982

Int. J Sup. Chain. Mgt   Vol. 8, No. 3, June 2019

Investigation of Supplier Selection Criteria that Leads to Buyer-Supplier Long Term Relationship for Semiconductor Industry

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Abstract— **Selecting the right supplier has been the greatest challenge in supply chain management (SCM) in many industries. Large spool of suppliers in industry and diversity of purchasing scope causes a wide variety of supplier selection criteria. The right strategy in fixing the criteria for supplier selection is crucial, to ensure smooth supply chain operation. It is believed that in SCM, a good relationship with suppliers will further benefit the operations of both buyers and suppliers. This research attempts to investigate the supplier selection criteria that leads to buyer-supplier long term relationship, especially for the semiconductor industry in Penang, Malaysia. In this study, the focus is to identify the critical supplier selection criteria such as supplier quality, performance delivery, supply service, cost and estimate their influence towards buyer's satisfaction which later on, narrate a path for a buyer-supplier long term relationship. Two hundred eighty-eight respondents with a minimum one year of working experience in handling suppliers in the semiconductor industry in Penang, Malaysia, participated in this research. Smart PLS was used to conduct hypotheses testing while confirming the validity and reliability of the data collected from the survey. The finding of this research shows that supplier quality, performance delivery, and supply service criteria are significant for the buyer-supplier long term relationship. The outcome of this research will help semiconductor companies to have a set of best criteria for supplier selection. Later, it could help them establish long term relationship with the supplier to benefit their supply chain operations, and at the same time ensuring the growth, survival and sustainability of their supplier business.**

Keywords— *Supplier selection criteria, Semiconductor industry, Buyers Satisfaction, Buyer-supplier long term relationship, Malaysia*

1. Introduction

The semiconductor industry in Penang is among one of the supply chain industry that deals with various suppliers for materials and services. Managing such industry in today's competitive business world is an ultimate challenge which contains several tasks planning, selections criteria, decision makings and operation executions. Among the list mentioned, procurement of supplier is one of the critical agendas in operating a semiconductor business. Suppliers in the semiconductor industry play a role in all inputs of the processes, manufacturing flow and its final deliverables. They can be varied from the source of raw materials, machine makers, machine maintenance, service providers, accreditation lab support, final product assembly and as well as logistics delivery. Selection of right supplier dictates the success of the business, as they have significant contribution in every single phase of the process in the semiconductor industry from the beginning of the process till the final product delivery to end customers. Therefore, selecting the right suppliers will increase customer satisfaction and brings significant benefits to businesses [1].

In the semiconductor industry, sourcing supplier for a repeat purchase items even for suppliers who are already in company's preferred supplier list is one of the critical activities in order to ensure the productivity in the production line is not impacted. However, the failure to source a right supplier, mainly for repeat purchase items, will cause the company to implement change management in order to source a new supplier. The implementation of change management requires enormous efforts,

983

Int. J Sup. Chain. Mgt   Vol. 8, No. 3, June 2019

resources, time, and cost. Besides, change management will also impact the reputation of the company in the view of their final customers. Hence the procurement team responsibility is undoubtedly critical in the supply chain of the semiconductor industry. The objective of supplier selection is to choose the best supplier, who can offer the best value for the client, reliable and can provide the reasonable terms [2]. If the quality of the supplier's selection process is high, the quality of the selected suppliers also will become amazing [3]. Hence, it is essential to implement structured approaches to select suppliers who adequately meet the firms' requirements [4]. However, to identify the selection method that satisfies all the critical selection criteria is a challenge, especially for the semiconductor industry.

Selecting the right suppliers, according to Lin et al. [1], will increase customer satisfaction. However, the level of satisfaction and its force to lead the buyer-supplier long-term relationship is uncertain in the semiconductor industry due to the lack of structured criteria in selecting suppliers. According to Ellram [5], buyers tend to choose closer relationships with the supplier when they wish to control the reliability of supply or influence supplier quality and delivery schedules. Suppliers may be also inspired when they seek to secure long-term relationship, reliable markets, or to influence customer quality [4].

However, in semiconductor industries today, the high business competitions lead to the existence of many suppliers around the globe who provides the same scope of products and services. Procurement responsibility becomes heavier in identifying and selecting the best supplier who can meet their requirement and sustain for the long term. The research objective of this study is mainly to investigate the supplier selection criteria and estimate their influence towards buyer's satisfaction which later on, narrate a path for buyer-supplier long term relationship for the semiconductor industry in Penang. The investigation will focus on existing suppliers who are already in the company's preferred supplier list and asses the selection criteria for mainly repeating purchase items. The selection criteria for the known suppliers will be assessed whether its results satisfaction among the buyers and also to assess whether it leads to buyer-supplier long term relationship.

