

# SUPPLIER ASSESSMENT FOR COMPOSITES' PRODUCT-BASED MANUFACTURERS: CASE STUDY

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**ABSTRACT:** *Supplier assessment as a method to company for choosing the potential supplier; it is important decision makings in business operation. This paper examines the similarities and differences of supplier assessment methodology on four selected companies which involved in composites products and manufacturing. The data collections consist of semi-structured interview with supply chain personnel, documentation review and observation. The findings show that effective supplier assessment is not easy to achieve and it takes knowledge or an organization's goals, supply base, business processes, and structure. Besides, the study identified that different companies (same business nature but different product) have their own ways in selecting out the main criteria in supplier assessment that in line with their business strategy. The results can be used as reference to the others companies to restructure their supplier assessment focusing on the main criteria based on their business objective.*

**KEYWORDS:** Supplier Assessment, Composite's Product-Based Manufacturers, Case Study

## 1.0 INTRODUCTION

Supplier assessment increasingly recognized as a critical factor in supply chain management in manufacturing industries. It is a method to company for selecting the potential supplier, there are four main criteria contained in the supplier assessment, commonly discussed by the researchers as "delivery", "quality", "cost", and "services"[1]. While researchers [2] find that "quality", "cost" and "on-time delivery" are the three most important criteria in supplier assessment. Each of the criteria set out by the researcher is important to ensure that the supplier is able to meet the requirement of the company. A good coordination between the supplier and the manufacturer can produce a balance in supply chain management to ensure the company is able to compete with other companies. Failure of coordination results in excessive delays, poor-quality product and ultimately leads to poor customer services [3]. As stated by researcher [4], having known the necessity to higher manage the supplier selection method, the companies acknowledge the requirement for a scientific and a sound approach to avoid the results of poor choices on the supplier selection. However, the selection of potential suppliers is not a simple matter because of the fact that various criteria must be considered in the decision-making process. Hence the supplier assessment criteria should take the critical factors like or an organization's goals, supply base, business processes, and structure. In order to reflect the needs of the company, its supply and its technology strategy, each criteria and measures are developed to be applicable to all suppliers; those being considered. Converting the needs into useful criteria is not an easy work since criteria are commonly understood as the specific requirements that can be quantitatively measured while needs is usually explained as general qualitative concepts. To make sure the criteria is practical to use, the company can set the measures while developing the selection criteria for supplier assessment [3]. The supplier assessment is nurturing dominance in research areas. Several studies have been done by researcher to select the best criteria based on industrial business nature. In spite of the importance of supplier assessment criteria only a few

articles have addressed the decision making. Researchers [8] stated ten collaborative criteria in his study that included quality, delivery, price, innovation level, commercial awareness, production flexibility, level of technological culture, ease of communication, and current reputation. This case study has been done at consumer products manufacturing using case-based reasoning method for evaluating the supplier. Researchers [9] identified four main criteria in supplier selection, which are quality, delivery, price and quantity. These criteria have been applied in the agriculture industry in Korea using mixed integer linear programming during process of evaluating supplier refer to this four main criteria. Researchers [10] conclude that the provided faster delivery, improved quality, and reduced cost as criteria in the ultimate goal of supplier selection in order to improve the competitiveness in the market. The other criteria, such as customer service, finance, production capacity and distance included in other criteria listed by Yang and Chen in the case study at computer manufacturing. Researcher [11] listed the quality, delivery, price, lead time, technology and service as the criteria that help decision making in selecting the potential supplier. Researchers [12] presented six main criteria that suit individual firm strategies in his case study on IT hardware manufacturing; which is quality, cost, delivery, organizational culture and strategy, technical, and capacity. These empirical researches revealed that quality, delivery, cost and service is the most important criteria used in evaluating potential supplier. Researchers [13] mention that many firms focused on quality, delivery, price, and service as the main factors on the performance of all supply sources in evaluating supplier. Based on these multiple criteria decision making, it is proved that the traditional single criteria with only consider financial measures is not supportive and robust enough in modern-day supply management. Relying on traditional single criteria make the supplier selection process becomes more risky because of customer-oriented criteria (quality, delivery, service and so on) was not measured [8]. Researchers [14] stated that the purpose of selecting the right criteria in supplier selection is to maximize overall value to the buyer,

reduce purchase risk and develop the long term buyer-supplier's relationships. Composite industry in Malaysia is growing rapidly nowadays. Therefore measures the precise selection of suppliers able to provide benefits to a company. The relevant criteria have been set by a company to ensure that suppliers are able to meet their needs. Good relationships between suppliers and manufacturers through supply chain management a good impact on an industry. The paper is to reveal assessment of supplier methodology by Malaysian composite manufacturing organizations decide on the potential supplier and the key criteria that have been used in the selection.

