimum noise and also provide good traction in variety of condition. The hybrid car uses the special tires that are both stiffer and inflated to a higher pressure than conventional tires.

Besides that, the material to build the Toyota Prius body also is the lightweight materials such as carbon fiber, aluminum, magnesium, titanium which used to reduce the overall weight of the vehicle body and increase the mileage.

4.5 Legal Factors

For legal and policies, available PHEV technology will decrease emissions of conventional air pollutants substantially as compared to a standard vehicle on the roads today. While similar emission reductions can be achieved with, for example compressed natural gas (CNG) and clean diesel vehicles with advanced emission control technologies, the PHEV combines both non-CO₂ and CO₂ reductions.

PHEVs decrease fuel consumption substantially compared to conventional vehicles used today and also compared to CNG and the new generation of cleaner diesel vehicles. Calculations have shown that over the average PHEV useful life time savings can amount to 6,000 L of fuel.

While PHEVs are more expensive initially, the fuel savings are recouped based on mileage and driving conditions. Analysis has shown that the PHEV life cycle cost, including the cost of purchase, fuel and maintenance costs, is, in most cases, less than owning a conventional vehicle. However, these calculations are strongly dependent on fuel prices, taxes and rebates.

PHEVs, HEVs, full electric vehicles, and fuel cell vehicles share basic technologies such as electric motors, batteries, and power electronics. Therefore, plug-in hybrids and HEVs function as stepping stone technologies to the large-scale electrification of fleets that is required for a long-term reduction of CO₂ emissions from road transport, and a low carbon transport sector.

According to the U.S department of energy load programs office (LPO) mission which is to accelerate the domestic commercial deployment of innovative and advanced clean energy technologies at a scale sufficient to contribute meaningfully to the achievement of our national clean energy objectives including job creation; reducing dependency on foreign oil; improving environmental legacy; and enhancing American competitiveness in the global economy of the 21st century. LPO endeavors to encourage commercial- and utility-scale development and adoption of new or significantly improved energy technologies. Besides that, fund innovative technologies which reduce greenhouse gas emissions also been created by LPO. Moreover, LPO also create jobs by financing the growth of commercial clean energy technologies and provide

direct loans to eligible automobile manufacturers and component suppliers for projects that re-equip, expand, and establish manufacturing facilities in the U.S. to produce advanced technology vehicles and components for such vehicles. Last but not least, LPO also protect U.S. taxpayers by ensuring the loans and loan guarantees we provide have a reasonable prospect of repayment [23].

On July 11, 2002, the California Legislature passed landmark legislation to propose adopting the first Greenhouse Gases (GHG) emission regulations on motor vehicles in the United States. AB 1493, expected to be signed into law by the Governor of California at the time of publication of this report, could significantly enhance the objectives of the State's LEV and ZEV program. The law requires the CARB to adopt regulations for carbon dioxide emissions from passenger cars, light trucks, and SUVs by January 1, 2005. The bill directs the CARB to adopt regulations "that achieve the maximum feasible reduction of GHGs emitted by passenger vehicles and light-duty trucks and any other vehicles" in the state [24].

4.6 Environmental Factors

Respects with environment, the gases that produce by our car were carbon dioxide, carbon monoxide, sulphur oxides, oxides of nitrogen (NO_x), and hydrocarbon and also lead. These gases will cause climate change, aggravate existing heart, lung diseases, acid rain, damage the ozone layer and lead released will damages organs, effect humans' brains, blood and also heart.

One of the major objectives of Toyota go into the hybrid (green) car is concern about the environmental effect of the Prius bring to us. For the first generation of Prius model NHW10 was sold at a loss due to the cost of Prius as much as US\$32,000 but only sales at US\$16,929 per vehicle. This show that the effort of the Toyota launches the "green" vehicles that aimed to reduce the air pollution and also increase the fuel efficiency.

As we know, the Toyota Prius is a hybrid car which requires less gasoline to run and with the and therefore cheaper to run. For the public benefits of using Toyota prius is less gasoline use which leads to less pollution, less greenhouse gas emissions and less dependence on the non-renewable oil.

Car owner know that driving a Prius provided a public benefit at the same time Prius also did not compromise quality, safety and functionally. Therefore, Toyota Prius provide the consumers with a role in addressing environmental concerns.

For the new model of Toyota Prius which using plug-in hybrid electric vehicle (PHEV). PHEV deliver the largest global warming reduction compare to other cars. Besides that, in regions of the country that have a relatively clean generation mix, PHEV is also reduces the smog-forming and also soot pollution.

5.0 Conclusion

After done our research, we came out with a conclusion it is enable higher accessible that moves Toyota Prius into hybrid vehicle production based on PESTLE analysis. For political view, the Government Policy using the renewable energy aims to reduce the dependence on foreign oil which will directly and indirectly affect the country's economy growth and security due to the raising of the oil price. These energy policy acts establish new technologies to enable the environment and economy to coexist harmoniously by achieving zero emissions throughout all area. There are some international and national policies such as United State Federal Law, Corporate Average Fuel Economy (CAFE), Energy Independence and security Act of 2007.

The fuel saving is one of the economy factors since the keep rising of oil price. Moreover, the cost of insurance and road tax for hybrid car are much lower than a gasoline car. Based on the economy analysis, it moves Toyota Prius into hybrid vehicle productions. The replacement of the renewable energy instead of using fossil fuel not only resolves the climate changes problem. It can reduce the burden of drivers that everyone able to afford for owning a hybrid vehicle. Conventional cars are significantly cheaper than the hybrid cars due to the high technology used on the hybrid cars.

Hybrid vehicle is Plug-In Hybrid Electric Vehicles (PHEV) which is using the battery powered car. Toyota did make a big step in technology that using 1.8 Liter displacement engine which able to generate higher output and torque. Other advance technologies such as using electric drive water pump, Cool-EGR system, advanced aerodynamics and low-rolling resistance tires that push the Toyota Prius into high technology vehicle in global. Toyota

use lightweight materials such as carbon fiber, aluminum, magnesium, titanium which used to reduce the overall weight of the vehicle body and increase the mileage. After having the technology analysis, the advance systems or technologies move Toyota Prius into hybrid vehicle production.

The PHEV technology will decrease emissions of conventional air pollutants and fuel consumption substantially. The new hybrid vehicle with PHEV technology fulfilled U.S department of energy load programs office (LPO) objective which reducing dependency on foreign oil improving environmental legacy; and enhancing American competitiveness in the global economy. Besides, LPO strict in greenhouse gas emissions, the growth of commercial clean energy technologies, provide direct loans to manufacturer facilities and protecting the taxpayers. The California Legislature adopting the first Greenhouse Gases (GHG) emission regulations on motor vehicles in the United States.

The major environment problem nowadays is climate changes which may affect human health. Toyota launches the "green" vehicles that aimed to reduce the air pollution and also increase the fuel efficiency which leads to less pollution, less greenhouse gas emissions and less dependence on the non-renewable oil. Plug-in hybrid electric vehicle (PHEV) delivers the largest global warming reduction which reduces smog forming and soot pollution.

Last but not least, PESTLE analysis is a simple and easy tool to understand and use in our research. Besides that, it is also a tool that encourages the development of strategic thinking due to its analysis tools (PESTLE). Thus, after analysis, it shows that the Toyota Prius did move into hybrid vehicle production which influenced by the factors.

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