

CUSTOMER ACCEPTANCE OF NEW TECHNOLOGY FOR HYBRID ELECTRIC VEHICLE

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Abstract. Government have three major concerned issues related to: increasing oil import, CO2 emission reduction, and current account deficit. One of solution is to reduce oil consumption which will impact to improve those three major concerned issues. For solution in automotive sector, Government have established roadmap of alternative fuel: bio-diesel B30 (year 2020), bio-gasohol E20 (year 2025), CNG (year 2025). Government also have developed LCEV program to motivate car maker to produce low carbon emission vehicle that more economical fuel. For this reason, Government already declared market share target of electrified vehicle 20% by 2025. Objective of LCEV program is for harmonization of vehicle luxury tax based on level of exhaust CO2 emission. Lower CO2 emission will have lower vehicle luxury tax. Industry must support LCEV program by developing new technology of electrified vehicle. One of alternative of electrified vehicle is hybrid electric vehicle. It is important to confirm customer's acceptance level, whether Government incentive is sufficient to cover the additional cost due to new technology adoption. Therefore, automotive makers need to analyse carefully and set an appropriate action plan to be able to set up vehicle price that meet customer's acceptance level in order to fulfil government target of electrified vehicle 20% by 2025.

Keyword: customer acceptance; Government incentive; hybrid electric vehicle; state deficit; vehicle price

INTRODUCTION

Government concerned issues. Indonesia governments are currently facing three major concerned issues related to energy security, environment, and economic. Concerned issue no.1: Indonesia become net oil imports since year 2004. Oil consumption will continue to increase, in opposite, the number of domestic oil production decrease due to fewer of new oil exploration. As the result, number of oil imports will continue to increase. Concerned issue no.2: Every countries in the world concern about global warming as the impact of the increasing of CO2 emission globally. The Increasing CO2 emission will cause the greenhouse effect which will trigger to increase 2 degree Celcius by year 2030. In order to anticipate a risk, United Nation order every countries to make an action plan to reduce CO2 emission. Indonesia Government promote national target CO2 reduction for all sector by Indonesia Law no. 16/2016 which all industry sector must support including automotive sector. Concerned issue no.3: Government have current account deficit which is triggered by deficit of trade balance due to import portion is higher than export portion. Main reason of negative trade balance is due to the increasing of oil imports portion lately.

Government program to reduce oil consumption. Program no.1: Bio-diesel fuel for transport sector. Indonesia has huge potential of palm oil that others countries doesn't have. Currently, Indonesia become first runner of bio-diesel utilization in the world for automotive sector by implementation of bio-diesel B20. Program no. 2: Bio-ethanol fuel for transport sector. Besides bio-diesel, Indonesia government also establish roadmap of bio-ethanol which will be blended with gasoline to become bio-gasoline E20 by 2025. Program no.3: Indonesia government also implement CNG fuel for transport sector. In order to promote more developing CNG vehicle in the future, Indonesia government establish roadmap of CNG station by establishing 2.888 CNG station toward 2050. Program no.4: Government prepare the policy of Low Carbon Emission Vehicle (LCEV) program, such electrified vehicle technology: Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), Battery Electric Vehicle (BEV), and Fuel Cell Electric Vehicle (FCEV). The objective of LCEV program is for harmonization of vehicle luxury tax based on CO2 emission. The basic principle is, Vehicle that emit high CO2 gas will have higher vehicle tax. Under the LCEV program, locally produced of HEV will get incentive tax (lower tax): CO2 emission 100 gr/km → 2% tax, 100 up to 125 gr/km → 5% tax, and 125 up to 150 gr/km → 8% tax. LCEV program is designed in line with Automotive Industry Roadmap that is developed by Ministry of Industry. One of important target of Automotive Industry Roadmap is to establish the market share of electrified vehicle 20% by year 2025, 24% by year 2030, 30% by year 2035.

Problem Statement. This incentive scheme is necessary to be analysed whether it is sufficient to minimize vehicle price-up of electrified vehicle or not? If the incentive is not sufficient, it will become potential risk that Government's target 20% electrified vehicle by 2025 can't be achieved. Those figure will trigger the situation that automotive sector can't contribute the reduction of oil consumption optimally, and it will cause: not achieving CO2 reduction, not achieving of oil import reduction, and tending negative of trade balance. So, it is very important to set the optimum of vehicle price, so that customer have a willing to buy HEV in order to contribute to minimize impact of those three concerned issues.

Research Objective. The objective of research is designed to focus on MPV segment due to this segment is dominant market segment in Indonesia, and related to the company that author work for, therefore the research objective are:

1. To understand customer's awareness toward HEV, especially on Mid-MPV and Low-MPV model.
2. To understand the reason of customer's willing to buy HEV Mid-MPV and Low-MPV.
3. To determine the most optimum level of vehicle price for HEV Mid-MPV model.
4. To confirm whether Government's incentive scheme is sufficient, or not. (for case of HEV Mid-MPV model)
5. To determine the business plan in order to achieve target 20% of HEV Mid-MPV market.