## 2.0 RESEARCH METHOD

The main purpose of the research is to investigate more about supplier assessment criteria based on composites manufacturing. This research is included the quantitative analysis, where the researchers able to study the evaluation process through real setting. The concept of similarity and differentiation has been applied in this research for finding the actual data for top criteria in supplier assessment in composites manufacturing in Malaysia. The case study was conducted in June 2014 at four composites manufacturer in Malaysia for data collection. Data were collected through the semi-structured interviews with supply chain personnel, documentation review and observation which focused on supplier assessment methodology including the criteria, emphasis and implementation.

## 3.0 CASE STUDY

The aim of the study was to extend existing concepts and understandings within the field of criterion on supplier assessment. Four companies were intensely investigated. However, for discussion the companies are addressed as 'Company A', 'Company B', 'Company C' and 'Company D' to disclosure the private information for privacy and confidentiality. The following will explain the companies under study and their criteria on supplier assessment approach as a result of the case study.

### Case Study Companies

There are four composite companies involved in this case study; first, Company A, located in Kedah, Malaysia. This company was formed in 1998 is a Joint Venture (JV) company between the Boeing Company and Hexcel Corporation for composites fabrication and minor parts assembly has about 950 employees with factory footprint 440,000 ft<sup>2</sup>. A manufacturer of flat and contoured primary (Aileron Skins, Spoilers & Spars) and secondary (Flat Panels, Leading Edges, Trailing Edges & MISC: Components) structure composite bond assemblies and sub-assemblies for aerospace industries. Second, Company B established in 1997. This company which located in Batu Berendam Airport, Malacca, Malaysia is a JV company between Germany and Malaysia. Manufacture the dome, racing yachts and power boats also experienced in the aircraft and automotive industry, environmental industry, and the use of composites in architecture and building construction. Third, Company C is a JV Company between RPC Company located in Australia. This company was established in 2013 and stated in Krubong Industrial Park

Malacca, Malaysia. There about 25 employees with factory footprint 68,000 ft<sup>2</sup> and expertise in manufacturing structural composite product, ballistic protection products and fire protection products. This company undertakes the function of product design, pattern making, material procurement, process engineering, quality control, logistics, and manufacturing. Fourth, Company D was incorporated on 20 November 1990 and located in Composites Technology City in Batu Berendam, Melaka, Malaysia. This company runs the manufacturing of composite aero structures also providing other services such as engineering design, composites assemblies and R&D, automotive composites structures and for military defence related equipment. There are more than 1200 employees in the company.

### Supplier Assessment Criteria

#### Company A

Three main criteria were measured in this company to their supplier in supplier assessment. First, time delivery where the percentage based on purchase order delivered on time over the evaluation period. The second, quality acceptance, the percentage of acceptance at incoming inspection will be based on the number of lot accepted and total lots received from the respective supplier for 3 month period. Third, general performance where it divides by four criteria; timely communication and responsiveness is referring to supplier response to SCAR (supplier corrective action request) in 10 working days and supplier response to incomplete information or documentation or issues arise at receiving inspection. The management scheduling is referring to effectiveness of supplier scheduling in meeting purchase order requirements date within agreed standard lead-time. The developmental as a business partner is referred to evaluate on a quarterly basis, the effectiveness of cost control for programs in place and/ or future.

#### Company B

Four main criteria are measured in supplier assessment; quality, delivery performance, cost and service. Every criterion will be added the sub criteria, for quality there are eight sub-criteria that included various aspects such as quality system and quality on responsiveness. Seven sub-criteria added for delivery that covered all aspects starting from submission purchase order into received a product from suppliers. Four sub-criteria listed in the service, such as assigning personnel to monitor or help this company react in critical issue, accuracy in invoicing and delivery order. The most important criteria for this company is cost, which listed eight sub-criteria for the selection of potential suppliers such as participate in price locking and fluctuated commodities via blanket purchase order or partial delivery and absorb liabilities on commodities.

