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Knowledge Creation And Its Effects On NPD: A Survey Of Malaysian Manufacturing Firms

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ABSTRACT:

Several case studies from developing countries such as Malaysia have confirmed that a firm's knowledge creation competencies can significantly affect its new product development (NPD) and engineering performance. The generality of these findings however have yet to be tested among a number of firms. Therefore, this study aims to explore the effects of knowledge creation on NPD by surveying several Malaysian manufacturing firms. Using the SECI model, a survey was developed. A total of 150 responses were collected and analysed using reliability, correlations and multiple linear regression analysis. It was found that every variable had a significant correlation with NPD. Also, 44.8% of the variance in NPD was explained by knowledge creation. This study contributes to the understanding of knowledge creation and NPD of most Malaysian manufacturing firms. It contends that knowledge creation acts as a reinforcement and catalyst for NPD success. The outcome of reinforced NPD in Malaysian manufacturing firms may lead to the eventual improvement of the country's overall economy and knowledge, towards the primary goal to achieve the status of a high-income nation.

Keywords: *Knowledge creation, New product development, Manufacturing firms, Malaysia*

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1. Introduction

Most manufacturing firms condone that new product development (NPD) is a competitive advantage since it is capable of improving the quality and performance of both new and existing products. In the process of manufacturing a product, NPD is the initial step that entails a certain amount of steps before the product is released into the market (Ng and Jee, 2013). In relation to NPD performance, it has also been hypothesized that the superiority of knowledge creation as a sustainable competitive advantage for firms requires serious attention especially when it comes to organizing project resources (Ng et al., 2011b).

Innovative and new product development (NPD) often relies on the creation of knowledge (Madhavan and Grover, 1998; Schulze and Hoegl, 2006). According to Schulze and Hoegl (2006), both leaders and researchers perceive a link between knowledge creation and innovation processes. It has also been perceived that there is even a link between knowledge teams and creativity in NPD (Ng et al., 2010b; Ng and Jee, 2012a; Ng and Jee, 2012b; Ng et al., 2012). The fundamental suggestion is that

more value can be delivered through the generation of superior products if a company is better at knowledge creation (Schulze and Hoegl, 2006).

In their quest for hermeneutic and empirical evidence, researchers have conducted reviews and empirical studies on how the consistent creation of knowledge in firms can in fact lead to enhanced NPD performance (Madhavan and Grover, 1998; Ng et al., 2011b; Ng and Jee, 2013; Schulze and Hoegl, 2006). Even several case studies from developing countries such as Malaysia showed that a single firm's NPD and engineering performance can indeed be affected by its knowledge creation capabilities (Ng and Anuar, 2011; Ng et al., 2009b; Ng et al., 2011a; Ng and Jee, 2011a; Ng and Jee, 2011b; Ng and Jee, 2012c; Ng and Jee, 2012d; Ng and Jee, 2012e).

However, it appears that the generality of the abovementioned findings from Malaysia have yet to be confirmed, seeing as only simple case studies have been conducted. This concern unveils and highlights the need for researchers to further improve the aforementioned generalization by studying the effects of knowledge creation on NPD across several Malaysian manufacturing firms.

Hence, the aim of this study is to explore the effects of knowledge creation on NPD, with a special emphasis on the SECI model developed by Nonaka and Takeuchi (1995). This study contributes to the understanding of knowledge creation and NPD in the circumstances of most manufacturing firms in Malaysia. It contends that knowledge creation capabilities act as reinforcements and driving forces for NPD success in Malaysian manufacturing firms. The outcome of reinforced NPD in manufacturing firms may lead to the improvement of the country's overall economy and knowledge. Hence, the first hypothesis of the study can be proposed as:

H1: Knowledge creation significantly affects NPD among Malaysian manufacturing firms

2. Knowledge Creation

Knowledge creation involves the continuous transfer, combination and conversion of different types of knowledge, as users practice, interact and learn (Nonaka and Takeuchi, 1995). It is often at the heart of the organization's competitive advantage (Frost, 2010). Researchers propose that knowledge creation is a product of the relationship between knowledge and knowing (Cook and Brown, 1999).

