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SUPPLIER'S CAPABILITIES AND ITS INFLUENCE ON COMPETITIVE ADVANTAGE IN AUTOMOTIVE INDUSTRY

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Abstract

In an increasingly competitive market place, manufacturers need to provide higher quality products at cheaper price and faster delivery. Besides that, rapid technology changes require greater supplier capabilities and more active manufacturer-supplier collaborations. However, many related studies do not support the proposition that firms could secure competitive advantage from the capabilities of their suppliers even though some technological and economic benefits have resulted from the manufacturer-suppliers collaborations in the new product development (NPD). This research examined the manufacturer-supplier's current collaboration practices in the NPD; the relationships between suppliers and their capabilities; and the extent of collaboration in NPD. In this research, a framework was designed to represent the flow of a supplier's capabilities and the collaboration in the NPD towards securing competitive advantage. To achieve these objectives, primary data from 117 survey samples who are Proton's suppliers were gathered and analysed. The results confirmed that a positive correlation exists between collaboration in NPD and Proton suppliers' capabilities. There is a positive and significant relationship that exists among the three supplier capabilities which are production, manufacturing, and research and development (R&D). Results from regression analyses also supported the idea that strategic alliances and technical collaborations have significantly affected the extent of competitive advantage. However, no impact on competitive advantage could be demonstrated from the suppliers' manufacturing capabilities based on cost, innovativeness and quality of competitiveness. This study has illustrated the indicators of competitive advantage of manufacturers and capabilities of suppliers but it can be extended and enriched by incorporating other dimensions.

***Keywords*:** Automotive industry, Product development, Supplier relations, Competitive advantage

1. Introduction

In today's global market and rapid economic growth, companies attempt to implement new programs and organizational structures to enhance their competitiveness. A successful NPD strategy involves the identification, development and exploitation of key resources that successful new products and sustainable competitive advantage derive from such exploitation of a firm's unique knowledge base (Jablokow and Booth, 2006; Sanongpong, 2009). In recent years, fast product development, which is an important factor

of competition, has become more significant for large manufacturers in industries such as automobile. So, automotive manufacturers rely on their suppliers to deliver defect free and high quality products, on time, and at competitive price. The competitiveness of an automobile producer is highly related to its supplier's capability (Takeishi, 2001). Takeishi (2001) explored how an automaker/firm could surpass others in handling the division of labor with a supplier in product development. Involving suppliers in new product development and making effective collaborative relationships with them bring many advantages to both parties (Petersen et al., 2005). By collaboration between two partners, better experience and targeted suggestions can result in improvement of design of parts, performance and entire products (Echtelt et al., 2008). It can be significantly beneficial for manufacturers to improve their performance in terms of enhancing new product design and product innovation so they considered supplier competencies and service provided in their relationships with suppliers (Goffin et al., 2006). The questions from above mentioned arise are what is the current collaborative practices in NPD and to what extend the suppliers' capability in NPD?

2. Literature

Previous researchers investigated different types of supplier capability. Most common capabilities that derived from their research are consist of manufacturing capability, technical capability and production capability. For example, Möller and Törronen in 2003, suggested factors of supplier capability include production, delivery performance, process improvement, innovativeness, information technology and customer understanding. Based on Oh and Rhee (2010), suppliers' capabilities contain R&D capability and production capability that influences the quality level of a car. Later in 2011, Wu and his colleagues evaluated the supplier capability variables of quality, due dates, innovativeness, flexibility and cost.

The above mentioned capabilities can be subdivide into different factors which impact on collaboration in new car development that positively results in the competitive advantage of carmakers. For example, production capability operations strategy can be subdivided into dependability improvement, cost reduction, quality improvement and flexibility, and R&D capability into engineering, design and modularization capabilities (Oh and Rhee, 2010). In addition, based on Squire et al. (2009) suggestion, responsiveness, flexibility and modularity are three manufacturing capabilities of supplier which have a direct effect on buyer firm performance as measured by levels of customer responsiveness. Oh and Rhee (2010) referred collaboration in new car development to the active involvement of suppliers in new car development from a very early stage in an effort to improve quality and reduce development time and expenses. Regarding competitive advantage, previous researchers had measure it based on different factors. Feng et al. (2010) used cost leadership, product quality, delivery reliability, process flexibility, and customer service as a dimension of competitive advantage. Oh and Rhee (2010) operationalized the construct of competitive advantage by evaluating a operational performance of carmaker with regards to cost and quality competitiveness, customer satisfaction and product diversity. Wu et al. (2011) categorized variables of competition to five variables as flexibility of products, innovativeness, lowering cost of production, delivery performance and quality of product. Other scholars have different ideas on which to consider as competition variables.

