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Effects Of Knowledge Management & Concurrent Engineering On NPD Performance

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ABSTRACT:

The progressively increasing customer awareness of quality raises the demand level of new product development (NPD) processes in manufacturing firms. As such, manufacturing firms of today require cutting-edge strategies, innovation and management skills to improve their level of NPD performance. This research aims to explore the effects of knowledge management and concurrent engineering on NPD performance. A total of 150 surveys were collected back from several Malaysian manufacturing firms and analyzed using reliability, correlations and multiple linear regression analyses. The results revealed that concurrent engineering has a higher influence over NPD performance compared to knowledge management. However, the combined effects of both concurrent engineering and knowledge management on NPD performance were found to be significant. According to the model, the significance of knowledge management is not to be ignored. Nevertheless, the combined practice of concurrent engineering and knowledge management is likely to be a dominant catalyst for improved NPD in most Malaysian manufacturing firms.

Keywords: *Knowledge management, Concurrent engineering, New product development*

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1. Introduction

New product development or NPD is defined as a development approach that fits a market's demands and customers' desires on a certain product (Oliver et al., 2004). NPD is considered as the initial step in a product or service that involves a number of steps before the product is introduced to the market. NPD is emphasized because it is needed to improve the functionality, quality and performance of an existing product.

NPD performance directly influences organizational performance as it often allows the organization to meet or exceed the expectation of customers (Ng and Anuar, 2011; Ng and Jee, 2011b). As a result, the revenues earned from the market can be used for the further development of new products and improvement of existing products and services (Oliver et al., 2004). The variables for NPD include research and development (R&D), time and technology (Anuar and Ng, 2011; Ng et al., 2011a; Ng et al., 2011b).

R&D is important for innovation which involves scientific, technical, commercial and financial steps for achieving successful NPD (Neely and Hii, 1998). R&D involves the discovery or convergence of new product ideas which lead to the development of new products/procedures or improved existing products/procedures in the external market (Gauvin, 1993).

Time is a strategy weapon in NPD and is often related to productivity, cost, quality and innovation (Anuar and Ng, 2011; Das, 1991; Ng et al., 2010c; Ng and Jee, 2012b). The important factor that is to be taken seriously in NPD is the lead time for new products to be launched in the market (Ng et al., 2010a; Ng et al., 2011a; Ng and Jee, 2012c; Prasnikar and Skerlj, 2006).

Technology is important because *t*he selection of emerging and newer technologies in NPD improves the performance of existing products (Krishnan and Bhattacharya, 2002). It also makes NPD more challenging and risky (Krishnan and Bhattacharya, 2002; Ng et al., 2009; Ng and Jee, 2011a).

Although NPD is important for the development of new products and innovations, the amount of wasted raw materials due to extensive research and costs incurred due to the excessive purchase of R&D materials show that there is a dire need to improve NPD performance in a more efficient way (Ng et al., 2011b; Ng and Jee, 2012b; Ng and Jee, 2012e).

In association to this predicament, researchers hypothesize that knowledge management (KM) and concurrent engineering (CE) practices are capable of giving organizations a competitive edge on technology, development and lead time to market (Ng et al., 2010a; Ng et al., 2011a; Ng and Jee, 2012c). Therefore, this study aims to investigate the possibility of employing KM and CE practices to further improve NPD performance and minimize the problems faced in NPD in terms of development and manufacturing. The research question for this study can be proposed as:

2. What Are The Effects Of KM And CE On NPD Performance?

The importance of this study is to understand the contribution of these factors on NPD, since both factors can improve the performance of the manufacturing industry which drives the economy of a country. Concurrent engineering and knowledge management are widely accepted strategies in the manufacturing industry. Furthermore, they are also catalysts for the 10th Malaysian plan which aims to enhance the overall industry that includes the manufacturers, suppliers and end users. Hence, the first hypothesis of the study can be proposed as:

> *H1: CE and KM influence NPD performance in Malaysian manufacturing firms*

2.1. Concurrent Engineering (CE)

CE is known as simultaneous engineering or integrated product development and can be used to replace the traditional sequential engineering approach that has been used in the manufacturing industry for years (Ng et al., 2010a). CE teams are multidisciplinary and include product developers from different functions (Ng et al., 2010b).