METHODOLOGY

This research apply the methodology of descriptive analytic by analysing primary data and secondary data. Secondary's data are taken from related source from internal Toyota and external parties which include data from Government, Government's institution, University and Automotive Association. Primary data are taken by conducting survey to the existing customers of Mid-MPV and Low-MPV by support from dealer (Auto2000 Sunter), Innova Club, Avanza Club and volunteers.

Target of respondent for primary data are at least 100 respondents for Mid-MPV customers and 100 respondents for Low-MPV customers which were conducted on March to April 2019.

FINDINGS AND ARGUMENT

In the 4 consecutive year, Indonesia automotive market continue to grow. This is in line with positive growth of macro-economic in Indonesia. GDP growth is stable above 5% in average, inflation rate tend to lower 5% for 4 consecutive year, and interest rate is also kept in low rate. This positive growth of macro-economic lead Indonesia to have bonus of demography which increase the number of middle income class people. Middle class income people will boost Indonesia's economic growth, and they are the main buyer of MPV segment. Historically, Indonesia has strong market on MPV segment due to Indonesia culture which is to be family orientated. MPV market in Indonesia is very dominant which have market share 40% more. This situation lead many makers, as well as PT TMMIN, the company where author work, to develop and produce MPV model for Indonesia customers.

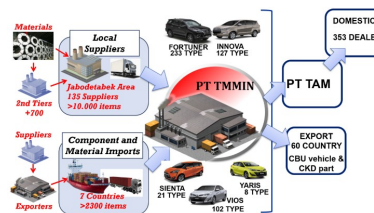


Figure 1. Supply chain of PT TMMIN business flow. Source: PT TMMIN internal data.

Figure 1. illustrate the supply chain of PT TMMIN's business flow that currently produce 5 model vehicle which are manufactured at Karawang Pant. Those model vehicle are Fortuner, Kijang Innova, Sienta, Vios and Yaris. PT TMMIN supply those 5 model vehicle to PT TAM as main distributor for domestic market, and PT TAM sell the vehicle though the domestic delaer which consist of 353 dealers. PT TMMIN also do export business to more than 60 destination countires in the form of CKD part and CBU vehicle. For the local component, PT TMMIN are supported by 135 local suppliers which their location are mainly at Jakarta, Bekasi, Karawang, Tangerang, Bogor. Some components and materials are imported from 7 countries.

Competitive Force analysis of Hybrid Electric Vehicle introduction. This analysis utilise framework of The Porter's Five Force for mapping and analysing comprehensively regarding the competitive force from view point of customers, suppliers, existing competitors, new entry barriers and products substitute. It can be summarized that the bargaining power of buyers and suppliers are moderate. Buyers or customers have an intention to own electrified vehicle because of its benefit, but customers have limit budget for additional price. Supplier will collaborate with each makers to develop new technology of electrified vehicle, because it is future business trend in the world. On the other hand, the potential threat from new entry, product substitute and existing industry are high. It can be concluded that the competition is very high, because every maker intent to develop and market of electrified vehicle due to it will become future business trend in automotive industry. One of the key factors to win the competition now a day is in regard cost competitiveness as well as vehicle price.

TMMIN assessment based VRIO framework. PT TMMIN do the assessment of internal resources for cost competitiveness by apply the VRIO framework which consist of 4 element: *Value*: the ability to exploit an opportunity or neutralize the competition with an internal capability or resources. *Rarity*: the ability to own the capability or resources that very hard to find in others.

Imitate: the ability to have the capability or resources that's difficult to find an equivalent or make a copy. *Organized*: the ability to organize management system, process, structures and culture to capitalize the capability or resources. It can be summarized that PT TMMIN have a competitive advantage on capability of technology development, supply chain network, production system, logistic management, brand image and product distribution.

Summary of survey result. Below are summary based on the actual survey that have been conducted to the 293 respondents who 188 are Mid-MPV segment customer, and 107 are Low-MPV segment customers. Respondent profile. Mid-MPV customers: About 89.9% of customers uses their car for daily activities going for working (office). The distance of home to office are evenly distributed from less than 5 km up to 40 km. Most of customers spend the expense for fuel are about Rp 500.000 up to Rp 2.000.000 depending on their home's distance which are almost 10% from their total monthly expense in average. Mid-MPV cars curently used are mainly year 2015-2019 (73.6%). Low-MPV customers: About 57.9% of customers uses their car for daily activities going for working (office) .The distince of home to office are evenly distributed from less than 5 km up to 30 km. Most of customers spend the expense for fuel are about Rp 500.000 up to Rp 1.500.000 depending on their home's distance which are almost 10% form their total monthly expense in average. Low-MPV cars curently used are above year 2015.