#### Company C

There are six measurements for supplier assessment in Company C. First, "quality", which the requirement for their supplier and emphasizes their supplier in system ISO that included QMS from supplier quality department. Second, "price or cost", it computes all the direct cost, like the purchase price (the lowest cost bidding), the transport cost and also including term of payment from the supplier. Third "delivery performance" it describes the efficiency rate of

business operations when preparing and delivering an order, including procedures used to receive orders from the supplier and the time necessary to deliver the goods or services to meet expectations lead time. Fourth, “production capacity”, supplier schedules for production of the goods or services necessary to fulfil the orders. Fifth, “attitude” tolerance between supplier and customer is important to achieve a good relationship. Last criteria, “service”, quick response to all inquiries and requests, handle complaints efficiently (NCR), follow the instructions regarding invoicing, packaging and shipping note.

#### Company D

Supplier in Company D is divided into 3 main types; custom suppliers (such as honeycomb, metallic/ subcontracted parts, tooling etc.), off the shelf supplier (such as prepreg, chemical, indirect materials, AGS, gas, packaging etc.), and services suppliers (such as a forwarder, testing, etc.). Quality performance, delivery, cost and service are the main element that will be measured in the supplier assessment rating system. Quality performance is based on lot acceptance rate (LAR) and written report. LAR is calculated on the basis of the total amount of goods inspected in a given fiscal month. This calculation is then normalized to reflect a constant basis of the one hundred units received. Meanwhile, the written report category system rates supplier on the number of non-conformance report (NCR) issued and NCR includes Goods Discrepancy Report (GDR), Service Discrepancy Report (SDR) and SCAR. Delivery performance is calculated based on the shipment by suppliers. The service category is determined on the basis of timely and accurate response to quality issues through NCR, external document distribution, PO acceptance and performance report. For forwarder and testing supplier, the companies will be added on email response.

#### 4.0 DISCUSSION

Criteria of supplier assessment information have been collected from four different companies with the same nature of business; which is composites products and manufacturing. The information gathered by semi structured interviews, documentation review and observation later been simplified in-term of weightage. This data presented in Table 1.

This study demonstrates the supplier assessment criteria in Malaysian composites manufacturing companies. Table 1 shown all companies; Company A, B, C, and D picked two crucial criteria in the supplier assessment, although they have differences in weightage; those are quality and delivery. On the other hand, Company B, C, and D put the concern on another two criteria in the assessment; Price/Cost as well as Service. Company A did not list Price/Cost and Service in the supplier assessment criteria since it is a JV based company. Thus the Price/Cost and service will not cause an issue to this company. From Table 1, Company D

**Table 1: Supplier Assessment Criteria (weightage, total=1)**

Criteria	Company			
	A	B	C	D
Quality	0.3	0.2	0.25	0.4
Delivery	0.3	0.25	0.3	0.3
Price/Cost	-	0.35	0.3	0.2
Service	-	0.2	0.13	0.1
Production Capacity	-	-	0.01	-
Attitude	-	-	0.01	-
Timely communication and responsiveness	0.1	-	-	-
Percentage of part rejection claim from production	0.1	-	-	-
Management scheduling	0.1	-	-	-
Developmental as business Partner	0.1	-	-	-

put the highest weightage; 0.4 on quality, followed by Company A with a weightage of 0.3. The rest weightage on quality are 0.25 and 0.2 with respect to Company C and B. Both Company A and D focuses on quality because the nature of business is manufacturing of aero composite components. The type of composites used in spacecraft manufacturing is a “pre-preg” type; where quality is an important subject. “Pre-preg” is a term for “pre-impregnated” composite fibres. These usually take the form of a weave or are uni-directional. Compared to Company B and C, they produce different type of composite; which is the Matrix and Reinforce Material where quality of raw material is not a critical point.

With refer to the weightage values on the delivery criteria, it can be clearly seen that all those four companies put an almost same weightage average of 0.3. It is clearly shown that delivery is a crucial criterion for the continuity of the production. The delivery performance becomes an important criterion as outsourcing activities has been increased [5]. The goal is to manage and pay attention to every task across the whole process chain to deliver goods and services as efficient as possible. Both Company B and C put the highest concentration on price in selecting potential suppliers with a weightage of 0.35 and 0.3 respectively. This is because both developing companies need to make the most informed decision to strive for a balance between lowering costs and rising profits, rather than only focusing on quality. As time goes and the trade grows, companies are urged to reduce the cost and development time of a new product to be competitive in an increasingly open and global market place [6]. Thus companies have to take every possible factor into consideration in making the strategic decision to minimize costs and product development time. So, reducing costs in purchasing raw materials is also a critical factor for supplier assessment to ensure that both Company B and C remain competitive in this globalization trade. As compared to Company A and D, price seems to be not a critical factor in assessing their supplier since both companies are fully established and the main objective is to ensure that the goods produced are high in quality; with a high grade raw materials