As mentioned in the above discussions, the competitiveness of a manufacturer is highly related to its supplier's capability. Therefore the capability of a supplier will have a positive influence on the manufacturer's competitive advantage. In addition, studies highlighted in the literature did not only support the proposition that firms could secure competitive advantage from the capabilities of their suppliers but some technological and economic benefits had been shown to have resulted from the manufacturer-suppliers collaborations in the NPD. Therefore, as illustrated in Figure 1 a framework had been designed which represents the flows of supplier's capabilities and collaboration in the NPD towards securing competitive advantage.

The framework developed based on three conceptual frameworks adapted from (Wu et al. (2011), Oh and Rhee (2010), Feng et al. (2010). The Figure 1 represent the framework for this study showing supplier capabilities as independent variable on the left which subdivided into production capability and R&D capability (Oh and Rhee, 2010), manufacturing capability (Squire et al., 2009), collaboration in new product development as a mediator and competitive advantage as dependent variable on the right that is consists of cost, quality, delivery, time to market and innovation (Li et al., 2006).

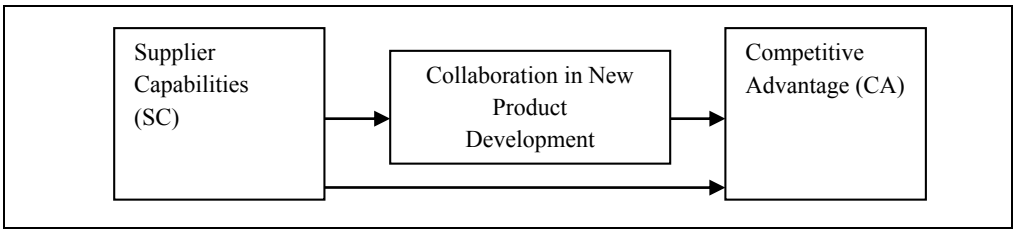

***Figure 1**: Research Framework*

3. Methodology

The survey questions were designed to measure each of the dimensions of three variables and combines validated measures of constructs used in previous studies. The questionnaire consists of four sections (A, B, C and Section D) with a total of 88 items using the 5- point Likert scale. The survey items which were adapted and adopted from the previous studies and sources of references are listed in Table 1.

Dimension	Variable	Item No.	Sources of References	Dimension	Variable	Item No.	Sources of References
A. Supplier capability				**B. Collaboration in NPD**	1.Communication 2.Concept 3.Design	(12 items)	*Oh and Rhee, 2010*
A.1 Production capability	1.Quality 2.Cost 3.Dependabilitu 4.Flexibility	(17 items)	*Wu et al., 2011* *Oh and Rhee, 2010* *Feng et al., 2010*		4.Development 5.Material 6.Technology 7.Process 8.Concurent 9.Cost		*Squire et al., 2009* *Oh and Rhee, 2008*
A.2 Manufacturing capability	1. Flexibility 2.Responsiveness 3.Modularity	(12 items)	*Squire et al., 2009*	**C. Competitive advantage**	1.Quality 2.Cost 3.Process flexibility 4.Delevery	(23 items)	*Wu et al., 2011* *Oh and Rhee, 2010*
A.3 R&D capability	1.Engeenering						

	2.Design 3. Modularity	(17 items)	*Oh and Rhee, 2010* *Oh and Rhee, 2008*		5.Innovativeness		*Feng et al., 2010* *Li et al., 2006*

***Table 1**: Questionnaire design and source of reference*

In order to achieve the objective, the Malaysian Proton automotive suppliers are selected as the population of this study. A total numbers 197 of suppliers were considered. The sampling units consist of managers whom were involved in manufacturing department and new product development team. A random sampling strategy was applied that assures each element in the population has the equal chance of being included in the sample.

This study mainly stands from the manufacturer's point in understanding the influence of supplier's capability and collaboration in NPD on a firm's competitive advantage. Therefore, to fill-in the questionnaire each supplier's firm was considered. Two ways were used to distribute the questionnaire. One was doing the paper format and it was distributed to the suppliers firm during manufacturers' briefing which holding every month and asked them to fill it and return it back. The other way was the digital format which mailed the questionnaire and asked the respondents to email them back. During this way follow ups was done by phone to make sure whether they have received it or not. However, the low response rate (5% or 7/130) through email forced the study to administer the distribution of questionnaire set by hand.