Reason to determine the choice car. Customers have five main reason to determine their choice cars, those are product qaulity, brand image , product design , price and re-sale velue. Price and re-sale value are highly considered when customers will decide to buy a car. Awarness toward HEV. Both Mid-MPV and Low-MPV customers aware toward new technology adoption of HEV whom more than 98% of both customers understand the existence of HEV, and most of them have a willing to buy HEV in the future when HEV variant is available for Mid-MPV and Low-MPV. Willingnes to buy HEV. More than 92% of Mid-MPV customers are interested to buy HEV model in the future, while 75% Low-MPV customers are interested. Mid-MPV customers are more established than Low-MPV customers in term of income. For both Mid-MPV and Low-MPV customers, the main reason of their interesting to buy HEV in the future are their expectation to get the benefit of fuel consumption reduction as well as reducing their daily operational expense.

Analysis of price elasticity. To understand customer's price elasticity, it need to analysis price and demand relationship. The analysis of price and demand based on survey result focus on Mid-MPV case only. Based on internal analysis and special effort, price projection of Mid-MPV medium grade Y2025 is 329 million. The projected vehicle price of Mid-MPV HEV is considered to increase due to addiotional cost for new technology adoption such as hybrid technolgy. On the other hand, by joining LCEV program, locally produced Mid-MPV HEV will have lower tax 5%. As for the referance that conventional one have vehicle luxury tax 20% (gap of vehicle luxury tax betweena HEV and convetional one is 15%. So, based on the calculation, the projected vehicle price for Mid-MPV HEV is Rp 373 million. Based the survey result that conducted to 188 respondent especially in regard to the price awarness, it resulted the formula of correlation between price and demand: $P = -0.65 Q + 376$, which $P =$ price , and $Q =$ demand. Based on the formula, conventional Mid-MPV medium grade with vehicle price Rp 329 million have the demnad about 72.000 unit per year. Mid-MPV HEV with vehicle price Rp 373 million have 4.600 unit per year. It mean that the demand is about 6% which is much less than Government target 20% of market share for electrified vehicle. With condition above, in order car makers to achieve 20% of HEV market share as Government target, car makers must find a way-out for business solution.

Price elasticity of Mid-MPV. Based on the formula, it can be concluded that 1% of price up for Innova will lead demand down about 0.93%.it mean that Innova price movement is not elastic, because demnad down less than 1 % when price-up 1%. Innova customers have more value oriented rather than price oriented.

Target setting for business solution. In order to achieve market share 20%, HEV must be deducted from projected HEV price Rp 373 million to the targeted Rp 366 million. Target of HEV price Rp 366 million is the customer's preference based actual survey result. It can be summarized that minimum target of HEV price reduction is Rp 7 million.

Alternative of business solution. Based on the analysis, internal effort include related activities of value analysis-value engineering activity, material localization activity, in-house process improvement activity, out-house process improvement activity. External effort will include the activity to obtain support from government's incentive of further tax deduction. Internal effort have potential cost reduction that reflect price reduction about Rp 7.3 million, while related external effort have an potential impact for price reduction about Rp 5.2 million.

Analysis of business solution's alternative. The analysis of alternative business solution is shown below table:

Table 1. Analysis of business solution's alternative.

No	Effort	Cost down (Rp million)	Price down (Rp million)	Confident Level (%)	Reason of Confident Level
1	<u>Internal Effort:</u> VA – VE Activity	- 1.8	-3.0	100%	The VA-VE ideas are exist, and TMC's Engineer will support.
2	Material Localization	-0.5	-0.8	90%	The potential suppliers has high capability to produce high quality of material.
3	Outsource Process Improvement	- 1.4	-2.4	90%	Most of local suppliers can achieve target, only view are not
4	In-house Process Improvement	- 0.6	-1.0	100%	Company do the structural reform as company wide activity
5	<u>External Effort:</u> Vehicle Ownership Tax → Differentiation of Conventional and HEV, PHEV, BEV	-1% vehicle ownership tax	-3.3	50%	DKI, West Java, Banten may accept, but Centre Java, Yogya, East Java may not accept due to number of Industry in these area are less (less income substitute)
6	Vehicle Luxury Tax → more reduction than government draft.	-0.5% Vehicle Luxury tax	-1.9	<10%	Ministry of Finance will have an objection, because they must secure Government income.

