Product Life Cycle Analysis of Automotive Products on Multi-Purpose Vehicle’s (MPV) Segment

A Suzianti, D R Putra and C P Sibuea

Universitas Indonesia, Kampus Baru UI Depok, Jawa Barat, 16241, Indonesia

suzianti@eng.ui.ac.id

Abstract. Since 1990, the ever-increasing sales trend of automobiles in Indonesia has made the competition atmosphere much fiercer, particularly for Multi-Purpose Vehicle, the car segment with the highest sales in Indonesia’s automobile market. Therefore, a product life cycle management of automobiles is demanded to secure current position in market or further, to lead the market. This research uses MPV Model A and MPV Model B as a study case for Multi-Purpose Vehicle. Methods deployed are the computation of product line extension, the computation of product line innovation, t-test, Person Index Test, and Importance-Performance Analysis. Results are used to formulate product life cycle management strategies for automobiles of Multi-Purpose Vehicle aimed secure current position in market or further, to lead the market.

1. Introduction
Car sales growth into one of the parameters that indicate economic growth and growth in the industrial sector due respect to purchasing power. Car sales growth in Indonesia is one of the biggest market in ASEAN region, successfully sold 940,000 units over Thailand only 698,000 units in 2015. There are 4 cycles of growth in car sales in Indonesia.

In the first cycle, from 1993 to 1998. The highest achievement in this cycle in 1997 with the total sales of 389 thousand units. The decline that occurred due to the global economic crisis that affected Indonesia and affect the political situation as well. In the second cycle, between 2000 and 2006. The decline that occurred in 2006 was also caused by the global economic crisis. The same thing happened in the third cycle from 2006 to 2009, and 2010 to 2015. So, it is clear that the decline in car sales in Indonesia is largely determined by economic growth in Indonesia, and also global economic.

The purpose of this study is to analyse the product life cycle of car with the MPV segment represented by MPV Model A and MPV Model B by using the method of calculation of Product Line Innovation, and Product Line Extension, and the Importance-Performance Analysis to analyse the facelift and the development of variants on both models. That may eventually provide output for both products on their development strategy in the automotive product lifecycle management on MPV segment.

2. Study of Literature

2.1. Product Life Cycle Management

Levitt (1965) first introduced the concept of the Product Life Cycle (PLC) as a predictive instrument to do forecasting marketing needs and assist in planning their long-term product strategy. PLC is used
for the company’s strategy, product development, finance, and production, and is considered to be an influential concept.

PLC curve is described as a bell-shaped curve that describes the journey of products since its product introduction into the market until its withdrawal from the market. Model hypotheses showed that sales follow the sequence of steps, beginning with product introduction and continued with growth and maturity, and decline.

The term ‘life cycle’ generally indicates a whole series of stages, which could be recognized as an independent stage for continued or followed or implemented by a product since its ‘birth’ to expire. (Terzi et al., 2010). By adopting a model that is easier to use, the product life cycle can be defined by three main phases (Kiritsis, 2003), namely: Beginning of Life (BOL), Middle of Life (MOL), and End of Life (EOL).

(Rogers, 1962) Stating that the number of sales of a product from beginning until the end, can be the reference of trend that existed. Other significant factor also the instalment of specific feature in the existing model. The effectiveness of product lifecycle management policy is very important in the automotive industry related to consumer saturation, and assisting planning strategy of product changes from existing model to new model products. (Volpato, Stocchetti, 2008). Therefore, product life cycle management is crucial for the success of automotive products to compete in a Indonesia’s market.

2.2. Product Line Extension (PLE)
Product line extension is one of the indicators used to analyze product life cycle management (Volpato; Stocchetti, 2008). Product line extension is when a company creates a new product in the same product line of existing brands. It can be done with the product strategy to distinguish shapes, different colours, sizes, and have different ingredients or served in various flavours (Kotler, 1997).

2.3. Product Line Innovation
Product line innovation is also an indicator in the analysis of the product lifecycle management. This indicator based on the renewal and additional variants of a product. The results of the calculation of product line innovation will not represent how innovative a new model compared to the old model, but rather shows how often a brand renew or innovate its products (Volpato; Stocchetti, 2008).

2.4. Importance-Performance Analysis
Importance-Performance Analysis (IPA) was first introduced by Martilla and James (1977) as a framework to understand consumer satisfaction as a function of expectations related to the important attributes and research that related to performance. Although each provide the necessary information, the full potential of the information above realized when two concepts were combined.

