EVALUATION THEORIES OF PRODUCT DEFINITION METHOD FOR A SUCCESSFUL NEW PRODUCT

Hassan Alli[1]*

[1]Department of Industrial Design, Faculty of Design and Architecture,
Universiti Putra Malaysia 43400 UPM, Serdang, Selangor
Malaysia

* Corresponding author:
halli@upm.edu.my

ABSTRACT

In this paper, The Product Definition Method is used to facilitate the product designer to establish successful product design characteristics. It presents a complete process to involve users in the product definition stage of the design process. The validation of this method is conducted through using one example of a very successful product as a case study. In addition, the in-depth study of sales performance through Correlation Test and Regression Analysis of its success. The result identified that The Product Definition Method is a systematic method as well as a decision making tool in order to involve the user in the design process and will assist them to develop the product design specifications. It also allows the product designer to verify the product quality and make decisions to contribute to its success.

Keyword: New Product Development, Product Design Definition Method, Design Process and Successful Product

1. INTRODUCTION

Innovation begins with creative ideas. Idea quality generated by a user consists of novelty, feasibility, strategic relevance and elaboration. Users can be the source of new ideas to develop an innovation (Riedl et. at., 2010 and Taha et. al., 2013; Alli, 2018). User knowledge provides more opportunities in supporting the innovation idea. Much has been written about the expected consequences of user contribution in the entire product development process, whereby their relationship with product developers increase the level of innovation performance and the way the product become a success in the market. The user requirements also influence the development of a new product by providing the product direction, while preferences determine the product success. A deep understanding of how users gain value including an accurate understanding of user's need and wants, is required if the product developer wants to be commercially successful. The success of a new product not only often requires satisfying the user requirements and preferences, but also the systematic process (Taha et. al., 2013; Alli, 2014; Alli, 2018).

Product development deals with many aspects, it not only concerns bringing a new product innovation but also conceptualizing the redesigning or reengineering of a product. The empirical studies implied the outcome of coordinating product development activities and resources with users in the product definition stage of the design process. It is a valuable means of enhancing the development process and increasing the like hood of product success (Awa, 2010 & Bhuiyan, 2011). User involvement in new product development has been widely discussed among academicians and product developers from various disciplines of engineering, design, management and marketing. The collaboration of the product designer and user in the design process is highly required to produce the perfect new product (Lee, 2008; Taha et. al., 2013; Alli, 2018). They become important as an effective means to

identify a unique solution for an intended new product. The product definition phase is known as an important phase to identify and develop the specification of a new product. In addition, it covers the upfront product development activities that are more considered for understanding user needs, market analysis, priority decision criteria list, organizational support and others. The involvement of the user in product development needs a systematic and effective strategy in order to obtain user requirements and preferences, and incorporate them as part of product design specifications (Alli, 2014; Alli, 2018).

A number of researchers have investigated and found that a lack of collaboration between product designer and user brings conflict and failure on new product ideas. The development of a new design methodology is important to support the early design activities in the early stage of the design process. The Product Design Definition Method (PDDM) is developed to incorporate the three characteristics of product design (design requirements), user requirements and successful product in an attempt to establish successful product design characteristics and increase the probability of product success (Figure 1).
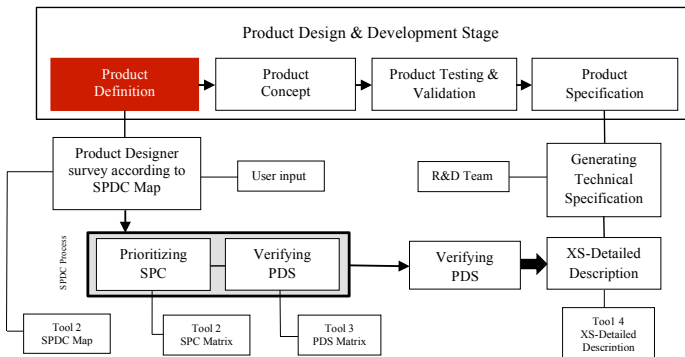

Figure 1: Product Design Definition Method

The PDDM is intentionally developed as a process to identify and establish the successful product design characteristics (SPDC) in the product definition stage of the design process. There are four steps that the product designer should follow to use the proposed PDDM framework in order to establish the successful product design characteristics (Table 1).