CONCLUSIONS

This section conclude and summarize the result to respond the problem statement and research objective. Customer's awareness toward hybrid electric vehicle. Awareness level of current customers for Mid-MPV and Low MPV are high as it confirmed based on respondent's feedback that 98% of customers understand the existence of hybrid electric vehicle, and most of them have a willingness to buy HEV when HEV variant will exist in market in the future. Three main reason to buy HEV in the future are: 1. The expectation to get the benefit of more economical on fuel consumption, 2. Concerning to contribute environment better, 3. experiencing new technology of HEV. More than 92% of Mid-MPV customers are interested to buy hybrid electric vehicle in the future, while Low-MPV customers are 75%. We identified that, in term of income, Mid-MPV customers are more established than Low-MPV customers, as it can be confirmed based on respondent's feedback that the average of monthly expense of Mid-MPV customers is much more than Low-MPV customers, about Rp 5 to 10 million of gap. Mid-MPV customers are expected to spend more budget to absorb price-up for hybrid electric vehicle in the future. Vehicle price that can be accepted by customers.

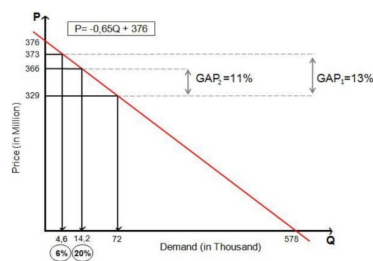


Figure 2. Correlation price and demand considering gap between ideal and projection vehicle price

Based on price and demand analysis that shown at the graph, in case of Mid-MPV HEV, the maximum gap of vehicle price between HEV and conventional one that can be accepted by customers is 11%. This maximum gap 11% is defined to be related with target of Mid-MPV HEV market share 20% toward government target 20% by 2025.

As we can see at figure 8., when vehicle price gap is 13%, then the sales of HEV is 4.600 unit per year or equal 6% market share. When vehicle price gap is 11%, then the sales of HEV is 14.200 unit per year or 20% of market share. So, the conclusion is, in line with Government target, in order to achieve market composition of 20% HEV, the maximum gap of HEV price for Mid-MPV should not more than 11% than conventional one.

Conclusion of Government incentive for vehicle luxury tax. Based on the simulation and analysis of cost and price calculation as figure 8., Government incentive for vehicle luxury tax is insufficient to cover additional cost of technology. By considering vehicle

luxury tax for HEV Mid-MPV is 5 %, the vehicle price gap with conventional one is 13% which lead to have its market share 6% only. As we can see at above graph, price and demand graph, price of HEV Mid-MPV should be Rp 366 million which require the maximum 11% gap of vehicle price with conventional one. So, it require a solution to cover the remaining gap 2% of vehicle price in order to achieve Government target 20% of HEV market share.

Business plan to achieve market share 20% of hybrid electric vehicle. Based on the business idea exploration and analysis of alternative solution, the most potential business solution that can be proceed in the future are included internal effort and external effort as below table:

Table 2. Summary of cost reduction potential to reflect vehicle price reduction

No.	Action Plan	Potential Cost Reduction (Rp million)	Reflect to MSRP Reduction (Rp million)
1	Internal Effort: VA – VE activity	-1.8	-3.0
2	Material localization	-0.8	-0.8
3	Outsource process improvement	-1.4	-2.4
4	In-house process improvement	-0.6	-1.0
	Total cost reduction internal effort	-4.6	-7.8
5	External Effort: Vehicle ownership tax reduction	-1%	-3.3
	Total potential MSRP reduction		-11.1

Based on above table, it can be seen that the potential achievement of vehicle price reduction which is - Rp 11.1 million is bigger than reduction target its self which is -Rp 7 million. The excess of achievement which -Rp 4.1 million will be allocated as a risk management in the execution of action planned. Based on the most potential of cost reduction idea, it require to set up more concrete action plan in order to secure the potential of business solution to become real implementation in the future.

Implementation Plan. Based on the most potential business solution, it require further development of more detail and concrete action plan by applying project management with 5W 1H and PDCA cycle approach in order to make sure the necessary bases has been covered. The comprehensive action plan are developed based discussion result with related Division. For VA-VE and material localization, responsible Division to discuss are Engineering Management Division and Purchasing Division. For outsource process improvement, responsible Division to discuss are Purchasing Division. For in-house process improvement, responsible Division are Production Engineering Division and Plant Administration Division. For external effort, responsible Division to discuss are Technical Government Affairs Office, External Affairs Division.

Recommendation.

Recommendation for future Government policy development. In order to make success of penetration for new technology to the customers, it need to enhance the collaboration among Government, industry and customers. So, as for the reflection, when developing new policy in the future, we recommend that, it is much better if customer point view will be also considered as important input during policy development. Recommendation to set priority. To recommend to focus on internal effort first with considering 2 following reason: 1) Achievement of internal effort will have an impact to level up company's competitiveness, especially cost competitiveness. While the achievement of external effort also can be utilized by all car makers, that will not create internal competitiveness. 2) By focusing on internal effort achievement, it is sufficient to cover additional cost up as well as vehicle price gap.

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