Multidisciplinary groups can work together in the early stages of the project and allow fast informed decisions relating to the process, product, cost and quality problems (Ng et al., 2010a; Ng and Jee, 2012b). This helps the immediate rectification of mistakes in new products and reduction of errors in the eventual production process (Bowonder et al., 2004).

However, CE can increase possible inefficiencies in a project due to its simultaneous nature that may cause some activities to overlap each other. In addition, it can potentially increase the production costs due to an increased number of workers hired for the production process (Willaert et al., 1998). In view of this, a hypothesis is proposed to determine whether CE supports or impedes NPD:

H2: CE influences NPD performance in Malaysian manufacturing firms

2.2. Knowledge Management (KM)

Knowledge management (KM) is the one of the most important value-creating resources that can change the dynamics of an organization (Cummings, 2003; Norris et al., 2003). It is an imperative managerial practice for most Malaysian manufacturing firms (Ng and Anuar, 2011; Ng et al., 2009; Ng et al., 2010c; Ng et al., 2011a; Ng and Jee, 2011a; Ng and Jee, 2012e). KM can also be referred as an information system that enhances the sharing of ideas and information in the organization (Cummings, 2003; Norris et al., 2003).

The culture of KM is important because it directly influences the work results of a project team (Hussock, 2009). It involves a system that approaches the understanding, invention, sharing, creation and utilization of knowledge to create values that help achieve organizational goals (Gold et al., 2001).

KM absorbs the knowledge from an organization through an appropriate management process to achieve future and current needs (Kanagasabapathy et al., 2006). It also helps to select, filter and disseminate important and relevant information to the right people at the right time (Gupta et al., 2000).

The main drawback of KM is perhaps the loss of technical knowledge to other competitors. Since many employees these days do not choose to pursue their career path for long in a single manufacturing firm and eventually move on to another firm, it is likely that they will bring their technical knowledge, information and experience to other firms that employ them with better benefits. This causes a loss of competitive advantage from their former company that spent time and money training them (Spencer, 2003). In consideration of this, a hypothesis is proposed to determine whether KM supports or impedes NPD performance:

H3: KM influences NPD performance in Malaysian manufacturing firms

3. Research Method

Surveys were used for data collection in this study. The targeted organizations were ten Malaysian manufacturing firms. A total of 50 surveys were sent out to each firm. Only

150 surveys were collected back. However, since the response rate is 30% (an acceptable requirement in most studies), the amount of data collected is sufficient for this research (Sekaran, 2003). The participants include managers, engineers and general executives. The data were compiled and analyzed using SPSS 19. The tests carried out were the reliability, correlations and multiple linear regression analyses.

4. Results and Discussions

The results of the reliability analysis in Table 1 show that all the data for the variables of this study (NPD performance, CE and KM) are reliable. The Cronbach's alpha value for each variable is above 0.7, signifying high reliability (Cronbach and Shavelson, 2004; Nunnally and Bernstein, 1994). Hence, the internal consistency of the all the data used in this study is considered good.

Table 1: Reliability Analysis

Variables	Cronbach's Alpha	No. of Survey Items
New Product Development Performance	0.883	15
Concurrent Engineering	0.808	21
Knowledge Management	0.833	20

From the Table 2, the correlation between CE and NPD performance is significant ($R = 0.637$, $p < 0.001$). Since CE involves simultaneous efforts in development processes, it enables a faster and more efficient manufacturing of quality products (Gatenby et al., 1994; Weber et al., 1999). This increases the competitiveness of the market and also attracts the customer engagements with the products. It reduces product design time and lead time for the production process. Thus, ***H2*** is not rejected.

Table 2: Correlation Between CE And NPD Performance

riables	N	Pearson Correlation, *R*	Significance, *p* (2-tailed)
D Performance	150	0.637	0.000

(Significance: $p < 0.001$)

From the Table 3, the correlation between KM and NPD performance is significant ($R = 0.616$, $p < 0.001$). According to Hansen (1997), incremental information sharing between R&D departments and other functions is bound to take place to ensure the efficiency of NPD. This can be closely related with knowledge management since it involves knowledge sharing across the entire organization (Hansen, 1997; Ng and Jee, 2011a; Ng and Jee, 2012c; Ng and Jee, 2012d). With knowledge shared and transferred efficiently, information on the products will be consistently updated, allowing teams to have better ideas on concurrent product improvements (Ng and Jee, 2011b; Ng and Jee, 2012a; Ng and Jee, 2012e). Thus, ***H3*** is not rejected.

