

The Impact of Product Design and Process Design towards New Product Performance in Manufacturing Industry: A Survey Result in Malaysia

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Abstract— New product design and process design are vital aspects for a company to survive in in global competition market. Product design determines the success of a company through how product design can accomplish in today's marketplace and customer needs. Nevertheless, many new products which have been developed from research and development fail to compete in global market due to product performance issue such as quality, cost and delivery. Besides, many new product design is not capable to match with the process design and machine capability in production process. The objective of this paper is to identify the relationship between new product design and new product process design towards new product performance in manufacturing industry. Random sampling techniques have been used by distributing questionnaire to 400 companies in Malaysia manufacturing sector. 80 companies had replied with the respond rate of 20%. The result shows that the extent level of new product design and process design are moderate and high level respectively. Furthermore, there is a significant

relationship between new product process design and new product performance ($r(80) = 0.570$, $p < 0.05$). However, there are no significant relationships between new product design and new product performance ($r(80) = 0.092$, $p > 0.05$). The study is important to gain insight on the effect of new product design and new product process design towards new product performance.

Keywords— Total Quality Management, Automotive Industry, Lean practices, Survey, TQM

1. Introduction

The new product development (NPD) emphasizes on the importance of introducing new products in the market for business sustainable. In order to ensure successful in global business, companies have to introduce new product by a carefully accomplished new product development process. Of thousands of products entering market, not many products will success. Therefore, it is vital to comprehend consumer needs, markets, and competitors in order to develop products that provide greater worth to customers. In other words, customer-driven in NPD process is very important to fulfilled customer satisfaction. NPD contributes

to the growth of the companies, profit performance, and its role as a key factors in business performance in short and long term [1]. The process of NPD in organizations is based on a variety of products, specifications, applied technology and capacity of design.

Product design is usually related to the final result of the new product development process [2]. In addition, new product design should be thoroughly reviewed in order to avoid problems during production process. However, developing a new product is risky due to high failure rates and the large amounts of capital required [3][4]. Many new product that just developed from R&D is unable to compete in the market due to the higher cost compare to current product [3]. Product design is a process where a product is developed by considering customer requirements such as function, use, manufacture and communication to technical aspects [5]. Product design is not only an act of creation but also the combining of technical, strategic and market aspects. Good design can interact positive reactions from consumers [6], help differentiate products [7], and lead to competitive advantage [8]. On the other hand, there are strong relationship between design and new product performance [9].

Process design involves process of understanding between characteristics of a product and appropriate manufacturing process; it translates product design into the technical characteristics and operating processes to create the product [10] [11]. There is a gap between product design and process design [12]. Many cases shows that the process design is not matching with product design which finally effect the desired quality and productivity [13]. Therefore, the products must be checked and tested in the manufacturing process according to product specifications [14]. A designer should work together with production members' proactivity to design a product which aligning with manufacturing process [15].

A common misperception is that process design is less important than product design in producing a product. Pisano and Wheelwright [16] noted many problems occurred in the production process due to process design even many companies had devoted the vast majority of their R&D spending. Main problem is that design of the product does not meet to manufacturing process, while the other problem is the designer did not design new product based on process or machine performance [17] [18] [19]. The process of the manufacturing is unable to cope with design of the new product.

The objectives of this study are:

1. To identify the level of new product design and process design in manufacturing companies.

2. To identify the relationship between new product design and new process design management towards new product performance.

2. Methodology

First, research problem has been identified as the basis for identifying the solutions. Secondly, literature related to the research topic was reviewed for better understanding according to research objectives. Then, based on literature review, conceptual framework and several hypotheses were developed. Questionnaire was designed and undergoes the stage of pilot test for further refinement. The survey respondents targeted in this research were manufacturing companies in Malaysia Manufacturing sector. 400 respondents have sent in final survey and 80 companies participated in this research. Next, after the distributed questionnaires have been collected, data is analysed for achieving research objectives. Finally, the interpreted result is combined and reported.