2. Hypothesis Development

Although the supplier selection has become a strategic issue for some organisation [6], the outcomes, however, will bring benefits to the organisation and increases the level of customer satisfaction [1]. Good level of satisfaction will lead to long term buyer-supplier relationships, which is the success of the supply chain in any industry [4]. This statement is supported by a study conducted by Harland [7], which says that the management of buyer-supplier relationships is central to the success of supply chain management in firms. However, reviews of literature in supplier selection indicate a substantial diversity in the systemic approaches in supplier selection methodology [8] as well as in supplier selection criteria [9]. In order to select the best suppliers, it is necessary to make a trade-off between all diversity criteria. In this study, the focus is to identify the critical supplier selection criteria especially for suppliers who are already in company's preferred supplier list and estimate their influence towards buyer's satisfaction which later on, narrate a path for a buyer-supplier long term relationship. It is not easy to mention any specific theory to cater for supplier selection.

There are four independent variables in this research, namely supplier quality (SQ), performance delivery (PD), supply service (SS) and cost. The first variable, supplier quality, point out to supplier quality, which is a competitive tool that provides a significant contribution to the supplier organization. Supplier quality is the level to which buyers' requests have been fulfilled. The quality products or services supplied by the supplier are discussed when both supplier and buyer agree on requirements, and these requirements are met [10]. The second variable, performance delivery, refers to the certainty of the right product delivered at the right time in the right quantity. Performance delivery describes the efficiency rate of business operations when preparing and delivering an order to a customer [11]. The third variable, supply service, refers to the capability of suppliers to follow instructions, handling complaints, ease of doing business and quick response. Purpose of service is to satisfy the customers' needs; it means that service includes issues such as delivery reliability and short order lead-times. While the last variable, cost, refer to competitive pricing and total cost. In the situation with a single criterion, generally, the cost is considered an essential criterion. It computes all the direct cost, like the purchase price, the transport cost, the labour cost and many more.

Besides the independent variable, the moderating variable for this study will be the buyer's satisfaction (BS). Satisfaction can be linked closely to expectation, as it measured the level of expectation met. In any business or industry, satisfaction is a valuable yardstick, as it measures the level of success of their service. The level of satisfaction is an indication of any act of improvement. In this research, the buyer's satisfaction refers to the success of suppliers in meeting their buyer's expectations. In this context, the process of procurement in getting the right supplier is evaluated based on the buyer's satisfaction at last resort.

The dependent variable for this study will be buyer-supplier long term relationship (BSLTR). Strategic relationships emerge as an opportunity to create competitive advantages for both buyer and supplier [4]. Ellram [5] emphasizes that partnerships with relevant suppliers can lead to management, technological and financial benefits and Tan et al. [12] stressed that successful management of the buyer and supplier relationships contributes to the long- term success of an organization. Supplier quality is one of the critical criteria in supplier selection, determines the relationship between the buyer and supplier. Suppliers that provided high-quality product/service has the potential to develop constructive buyer-supplier long term relationship [10]. Evidence from the literature suggests that supplier quality will influence the buyer to have closer relationships with supplier [5]. Hence from the discussion above, hypothesis for the correlated set of supplier quality can be developed as below;

H_1 *Supplier quality has a positive influence on buyer-supplier long term relationship.*

Consistent performance delivery is crucial for suppliers in order to establish a wise reputation among their buyers and win their expectations and leads to long term buyer-supplier relationship. For suppliers, the continuity in the relationship can consider as a success [13] as well as the perceptions of satisfaction and performance delivery [14, 15]. By delivering superior performance relative to their competitors, suppliers increase the likelihood of satisfying the buyer's needs and establish a long-term relationship with buyers. Therefore, this study would hypothesize that:

H_2 *Performance delivery has a positive influence on buyer-supplier long term relationship.*

Developing close relationships with the suppliers will benefit the buyers in term of service delivery, reduction of cost or the combination of both [16]. The level and quality of service provided by suppliers differ them from other available suppliers in the view of buyers. Buyers, when selecting suppliers, consider the aspect of quality and reliable service, to ensure smooth business operation and growth. The discussion above explains the role of supplier service and its importance from the view of the buyer's criteria, which helps to lead long term buyer-supplier relationship. Therefore, the hypothesis for the correlated set of supplier service can be developed as follow:

H_3 *Supplier service has a positive influence on buyer-supplier long term relationship.*

As cost is one of the critical criteria in supplier selection, the ability of suppliers to offer and maintain consistency in terms of cost will be their winning point to allow long term relationship with buyers. Suppliers seek out opportunities to offer buyers superior value than their competitors in terms of long-term revenue generation and cost reduction [17]. The discussion above explained the importance of cost in buyer-supplier long term relationship. Therefore, this study would hypothesize that:

H_4 *Cost has a positive influence on buyer-supplier long term relationship.*

It is believed that the buyer's satisfaction has a high influence on the long-term buyer-supplier relationship. This statement is supported by the study of Dahlstrom et al. [18], who says that relationship success was primarily measured in the form of satisfaction, and buyer's perception of the performance of the suppliers. From other perspectives, relationship success should lead to sustainable improvements in product quality and innovation, enhanced competitiveness, and increased market share [19, 20]. To a certain extent, the improvement mentioned above will also give buyers some satisfaction, which enhances the buyer-supplier long term relationship. In a nutshell, the buyer's satisfaction moderates the independent variables towards the dependent variable in this study. Hence the below hypotheses are developed.