The first methodology focuses on identifying performance gaps, which are usually obtained by calculating the difference between performance and importance. The second approach to the IPA involves mapping the average yield of the two points on a two-dimensional graph (called "Action Grid" by Crompton and Duray) to make a four-quadrant matrix that identifies areas that need improvement and areas with the effective performance

Quadrant I (High Importance / Low Performance) is named as "Concentrate here". Elements that fall in this quadrant represents a core challenge that requires direct corrective action and should be given the highest priority. Quadrant II (High Importance/ High Performance) is named as "Keep up the good work" contain elements that are a strength for an organization and should be maintained. If the element is located in quadrant III (Low Importance / Low Performance) does not represent a threat to an organization, the dismissal of the resource/business can be done. The quadrant is named as "Low priority". Quadrant IV (Low Importance / High Performance), which is named as "Possible overkill" contain elements which constitute a significant force for an organization and shows the area where resources can be diverted to another place.

3. Methodology
This study is an analysis that was developed based on the product life cycle management. At the stage of data collection is done by taking the data from the company that made the object of research, then at
a later stage by doing the calculation of PLE and PLI, and then the next stage is to do a significance test and correlation tests, and at the final stage of the analysis done by using importance-performance analysis.

In the first stage, or the data collection, data is extracted from historical data that is owned by the company regarding the research object which is MPV Model A and MPV Model B. In addition, as the supporting data that is a version of the product, prices, and specifications, taken from books, the internet, and journal or similar research.

In the second stage, after collect the historical data from 2004 to 2015, then calculate the product line extensions and product line innovation. The results of this calculation can describe how big the development or differentiation of products are made in the MPV Model A and MPV Model B throughout their life cycle. And also based on the calculation of PLI will describe how often a product done their facelift or innovation.

In the third stage, after calculation of product line extension and product line innovation from both of the object of study, then do the significance test and correlation test between PLE by the number of sales and PLI by the number of sales to determine which variables that have more influence and relationship to the amount of sales that has been recorded.

The fourth stage or the final stage, after receiving the results of significance test and correlation test, then analysed using the importance-performance analysis to make the right strategy in developing products on the MPV segment. This analysis begins with formulating the action items based on the variables that are taken in the calculation of PLE and PLI, and also the action items is very possible for the company to do to the products that made the object of this study.

4. Data and results

4.1. Stage 1: Data Collection

From the table shows the number of versions contained in the MPV Model A. The meaning of this number of versions is the number of variants offered by XYZ Company to consumers. Examples such as MPV Model A that offers a variant E, G, and V in which each of these variants has significant difference. Starting from the installed features to the price offered. Variant V on MPV Model A offered several sub-variants again with different engine and transmission. For example, MPV Model A V 2.0 A / T. The meaning of such variants is a unit of MPV Model A with a V variant/version with 2000 cc of petrol engine and an automatic transmission. While that fact XYZ offers for variant V itself is consisted of two engines and two transmissions. Namely 2000 cc for petrol engine and 2500 cc for diesel, as well as automatic transmission and manual transmission which with all versions have been offered at a price that varies according to the engine option and transmission option chosen by the consumer.

Also, at this stage is collecting the same data for MPV Model B, as well as sales data for MPV Model A and MPV Model B.

| Years | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Total Variant | 10   | 11   | 10   | 10   | 20   | 16   | 16   | 17   | 17   | 18   | 19   | 17   | 13   |

4.2. Stage 2: Calculations of PLE, PLI, and Price Range

MPV Model A. From the figure 1 showing the results of calculation of product line extensions, product line innovation, and price range. It can be concluded that the visible link between PLE with PLI because of fluctuations in the PLE looks similar to the fluctuations that occur in PLI. For a chart of price ranges, seen stagnant from year to year, or the fluctuations are narrow, it shows that the increasing number of variants does not mean the growing magnitude of the price range between the entry-level variant to the flagship variant.
Figure 1. PLE, PLI, and PR (MPV Model A)

MPV Model B. From the figure 2 showing the results of calculation of product line extensions, product line innovation, and price range. It can be concluded that the visible link between PLE with PLI because of fluctuations in the PLE looks similar to the fluctuations that occur in PLI. For a chart of price ranges, seen stagnant from year to year, or the fluctuations are narrow, it shows a same thing with MPV Model A that the increasing number of variants does not mean the growing magnitude of the price range between the entry-level variant to the flagship variant.

4.3. Stage 3: Significance Test and Correlation Test.
Table 2 shows the results of tests of significance (t-test) and correlation test (Pearson Index) between the calculation of PLE, PLI to the total sales of MPV Model A. From the results generated that shows the p-value of 0.011, and the numbers Pearson correlation of 0.675 may concluded that the product line extension or can be explained as well as product differentiation, is more influence on the amount of sales when compared with the product line innovation. Product line extension also has a correlation that is stronger against the number of sales. Therefore, the conclusion that can be drawn from the results of tests of significance and correlation test, is the development of product differentiation will be more important than innovation or facelift that implemented on
automotive products on Multi-Purpose Vehicle (MPV) segment (this calculation is for MPV Model A).