According to Frost (2010), knowledge sharing and knowledge creation go hand in hand since knowledge, after all, has to be created, shared and converted through practice, collaboration, interaction and education. Knowledge sharing and knowledge creation are also activities of value creation and can change the dynamics of an organization (Cummings, 2003; Norris et al., 2003).

In order to understand the dynamic nature of knowledge creation and to manage such a process effectively Nonaka and Takeuchi (1995) proposed the SECI model. The SECI model involves a spiral of knowledge, where the explicit and tacit knowledge interact with each other in a continuous process, leading to new knowledge creation (Frost,

2010; Nonaka and Takeuchi, 1995; Schulze and Hoegl, 2006). It has become a pivotal cornerstone in the understanding of the transfer and creation of knowledge (Nonaka and Konno, 1998; Nonaka and Toyama, 2003). The SECI model includes variables such as socialization, externalization, combination and internalization as depicted in Figure 1.

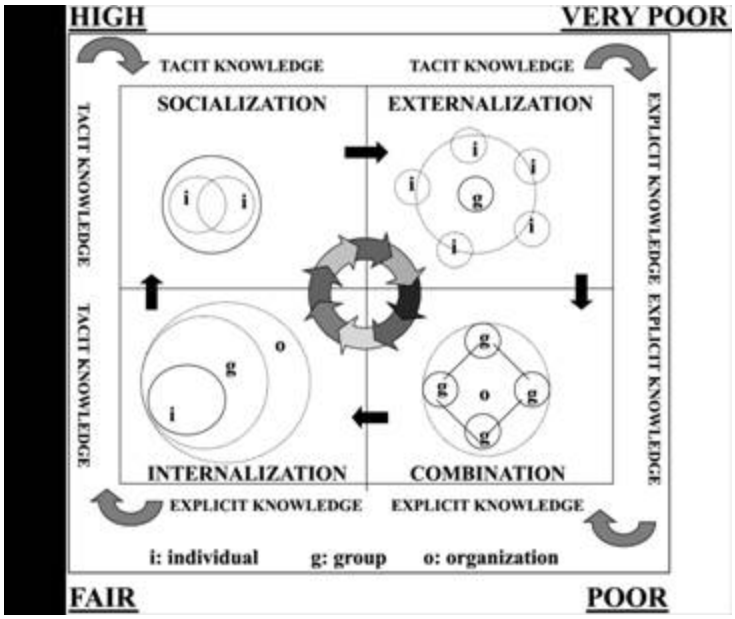

Figure 1: The SECI Model (Nonaka and Takeuchi, 1995)

Socialization. Socialization involves the sharing of tacit knowledge and information among individuals in an organization (Ng et al., 2011b; Nonaka and Takeuchi, 1995). It is an important connector or link between the customers and suppliers of manufacturing firms because suppliers are capable of providing up-to-date information to manufacturers directly and understand their requirements on a product (Ng et al., 2010a; Ng et al., 2010c). This enables the manufacturing firm to take immediate action in improving the product according to their quality and performance requirements (Nonaka and Konno, 1998; Nonaka et al., 2000).

Socialization can be an important enabler in Malaysian manufacturing firms and can potentially affect the processes in NPD significantly if harnessed with proper attention. Thus, the second hypothesis of this study can be proposed as:

> *H2: There is a significant correlation between socialization and NPD among Malaysian manufacturing firms*

Externalization. Externalization involves the conversion of tacit knowledge to explicit knowledge so that it can be shared by others to become the basis of new knowledge in forms of concepts, images and written documents (Nonaka and Toyama, 2003). Metaphors are very important mechanisms for externalization (Nonaka and Konno, 1998; Nonaka et al., 2000). Externalization is triggered by successive rounds of

meaningful dialogue, where the sophisticated use of metaphors can be employed to enable the articulation of perspectives, and thereby reveal hidden tacit knowledge that is otherwise hard to communicate (Nonaka et al., 1994).