purchased. There are only three companies; Company B, C and D have listed service as one of the criteria to be assessed in selecting suppliers. Company B with a weightage of 2.0 on service criteria, while Company C and D weigh this criterion less than 1.5; clearly shows that even though the service is not as crucial as another three criteria; quality, cost and delivery, but it still one of the important factors to be considered in making the best decision, as well as gaining some advantages from suppliers. Service can be divided into three sections; pre-transactions elements, transaction and post-transaction. A pre-transaction element of customer service is more on company policy such as accessibility, organization structure. While transaction elements mean supplier involvement in providing a good order status, order cycle time, inventory availability. For post-transaction elements of customer service included generally supportive of the product or raw material such as warranty, parts and repair service, customer complaints and claim [7]. Good service provided by suppliers will enhance an effective supply chain management between supplier and manufacturer.

## 6.0 CONCLUSION

In the nutshell, this study has proven that the main criteria quality, delivery, cost and service in supplier assessment can assist the industrial decision making in the selection of potential suppliers. Besides, the pre-measure or assessment is able to encourage the industrial third parties to improve the supplier overall performance. Base on this case study, quality has considered the major items in selecting a supplier followed by delivery and cost. Services are also able to be considered as a measurement criteria to enhance the commitment of the supplier. However, the weighting of the criteria is different and can be based on the nature of the business strategy. Cost effectiveness can be achieved when the company has mutual investment with suppliers.

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## REFERENCES

- 1 D. R. Krause, T. V. Scannell, Supplier Development Practices: Product and Service Based Industry Comparisons, *Journal of Supply Chain Management*, **38**(2)13-21, 2002.
- 2 C. Muralidharan, N. Anantharaman, S. G. Deshmukh, "A Multi-Criteria Group Decision Making Model for Supplier Rating, *Journal of Supply Chain Management*,**38**(4),22-33, 2002.

- 3 B. Pang, Assessment of Supplier Performance Based on TFN-AHP Method, in Proc 4th International Conference on Wireless Communications, Networking and Mobile Computing, WiCOM'08, 1-4, 2008.
- 4 E. E. Karsak, and M. Dursun, An integrated supplier selection methodology incorporating QFD and DEA with imprecise data, *Journal Expert Systems with Applications*, **41**, 2014.
- 5 R. Ernst, B. Kamrad, K. Ord, Delivery performance in vendor selection decisions, *European Journal of Operational Research*, **1176** (1),534-541, 2007.
- 6 T. N. Wong, L.H. Lee, Z. Sun, CSR and Environmental Criteria in Supplier Selection, *Proceedings of the Asia Pacific Industrial Engineering & Management Systems Conference*, 2012
- 7 M. Christopher, Logistics and Supply Chain Management: Creating value adding Networks, *3<sup>rd</sup> Edition, Great Britain: FT Prentice Hall*, 2005.
- 8 K.L. Choy, W.B. Lee, and V. Lo, A knowledge-based supplier intelligence retrieval system for outsource manufacturing, *Knowledge-Based Systems*, **18**(1), 1-17, 2005.
- 9 G. H. Hong, S.C. Park, D.S. Jang, H.M. Rho, An effective supplier selection method for constructing a competitive supply-relationship, *Expert Systems with Applications*, **28**(4), 629-693, 2005.
- 10 C. C. Yang, B.S. Chen, Supplier selection using combined analytical hierarchy process and grey relational analysis, *Journal of Manufacturing Technology Management*, **17**(7),926-941, 2006.
- 11 J Seydel, Data envelopment analysis for decision support, *Industrial Management and Data Systems*, **106**(1), 81-95, 2006.
- 12 S.Y.Chou, and Y.H. Chang, A decision support system for supplier selection based on a strategy aligned fuzzy SMART approach, *Expert Systems with Applications*, **34**(4), 2241-2253, 2008.
- 13 SH Ha and R Krishnan, A hybrid approach to supplier selection for the maintenance of a competitive supply chain, *Expert Systems with Applications*, **34**(2), 1303-1311, 2008.
- 14 C.T. Chen, C.T. Lin, and S.F. Huang, A fuzzy approach for supplier evaluation and selection in supply chain management, *International journal of production economics*, **102**(1), 289-301, 2006.