Table 3: Correlation Between KM And NPD Performance

ıriables	**N**	**Pearson Correlation, *R***	**Significance, *p* (2-tailed)**
PD Performance	150	0.616	0.000

(Significance: $p < 0.001$)

Multiple linear regression analysis was used to test whether or not the entire model of this study is significant. Table 4 presents the multiple linear regression results on the overall effects of both CE and KM on NPD performance. According to Table 4, the correlation value ($R = 0.748$, $p < 0.001$) indicates that there is a significantly strong correlation concerning the effects of CE and KM on NPD performance. The R^2 value ($R^2 = 0.559$, $p < 0.001$) of the model indicates that 55.9% of the variance in NPD performance can be explained by both CE and KM. Besides that, the model is also significant as indicated by the ANOVA results of $F\ (2, 147) = 93.328$, $p < 0.001$. Therefore, the effects of both CE and KM in Malaysian manufacturing firms are positive and significant, and ***H1*** is not rejected.

Table 4: Multiple Linear Regression Analysis For CE, KM And NPD Performance

Variables	***β***	**Std. Error**	***t***	***F***	***R***	***R^2***
(Constant)	0.972	0.221	4.390			
CE	0.548	0.091	6.001*	93.328*	0.748	0.559
KM	0.237	0.085	2.796*			

(*Significance $p < 0.001$; N=150; Durbin Watson = 1.756)

Based on the individual correlations and beta coefficients from the preceding tables, it appears that CE has a significant and higher influence on NPD performance as compared to KM. CE allows the optimization of product and process designs, and improves the quality of products within a shorter time by integrating manufacturing and design activities simultaneously (Evbuomwan and Anumba, 1998).

Although the correlations and coefficients that involve KM are not as high as the ones that involve CE, they are still significant. The culture of KM is still important because it directly influences the results of a team (Hussock, 2009). KM practices approach the understanding, sharing, creation and organization of knowledge to create value for an organization (Gold et al., 2001). Thus, its capabilities should not be overlooked, much less ignored by any organization that wishes to flourish in NPD performance.

5. Conclusion

Based on the key findings, this study provided evidence that both CE and KM practices significantly affects the performance of NPD. This study placed a special emphasis on several Malaysian manufacturing firms and suggested that the combination of CE and KM is an underlying factor of success in NPD. The results of this study suggest that the particular Malaysian manufacturing firms chosen for this study reflects the CE and KM practices in other manufacturing firms around the world as supported by the literature.

This study also points out that although CE appears to be the dominating predictor in the model, KM practices should also not be neglected. Instead, both practices should go hand-in-hand for more consolidated NPD performance as evidenced in the results of this study on multiple linear regressions.

However, a few limitations should also be pointed out in this study. Firstly, a simultaneous modeling analysis was not carried out since the framework was developed in such a way that the components were not able to be simultaneously tested against each other. This restricts the likelihood of uncovering more relationships and influences among the dependent and independent variables. Also, a study of only ten organizations would normally limit the generalization of the results. Thus, it may be still unclear if this study would have logical applicability outside Malaysia.

One of the suggestions to improve this study is to conduct in-depth qualitative studies in every technology group in the ten manufacturing firms to further understand its organizational context. Observational methods can also be employed to expose more evidence on this phenomenon. In addition, rather than utilizing respondent-reported scales, it is suggested that empirical data from the organization's records (sales performance, yield performance, customer satisfaction, development cost) can be used to further improve the study. An empirical study across several manufacturing organizations from different countries would also improve the generality of this study.

Lastly, a structural equation modeling (SEM) approach using a combination of statistical data and qualitative causal assumptions can be used in order to test and estimate causal relationships. One of the available software that can be used for this analysis is called AMOS.

Although much remains to be learned about the developed hypotheses and relationships in this study, it is believed that an introductory understanding of KM and CE is now within sight, due in part of an empirical study of their effects on NPD performance in Malaysian manufacturing firms. This study offers precursory guidelines for manufacturing managers and leaders who aim to use KM and CE as competitive weapons not only in improving the efficiency of the development process, but also in ultimately satisfying customer expectations.

6. References

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