Externalization can also be computerized by gathering all the information or ideas and transferring them into manuals, documents and books which make it be easier to understand by others (Ng and Anuar, 2011; Nonaka and Konno, 1998; Nonaka et al., 2000). The aforementioned points suggest that externalization can be an important mechanism in ensuring the steadiness of the NPD process flow in Malaysian manufacturing firms. Thus, the third hypothesis can be proposed as:

> *H3: There is a significant correlation between externalization and NPD among Malaysian manufacturing firms*

Combination. Combination is the process of concept systemization into a system of knowledge (Nonaka and Takeuchi, 1995). It occurs when individuals combine diverse sources of explicit knowledge into informational work, such as reports (Nonaka, 1991). It can also occur through meetings, phone conversations and exchange of documents (Nonaka, 1994; Nonaka and Takeuchi, 1995). The combination process results from knowledge transfer at the market and puts firms in line with the dynamics of market preferences and technological structures (Thorpe et al., 2005). It also enhances the knowledge creation of small and medium enterprises (SMEs) (Zivkovic et al., 2010).

In combination, computerized communication networks are often used to combine explicit and implicit knowledge together to form a useful and more interpretable context (Creplet et al., 2001; Nonaka et al., 2000). The preceding justifications lead researchers to understand that it is possible for knowledge combination initiatives to significantly affect the performance and outcome of NPD (Ng and Anuar, 2011; Ng and Jee, 2011a). Therefore, the fourth hypothesis is proposed as:

> *H4: There is a significant correlation between combination and NPD among Malaysian manufacturing firms*

Internalization. Internalization is the act of converting explicit knowledge into an organization's tacit knowledge, where individuals are required to identify the knowledge relevant for them within the organizational knowledge (Nonaka and Konno, 1998). Internalization may require individuals to achieve tasks that are process-oriented and in the focused domain (Chou and He, 2004). Therefore, internalization also creates operational knowledge (Engestrom, 1999) which is related to hands-on experience and manufacturing procedures. Through internalization, explicit knowledge becomes an individual’s new tacit knowledge foundation in the form of shared mental models and technical know-how (Chou and He, 2004).

The abovementioned explanations suggest that there is a potential relation between internalization and NPD due to their operationalised processes that involve focused and on-job trainings that can potentially sustain the control of process flows in NPD (Nonaka and Konno, 1998). Therefore, the fifth and final hypothesis is proposed as:

H5: There is a significant correlation between internalization and NPD among Malaysian manufacturing firms

3. Research Methodology

Online surveys were developed and sent to respondents via e-mail. The respondents of this research included executives from ten Malaysian manufacturing firms. The respondents were working in positions such as engineers, production executives, production planners, manufacturing managers and quality directors. A total of 150 survey responses were collected back. The data were organized and then analyzed by using SPSS 19. The statistical tests conducted were reliability, correlations and multiple linear regression analyses.

In the reliability analyses, it is understood that the closer of the alpha value is to 1, the higher the internal consistency of the data (Alhujran and Chatfield, 2008). According to Nunnally and Bernstein (1994), an alpha value that is above 0.7 can signify high reliability and good internal consistency.

4. Results And Discussion

The results of the reliability analysis in Table 1 shows that all alpha values obtained are above 0.7. This signifies that the data are reliable enough for further analyses due to their good internal consistency (Cronbach and Shavelson, 2004; Nunnally and Bernstein, 1994).

Table 1: Reliability Analysis

Variables	Cronbach's Alpha	Sig. (2-tailed)	No. of Survey Items
NPD performance	0.883	0.000	15
Socialization	0.813	0.000	5
Externalization	0.829	0.000	5
Combination	0.840	0.000	5
Internalization	0.849	0.000	5

Table 2 presents a summary of the correlations analysis results, where SOC refers to socialization, EXT refers to externalization, COM refers to combination and INT refers to internalization.