Table 2. Results of t-test and correlation test on MPV Model A

|                | P-Value | Pearson Correlation |
|----------------|---------|---------------------|
| PLE -> Sales   | 1.143   | 0.285               |
| PLI -> Sales   | 1.143   | 0.285               |

Table 3 shows the results of tests of significance (t-test) and correlation test (Pearson Index) between the calculation of PLE, PLI to the total sales of MPV Model B. From the results generated that shows the p-value of 0.339, and the numbers Pearson correlation of 0.288 may concluded that the product line extension or can be explained as well as product differentiation, is more influence on the amount of sales when compared with the product line innovation. Product line extension also has a correlation that is stronger against the number of sales. Therefore, the conclusion that can be drawn from the results of tests of significance and correlation test, is the development of product differentiation will be more important than innovation or facelift that implemented on automotive products on Multi-Purpose Vehicle (MPV) segment (this calculation is for MPV Model B).

Table 3. Results of t-test and correlation test on MPV Model B

|                | P-Value | Pearson Correlation |
|----------------|---------|---------------------|
| PLE -> Sales   | 0.339   | 0.288               |
| PLI -> Sales   | 0.912   | 0.034               |

4.4. Stage 4: Formulation of Action Items and Importance-Performance Analysis

Based on the results of significance test and correlation test, the tentative conclusion that can be drawn is that the product line extension is much more influence and has more correlation to the number of sales when compared to the product line innovation.

By looking at the factors involved in the calculation of product line extension which are price range, variants and engine options, there are three things that will be the action items from the calculation of product line extension, as follows:

- Growing or expanding the number of versions in a model that is offered in every one or two years for maximum (Attribute 1)
- Adding and developing a hybrid engine option for the MPV segment (in this case is MPV Model A or MPV Model B) (Attribute 2)
- Developing an engine with green technology or environmentally friendly that will be carried on MPV Model A and MPV Model B in the future. (Attribute 3)

Furthermore, by looking at the factors that are involved in the calculation of product line innovation that shows how much innovation or facelift is implemented and how often innovation or facelift is done, then there are two things that will be the action items from the calculation of product line innovation, as follows:

- Doing an innovation for each model every one year or two years for maximum (Attribute 4)
- Doing a facelift for each model every one year or two years for maximum (Attribute 5)
Figure 3. Quadrant Results of Importance-Performance Analysis

In quadrant one, there are two action items that are considered to have a high level of importance with low performance. These attributes are attribute 2 and 3. Developing hybrid engine options and engine with green technology for MPV Model A or MPV Model B has a high importance to the company and the environment due to fuel efficiency goals for every liter of gasoline used in a vehicle. Values of importance to attribute 2 is equal to 4 and attribute 3 is 4.33. So, it shows the importance of the development of hybrid engines and engine options with a green technology.

If we looked from the low performance, it can be concluded that it happened due to lack of consumer demand that is strong enough regarding the development of their options of hybrid engines or engine with a green technology for the MPV Model A and MPV Model B, which would certainly affect the price of products yet the products are still considered to be efficient or have an economical fuel by Indonesian consumers. Value of performance for attribute 2 is 3.67 and attribute 3 is about 4.33.

In Quadrant two, there is one action item that is considered to have a high performance, so it is worth to maintain its performance. Attributes inside this quadrant is attribute 5. The facelift always maintained with a period of approximately one and a maximum of two years in order to meet the needs of consumers and strong enough to compete with the competitors. Importance value of attribute 5 is 4, and performance value of attribute 5 is 5.

In quadrant three, there is one action item that entered in a low importance and low performance: Growing or expanding the number of versions in a model that is offered in every one or two years for maximum (Attribute 1). Attribute that is inside quadrant four is considered as a not important but has a good performance. In this quadrant, there is one action items which is Attribute 4. It is considered to have a lower importance than other attributes due to the innovation that is certainly needs research and development costs which are not cheap, so it does not make their importance becomes high. But with their innovations will affect the number of sales so it can be concluded that it has a high-performance value. Performance value for the attribute 4 is 4.67, and for the importance value is 3.33.

5. Conclusion
This study aims to recommend the product life cycle strategy for XYZ company. This study gives feedback for product life cycle management, not financial feasibility study and marketing model. From data processing and data analysis results, it can be concluded that the importance of product lifecycle management evidenced by the relationships and correlations between product line extension and product line innovation with sales amount of MPV Model A and MPV Model B.
From the action items that have been formulated, suggestions for priority implementation strategies of XYZ company in their product life cycle management for multi-purpose vehicle segment, Concentrate
Here for attribute 2 and 3; Keep Up the Good Work for attribute 5; Low Priority for attribute 1; Possible Overkill for attribute 4.

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