4. Findings and Discussions

Total of 130 questionnaires were given out and 117 were returned. The final response rate was 77%. The statistical distribution of general information of the responsive questionnaires is summarized in Table 2 which indicates that 52% of companies are local owned, 43% has more than 300 employees, 39% of respondents have more than 10 years working experience, 58% of the sample, is firms with 50% local and 50% imported machinery. It can also be found that 48% (nearly half) of respondents were holding other positions which most of them include sales and manufacturing managers. In addition, majority (86%) of companies conformed to the ISO/TS 16949 standard and a high majority (89%) are 5s certified.

Item	Category	Sample	Ratio	Item	Category	Sample	Ratio
Owner ship Type	Local	61	52%	Standard	ISO 9001-2008	47	40%
	Foreign	26	22%		ISO 14001	60	51%
	Shared venture	30	25%		ISO/TS 16949	101	86%
					OHSAS 18001	30	25%
					Others	2	1%
Number of Employees	Less than 100	27	23%	Designation	General manager	26	22%
	100-200	25	21%		Vice general	24	20%
	200-300	14	11%		Manager/Assistant manager		
	More than 300	51	43%		Quality assurance manager	8	6%
					Expert of engineering	2	1%
					Others	57	48%
Years of Working Experience	1-2 years	22	18%	Quality Approach	TQM	49	41.8%
	3-4 years	16	13%		QFD	8	6.8%
	5-9 years	33	28%		5S	105	89.7%
	More than 10 years	46	39%		FMEA	89	76.1%

					Six sigma TPM Lean Q7	24 46 57 3	20.5% 39.3% 48.7% 2.6%
Machinery Type	Local (100%) Imported (100%) Local (50%), Imported (50%) Other	3 44 68 2	2.5% 37% 58% 1%				

***Table 2**: Summary of statistical distribution of general information of questionnaire (n=117)*

Supplier Capability

The factor analysis result of supplier capability is detailed in Table 3 after excluding 14 items (PC3, PC8, MC1, MC7, MC8, RDC1, RDC3, RDC4, RDC5, RDC6, RDC7, RDC8, RDC15, RDC16) failed to meet the above requirements with a varimax rotation used in this research, 32 items were left and three major factors (i.e. production capability, manufacturing capability and R&D capability) with factor loadings greater than 0.6 were extracted which indicates the three factors can well explain the total variance within the original set of variables.

Variable No.	Factor/Variable	Factor Loading	Variable No.	Factor/Variable	Factor Loading
	Factor 1. Production Capability		MC9	Having products with interchangeable features and options	.792
PC1	Improve product quality	.726			
PC2	Low warranty claim from market	.704			
PC4	Offer very durable products	.750	MC10	Having options that can be added to a standard product	.806
PC5	Reduction in cost through process innovations	.711			
PC6	Reduce production cycle time	.672	MC11	Sharing components across products	.840
PC7	Reduce inventory expenses	.731			
PC9	Good reliability of product delivery	.803	MC12	Designing new product features within a standard base unit	.767
PC10	Timely delivery of goods	.700			
PC11	High delivery compliance	.720		**Factor 3.R&D Capability**	
PC12	Accuracy in due date in order to deliver product	.789	R&DC2	Developing materials for new parts	.753
PC13	Cooperate to shorten the purchasing cycle	.749	R&DC9	New design technologies	.779
PC14	Response to delivery schedule changes	.818	R&DC10	Integrate various parts into one (modular)	.760
PC15	Response to delivery quantity changes by customer	.811			
PC16	Responding to emergency orders	.821	R&DC11	Making parts for common uses (part communization	.766
PC17	Capability in manufacturing diverse products	.679	R&DC12	Utilizing electronic devices	.664
			R&DC13	Assemble modules	.900
	Factor 2.Manufacturing Capability		R&DC14	Just-in-sequence (JIS) provisions of modules or subsystems	.774
MC2	Quality vary with increases or decreases in supply volume	.705			
MC3	Prices per unit vary with increases or decreases in supply mix	.790	R&DC16	Manufacturing various modules or subsystems	.781
MC4	Quality vary with increases or decreases in supply mix	.740			
MC5	Quick response to enquiries and problems	.755			
MC6	Quick response to changes in products and services	.745			

Table 3: Summary of factor analysis of supplier capability

Collaboration in NPD

Table 4 shows the summary of factor analysis result of collaboration in NPD. After deleting the one item (CNP5) that had factor loading less than 0.6, two factors (i.e. technical cooperation and strategic Alliance) were extracted.