Table 2: Summary Of Correlations Analysis Results

Variables	NPD	SOC	EXT	COM	INT

NPD	**Pearson Correlation, R**	1	0.594*	0.510*	0.631*	0.513*
	Sig. (2-tailed)	-	0.000	0.000	0.000	0.000
	N	150	150	150	150	150

*significance $p < 0.001$

From the Table 2, it appears that all of the relationships are significant ($p < 0.001$). Table 3, Table 4, Table 5 and Table 6 present the individual correlations between the knowledge creation variables and NPD.

Table 3: Correlation Between Socialization And NPD

Variables	N	Pearson Correlation, *R*	Sig. (2-tailed)
Socialization versus NPD	150	0.594	0.000

From the Table 3, it appears that there is a significant correlation between socialization and NPD among Malaysian manufacturing firms ($R = 0.594$, $p < 0.001$). According to Nonaka et al. (2000), socialization involves the sharing of tacit knowledge and information among individuals in an organization. It is essential to disseminate tacit knowledge and transfer individual ideas/information directly to someone else in the organization so that a common organizational objective can be achieved by a team of individuals (Nonaka and Konno, 1998; Nonaka et al., 2000). This justifies the significance of the relationship between socialization and NPD, which normally involves the cross-functional collaboration and work of several individuals in an NPD project (Ng et al., 2010b; Ng and Jee, 2011b; Ng and Jee, 2012b). Thus, hypothesis 2 (*H2*) is not rejected.

Table 4: Correlation Between Externalization And NPD

Variables	N	Pearson Correlation, *R*	Sig. (2-tailed)
Externalization versus NPD	150	0.510	0.000

From the Table 4, there is a significant correlation between externalization and NPD among Malaysian manufacturing firms ($R = 0.510$, $p < 0.001$). Since externalization initiatives can be computerized for information gathering purposes to develop manuals and documents, it can be compatible with the NPD processes that often require systematic documentation for simplified understanding (Ng et al., 2009a; Ng et al., 2010a; Ng and Jee, 2011c; Nonaka and Konno, 1998; Nonaka et al., 2000). This rationalizes the significance of the relationship between externalization and NPD, thus allowing hypothesis 3 (*H3*) to be not rejected.

Table 5: Correlation Between Combination And NPD

Variables	N	Pearson Correlation, *R*	Sig. (2-tailed)
Combination versus NPD	150	0.631	0.000

Table 5 shows that there is a significant correlation between combination and NPD among Malaysian manufacturing firms ($R = 0.631$, $p < 0.001$). According to researchers, the knowledge combination process is one of the best ways to convert useful information into knowledge assets for the organization (Creplet et al., 2001; Rice and Rice, 2005). Combination is a process that allows a group of people to constitute knowledge owned by other groups of people (Garcia Muina et al., 2002). The preceding justifications give good reason for a significance to exist in the relationship between combination and NPD processes that often involve cross-functional teams and collaborative activities which require a blend of knowledge towards creative product development (Ng et al., 2010b; Ng and Jee, 2011a; Ng and Jee, 2012a; Ng and Jee, 2012b; Ng and Jee, 2012e; Ng et al., 2012). Thus, hypothesis 4 (*H4*) is not rejected.

Table 6: Correlation Between Internalization And NPD

Variables	N	Pearson Correlation, *R*	Sig. (2-tailed)
Internalization versus NPD	150	0.513	0.000

From the Table 6, there is a significant correlation between internalization and NPD among Malaysian manufacturing firms ($R = 0.513$, $p < 0.001$). Internalization involves the conversion of explicit knowledge into new tacit knowledge that can be used, integrated and transmitted continuously among individuals (Nonaka et al., 2000).

Internalization also creates operational knowledge (Engestrom, 1999), thus providing not only new knowledge for NPD purposes, but also a system of knowledge that can be easily accessed through procedures, operations and training (Ng and Anuar, 2011; Ng et al., 2009b; Ng et al., 2010d). This substantiates the significance of the relationship between internalization and NPD. Hence, hypothesis 5 (*H5*) is not rejected.