Table 1: Product Design Definition Method process

STEP	Description	Tools
STEP 1	User input is required, which product designers' team should capture information needed according to SPDC Map	Tool 1 SPDC Map
STEP 2	Prioritizing successful design specification design (PDS)	Tool 2 SPC Matrix
STEP 3	Verifying product design specification (PDS) through clustering process.	Tool 3 PDS Matrix
STEP 4	Building successful product design characteristics (SPDC) into the success factor (XS) Detailed Description worksheet.	Tool 4 XS-Detailed Description

The successful product design can be identified through the following formula:

$$XS = SPDC [SPC + PDS] + TS$$

Success Factor (XS) =
Successful Product Design Characteristics (Successful Product Characteristics + Product Design Specification) + Technical Specification

Product development is aimed to deliver the product specification that would satisfy and identified needs. However, there are many factors that can influence the success of a new product. In the context of product purpose, does it meet the user's need? In addition, how do the user requirements and preferences contribute to the success of a new product? To be able to clarify the factors that influence product success, the investigation conducted involved a mobile Smartphone. The discussion is based on decision making process in product development, in which there is need to incorporate the elements of product design in establishing the characteristics of a new product. It has extended the knowledge from product designer and users as a strategy for improving the efficiency of generating a new product idea, product quality and probability to increase product success. The Product Definition Method is used in the product definition phase of the product process in order to establish the characteristics of a new product and contribute to its success.

2. METHOD

A case study is conducted in order to identify and prove the success factors of Apple iPhone mobile through sales performance. Four successful product characteristics and the design specifications were identified as having a strong influence - multi function (usability), advanced technology (technology), good performance (performance) and user friendly (interface). The results indicated that multi-function characteristics, through usability which has increase the number of product features from previous iPhone models to the new iPhone model, has influenced of product success (Table 2).

Table 2: Successful Product Design Characteristics for iPhone mobile

Successful Product Characteristics (SPC)	Product Design Specifications (PDS)	Technical Specifications (TS)
Multi-function	Usability	Features
Advanced Technology	Technology	Camera and display
Good Performance	Performance	CPU, graphics and memory
User Friendly	Interface	Application Communication

2.1 Correlation and Regression

The success of a new product can be identified through it sales performance. Sales performance through Regression Analysis was conducted in order to provide evidence that the seven characteristic for success have a strong influence and become factors that contribute to sale performance. Apple iPhone mobile was selected as case study. The Apple mobile was selected based on its sale performance and user satisfaction. Factor analysis was carried out through correlation and regression methods using the SPSS software. The correlation result will be accepted if the correlation is significant $p<.05$, while, the regression analysis was used to analyze the relationship between interval variable. It contains two value dependent (Y) and independent variables (X). The regression analysis of the variable in this analysis can be identified through the formula $Y= a + bX$ and $Y= a + b_1X_1 + b_2X_2 ....b_kX_k$

3. RESULTS AND DISCUSSION

Table 3 shows the correlation between the sales and features variable of the iPhone. The results show that there is a significant and very strong correlation between the sale and features variable ($r=0.98;p<.05$). The results indicate that $R2=0.95$ showing 95 percent of the features variable strongly influenced the increment sales.

Table 3: Correlation sales and features variable

		Sales	Features
Sales	Pearson Correlation	1	.976*
	Sig. (2-tailed)		.004
	N	5	5
Features	Pearson Correlation	.976*	1
	Sig. (2-tailed)	.004	
	N	5	5

* Correlation is significant at the 0.05 level (2-tailed)

The results also show that if more features variable were added to the product it would increase the sales volume. The increment of sales has been proven by using the formula $Y=a+bX$. The correlation is found as $Y= -14003.05 + 7856.23X$

3.2 Correlation Test for Advanced Technology Characteristics

There are two variables from the advanced technology characteristics X1 (camera) and variable X2 (display) that are also shown to contribute to the sales of the iPhone. Table 4 shows the correlation between sales and the two technology variables. The results indicate that there is a significant and very strong correlation between the sales and variable X1 ($r=0.94;p<.05$). Variable X2 shows that there is a significant and very strong correlation ($r=0.97;p<.05$). Therefore, variable X1 and variable X2 show that there is a significant and strong correlation ($r=0.90;p<.05$) with sales.