The first objective of this research is to identify the relationship the relationship between new product design and process design towards new product performance. A survey instrument was developed with four constructs of new product design and three constructs of new product process design. For the purpose of scoring, a seven-point Likert scale was employed with 1 meaning 'not important' and 7 meaning 'very important'. A 'moderate' level is indicated as 4. When the questionnaire had been validated by quality experts, it was pilot tested and finalised. Finally, 80 questionnaires were returned which represented 20.0% response rate. The number of returned questionnaires that were found to be usable in this study was 80, which represented about 20.0% response rate. Since the response rate is quite high compared to a previous study, it shows that respondents are interested in this research. Next, after the distributed questionnaires have been collected for further analysis. Finally, the interpreted result is combined and reported.

3. Result

Descriptive analysis is a technique which is used in describing the extent of New Product Design and Process design [20]. The data is computed into means and standard deviation. Mean value obtained provides the average of respondents answered based on questionnaire [21][22]. While standard deviation is used to measure the dispersion of the data in which how close the entire set of data is to the average value [21][22]. The lower the value of standard deviation, the closer is the data to the average value. Table 1 shows the level of mean measurement which is ranked by the central tendency level.

Table 1: Level of Mean Measurement

Mean Range	Central Tendency Level
High	5.00-7.00
Moderate	3.00-4.99
Low	1.00-3.00

Descriptive analysis: New Product Design and New Product Process design

Table 2 shows the result of descriptive analysis for five factors of new product design. Based on the Table 2 has revealed that the average mean score for five average factors of new product design has a moderate and High level. Manufacturability shows the highest mean, 5.05.

Table 3 shows the result of descriptive analysis for five factors of new product process design. Based on the Table 3 has revealed that the average mean score for five average factors of new product design has moderate and High level. Worker skill shows the highest mean, 5.94.

Descriptive analysis: New Product Design and New Product Process design

Table 2 shows the result of descriptive analysis for five factors of Lean practice. Based on the Table 2 has revealed that the average mean score for five average factors of Lean practice has a moderate and High level. 5S shows the highest mean, 6.08.

Table 2 : Descriptive Analysis: New Product Design

Items	Mean	Standard Deviation	Interpretation
Manufacturability	5.05	.70007	High
Simple design	4.42	.85222	Moderate
Service availability	4.69	.66759	Moderate
Robust design	4.98	1.16345	Moderate
Average Mean Score	4.78		Moderate

Table 3 : Descriptive Analysis: New Product Process design

Items	Mean	Standard Deviation	Interpretation
Environment factor	4.92	.70007	Moderate
Equipment capability	5.21	.85222	High
Worker skill	5.94	.7639	High

Items	Mean	Standard Deviation	Interpretation
		3	
Average Mean Score	5.36		High

Spearman correlation are used in analysing data from respondents to identify relationship between new product design and new product process design on product performance. Significance value in this study is 0.05. From the Table 4, there is positive correlation ($r=0.570$) between new product process design and product performance at significant level 0.01. However, Table 4 shows new product design is not significant relationship with product performance.

Table 4: Correlation Analysis between Factors and product performance

		Product performance	Result
H1a	New Product Design	0.092	Not Sig
	Sig (2-tailed)		
H1b	New Product process design	0.570**	Positive
	Sig (2-tailed)	0.000	Significant

4. Discussion

The result shows there were significant relationship between new product process design and new product performance. However, it was surprised that there were no significance between new product design and product performance. The main reason is many Malaysia companies are focusing on manufacturing based and less focusing on new product design. Many of the companies operate their companies as original equipment manufacturer (OEM) and the design based on their customers. Their involving in product design is very limited. Many Malaysian companies in Malaysia are still in the journey in product design and they need recommendation guidance to compete with other long-term established companies [25] [26] [27].

4. Conclusion

Research Objective 1: To identify the level of new product design and new product process design.

Based on the data analysis, it showed that new product process design were high interpretation with high and moderate level. It indicates that new product process design is important because it can lead to the improvements and product performance [23][24].

Research Objective 2: To determine the relationship between new product design and product process design on product performance in SMEs.

Correlation analysis was used in this study to analyze the impact of product process design on product performance. It shows that there was a positive significant relationship between product process design and product performance which was 0.570 with the significance of 0.001 [25] [26] [27] [28]. However, no significant relationship between product design and new product performance. It shows that many companies are still not aware of the importance of product design. Malaysia companies must emphasise on management of new product design and process design. To further level up their new product performance, upstream management of new product design must be emphasise in future development.

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