A multiple linear regression analysis was also carried out to test whether there is a significant statistical effect from knowledge creation (which comprises of socialization, externalization, combination and internalization) on NPD. Table 7 presents the model summary for the multiple linear regression analysis.

Table 7: Model Summary For Multiple Linear Regression Analysis

Model	*R*	*R* Square	Adjusted *R* Square	Std. Error of the Estimate

wledge creation and NPD	0.672*	0.452	0.448	0.349

*significance $p < 0.001$

According to the model summary, there is a significant correlation between knowledge creation and NPD ($R = 0.672$, $p < 0.001$). Based on the adjusted R^2 results, it was found that 44.8% of the variance in NPD can be explained by knowledge creation. The results clearly support the suggestion that the development of new and innovative products highly depends on the ability to consistently create knowledge (Madhavan and Grover, 1998; Ng et al., 2011a; Ng and Jee, 2012c; Schulze and Hoegl, 2006).

Besides that, the roles and practice of knowledge sharing cultures are also important factors that can harness knowledge creation for improved NPD because it can directly affect the work results of an NPD team (Hussock, 2009; Ng and Anuar, 2011; Ng and Jee, 2011b; Ng and Jee, 2013). It is important to also pay attention to knowledge sharing activities for improved understanding, sharing, knowledge creation and knowledge utilization to create value for an organization (Gold et al., 2001). The aforementioned rationalizations provide reason and sense to the regression results. Thus, hypothesis 1 (*H1*) is supported.

5. Conclusion

From the correlations analyses, it was found that every variable in the SECI model had a significant correlation with NPD. It was also observed from the multiple linear regression analysis that the effects of knowledge creation on NPD among Malaysian manufacturing firms were significant. Furthermore, 44.8% of the variance in NPD was explained by knowledge creation.

It was found that the correlation between knowledge creation and NPD was also higher than the other individual correlations that involve socialization, externalization, combination, internalization and NPD. This finding provides evidence that the SECI model can systematically and efficiently describe the creation of knowledge in NPD among Malaysian manufacturing firms as a whole entity. This understanding can be beneficial to manufacturing firms that require a specific guideline to potentially enhance the knowledge creation initiatives for improved NPD performance. This specific guideline can also provide firms with precursory evidence for them to know their level of competence in socialization, externalization, internalization and combination activities. By monitoring and gradually improving their level of competence in these activities, it is hoped that a significant enhancement can also be seen in their NPD performance.

The benefit of knowledge creation is in its communication, strategy, competition and resources advantage. Being competitive in cost and product differentiation helps firms deliver high quality products that exceed customer expectations and competitor growth. Also, with the appropriate strategy, internalizing knowledge can be accelerated to improve communication among firms and allow problems to be solved in easier and

more creative manners. With knowledge creation, improved communication mechanisms that reduce time and cost resources will allow firms to reduce the time for their products to penetrate the market of product.

One of the limitations of this study is in the sample size of the respondents that participated in this survey. Although the reliability of the data was high, this study only gives an approximate representation of the entire population of manufacturing firms in Malaysia. Due to the time constraint in completing this research project, only a sample size of 150 respondents was used for the data analyses. However, the significance of the results can still be used in future references for the benefit of other researchers who are studying the area of knowledge creation, knowledge management and NPD.

6. Future Research Recommendations

The limitations of this study can be solved by increasing the time frame for the survey and using a face-to-face interview method to gather more phenomenographical data on the hypotheses developed in this study. Also, a greater number of survey respondents can be considered if time permits. Face-to-face interviews which are qualitative by nature can enhance the quality of the data and reassure the reliability of the study. These additional steps will improve the generality of this study.

Also, the use of some descriptive analyses can be beneficial for this study. A frequency distribution for example can allow the arrangement of the data in groups so that the mean, maximum, minimum and range values can be analysed. Paired samples T-tests can also be conducted to investigate the effect of gender on the NPD performance for example. This will enrich the findings of this study as it interprets results using descriptive and inferential statistics.

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