Variable No.	Factor/Variable	Factor Loading	Variabl No.	Factor/Variable	Factor Loading
	Factor1: Technical Collaboration			**Factor2: Process Flexibility**	
CNPD7	Developing new materials	.886	CA12	Lowering manufacturing	.784
CNPD 8	Developing part-related new technology	.881	CA16	cost	.790
CNPD 9	Developing process-related new technology		CA19	Provide customized products	.729
	Concurrent engineering	.862	CA20	Deliver product to market	.633
CNPD 10	Value analysis, value engineering		CA21	quickly	.646
CNPD 11	Establish target cost	.812	CA22	Introducing new products	.649
CNPD12	**Factor2: Strategic Alliance**	.605	CA23	Time-to-market	.648
	High level of corporate communication on			Fast product development	
CNPD1	important issues			React on rapid changes on	
	On-line system linkages	.721	CA15	design	.834
CNPD2	Frequent face-to-face communication			**Factor3: Innovativeness**	
CNPD3	Communicate from design concept stage	.653	CA17	Meeting customer quantity	.846
CNPD4	during development of new product	.760		requirement	
	Involve in new product development after	.799	CA18	Review product offerings to	.803
CNPD6	design is freeze	.636		meet client needs	
	Factor1: Quality			Respond well to customer	
	Maintain the stability of product quality		CA4	demand for "new" features	.716
CA1	Increase quality competitiveness of a new car	.624	CA9	**Factor 4:Cost**	.698
CA2	Increase quality competitiveness of a mass-	.718	CA10	Increase cost	.835
	produces car	.618		competitiveness	
CA3	Compete based on good quality product	.685		Offer competitive prices	
CA5	Offer highly reliable products	.739		Offer lower prices	
CA6	Offer very durable products	.740			
CA7	Offer high quality product	.753			
CA8		.598			

Table 4: Summary of factor analysis of collaboration in NPD

Competitive Advantages

The result of the summary of factor analysis of competitive advantage is also summarized in Table 5. After one item (CA11) was omitted, four factors were obtained in turn reflecting quality, process flexibility, innovation and cost.

This study applied Cronbach's alpha to verify the consistency of the scale. According to Nunnally's point of view a score more than 0.7 is considered reliable. Because the Cronbach's a of this study's supplier capability, collaboration in NPD and competitive advantage are all more than 0.7, it is clear that they are consistently reliable.

Correlation Analysis of Supplier Capability and Collaboration in NPD

This study applied Pearson's correlation analysis to discuss the correlation of supplier capability (production capability, manufacturing capability and R&D capability) and collaboration in NPD (technical cooperation and strategic alliance). The relevant matrix is shown in Table 5.

	Supplier Capability		
Collaboration in NPD	Production	Manufacturing	R&D
Technical collaboration	.468**	.485**	.499**
Strategic alliance	.431**	.441**	.616**

Table 5: Correlation analysis of supplier capability and collaboration in NPD
**Correlation is significant at the 0.01 level (2-tailed).

As indicated in Table 5, the production capability (r=0.468, P<0.01), manufacturing capability (r=0.485, P<0.01) and R&D capability (r=0.499, P<0.01) of supplier capability have positive correlation with technical collaboration. From the above, all three capabilities have moderate positive relation with technical alliance Also, the production capability (r=0.431, <0.01), manufacturing capability (r=0.441, P<0.01) and R&D capability (r=0.616, P<0.01) of supplier capability have positive correlation with strategic alliance. Summarizing the above, supplier capability has a positive correlation with all factors of collaboration in NPD. This indicates that supplier capability has a positive correlation with collaboration in NPD. Therefore, this supports the hypothesis 1 (H1) of this study.

5. Conclusion

This study was able to verify that having effective collaborative relationships such as suppliers' involvement at various decision making stages had supported Proton to enrich its resources and strengthen company's capacity in developing new product and thus enhance its competitive advantages (Wu et al., 2011). Furthermore, the extent of supplier capability is measured in three aspects: The Production Capability (PC); The Manufacturing Capability (MC); and The Research and Development Capability (R&DC). Results had shown that the Production Capability (PC) had a strong and positive correlation with R&D Capability (R&DC) compared to a positive but moderate correlation between PC with Manufacturing Capability (MC), as well as MC with R&DC. Therefore, this study concluded that there was a significant correlation among PC, MC, and R&DC.

This study discovered a positive and significant relationship exists among the three supplier capabilities. It also showed that the stronger and positive relationship exists between production capability and R&D capability. In a situation where an advanced manufacturing technology is at the introductory stage, the R&DC appeared to be important.

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