Table 4: Correlation sales and technology variable

		Y	X1 (camera)	X2 (display)
Pearson Correlation	Y	1.000	.940*	.967*
	X1 (camera)	.940	1.000	.895*
	X2 (display)	.967	.895	1.000
Sig. (1-tailed)	Y	.	.009	.004
	X1 (camera)	.009	.	.020
	X2 (display)	.004	.020	.
N	Y	5	5	5
	X1 (camera)	5	5	5
	X2 (display)	5	5	5

* Correlation is significant at the 0.05 level (1-tailed)
Note: Y=sales, X1=camera (megapixel), X2=Display (ppi)

The results also indicate that $R2=0.96$ showing that 96 percent of both technology variables strongly influenced increment of sales. In addition, if more X variable is added to the product it will increase the sales volume. The increment of sales is proven using the formula; $Y=a+b_1X_1+b_2X_2+.........b_kX_k$. The correlation result is shown as $Y=-3343.18 + 11945.71X_1 + 19.31X_2$

3.3 Correlation Test for Good Performance Characteristics

The performance of the product shows that the contribution to the increment of the iPhone sales was through three variables; variable X1 (CPU), variable X2 (graphics) and variable X3 (memory). The three variables show a consistent influence in the increment of iPhone sales. Table 5 shows the correlation between the sales and the three performance variables. The results show that there is a significant and strong correlation between sales and X1 (r=0.87;p<.05). Variable X2 is also strongly significant and has a very strong correlation (r=0.97;p<.05). Variable X3 has a significant and very strong correlation (r+0.99;p<.05). Therefore, variables X1 and X2 have a significant and strong correlation (r=0.96;p<.05). Variables X1 and X3 show a significant and strong correlation (r=0.91;p<.05).

Table 5: Correlation of sales and performance variable

		Y	X1 (camera)	X2 (display)
Pearson Correlation	Y	1.000	.940*	.967*
	X1 (camera)	.940	1.000	.895*
	X2 (display)	.967	.895	1.000
Sig. (1-tailed)	Y	.	.009	.004
	X1 (camera)	.009	.	.020
	X2 (display)	.004	.020	.
N	Y	5	5	5
	X1 (camera)	5	5	5
	X2 (display)	5	5	5

* Correlation is significant at the 0.05 level (a-tailed)
Note: Y=sales, X1=CPU core (MHz), X2=Graphics (MHz), X3=memory (DRAM)

The results also indicate that the value of R2=0.98 showing that 98 percent of good performance variable strongly influences increment in sales. In addition, if more performance variable is added to the product, it will increase the sales volume. The increment of sales is proven using the formula; $Y=a+b_1X_1+b_2X_2+.......bkXk$. The resulting correlation is indicated as; $Y=6943.67 + 54.82X_1 + 122.42X_2 - 29.39X_3$.

3.4 Correlation Test for User Friendly Characteristics

The interface variable from user friendly characteristics shows that they contribute to the increment in iPhone sales. Table 6 presents the correlation between sales and the interface variable. The results indicate that there is a significant and very strong correlation between sales and the interface variable (r=0.92; p<.05).

Table 6: Correlation of sales and interface variable

		Sales	Features
Sales	Pearson Correlation	1	.923*
	Sig. (2-tailed)		.025
	N	5	5
Interface	Pearson Correlation	.923*	1
	Sig. (2-tailed)	.025	
	N	5	5

* Correlation is significant at the 0.05 level (2-tailed)

The results also indicate that the value of $R^2=0.85$ showing that 85 percent of the interface strongly influences the increment in sale. In addition, if interface variable is added to the product, it will increase the sales volume. The increment in sales is proven using the formula; Y=a+bX. The correlation results are indicated as Y= -18637.51 + 7847.01X

4. CONCLUSION

A good and successful product development is often supported by a systematic management and robust approach by the companies. The systematic innovation process can prevent unexpected results and the failure of product development output, reduce time and the cost of the product process. New product development shows that the user is truly essential for the success of a product. The PDDM was designed by introducing an adequate framework to establish successful product design. This method also becomes a decision-making tool in which the product designer can determine a new product that meets the user needs and determine the likelihood of product success, as was proven through validation study of a very successful product. The in-depth study of sales analysis shows that products with more technical functions and higher specifications tend to be successful, and thus, have higher sales.

AKNOWLEDGEMENT

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