H_5 *Buyer's satisfaction positively moderating supplier quality for buyer-supplier long term relationship.*

H_6 *Buyer's satisfaction positively moderating performance delivery for buyer-supplier long term relationship.*

H_7 *Buyer's satisfaction positively moderating supplier service for buyer-supplier long term relationship.*

985

Int. J Sup. Chain. Mgt   Vol. 8, No. 3, June 2019

H_8 *Buyer's satisfaction positively moderating cost for buyer-supplier long term relationship.*

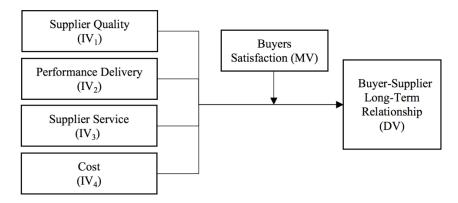The full modified research framework is shown in Figure 1.

Figure 1. Research Framework

3. Research Methodology

This study will be carried out in a correlational method describing the relationship between the variables like independent, mediating and dependent variables. Research data will be collected via research survey questions. Thus, it is a cross-sectional study [21]. Since this research's objective is to test the four independent variables and a moderator variable identified in the earlier literature towards the long-term relationship between buyers and suppliers (dependent variable), hypothesis testing will be used. This quantitative method will assist in explaining the variance in the dependent variable to predict the outcome of the research. The research question identifies which independent, and moderator variable significantly influence long term relationship between semiconductors industries buyers and suppliers in Penang, Malaysia. The population for this study will comprise of buyers, engineers and managers working in any semiconductor industry in Penang Industrial Zone. Thus, to conduct a more concentrated study, the population for this study will be narrowed to buyers, engineers or managers with at least one year of working experience in handling suppliers in the semiconductor industry. This is due to the fact that the research requires respondents to have a clear understanding of the survey requirement so that the respondent will be able to attempt the survey questions effectively.

By controlling the samples, unnecessary variations and distorted data can be avoided during the analysis of this research. With the narrowed respondents, the researcher will be able to test the buyer-supplier long term relationship. The samples consist of target respondents who will be buyers, engineers and managers working in the semiconductor industry in Penang Industrial Zone with a minimum one year of working experience handling suppliers. For this study, convenience sampling, which is a non-probability sampling technique was employed, and respondents are selected because of the accessibility convenience and the proximity to the researcher [22]. The data has been collected using a hard copy questionnaire. The intention to use hard copy questionnaires was to hold the respondent concentrations while answering the survey questions. Four hundred forty samples of hard copy questionnaires were distributed to the respondents. Out of 440 questionnaires, 334 samples were returned. The return rate was 75.9%. Out of the 334 samples, 18 samples were omitted from the study as it was incomplete and some have more than one answers for the same question, while 28 more discarded as they are not qualified respondents based on the qualifying questions. The final number of samples used in this research for statistical analysis was 288.

4. Analysis and Findings

The findings of this research are tabulated and described in the following order; beginning with the demographic profile of the respondents, descriptive statistics, confirmatory factor analysis for testing the reliability and validity of the data plus hypotheses.

4.1 Demographic Profile of Respondents

Table 1 summarises the profile of respondents' demographic, for gender, it is observed that male respondents are more compared to female

respondents in this survey, with the percentage of 72.2% and 27.8% respectively. Followed by age, majority respondents consist of engineers/managers from the age group of 26-35 (54.2%), and subsequently 36-50 (41.7%). Only 2.4% of respondents are from age below 25 years old, and 1.7% respondent aged 51-65 years old. There are no respondents over 65 years old in the survey. Next, on the highest education level, majority of the respondents hold a bachelor's degree (71.5%) and followed by a master's degree (26.4%). Only 1.4%

of the respondents are PhD Doctorates, and the least of 0.7% holds Certificate/Diploma. On the employment status, 96.5% of respondents are from private sectors, which tally with the data collections methods in this research whereby the majority of the hard copy questionnaires was distributed to private sector companies. Nevertheless, there were also respondents from Semi Government/Government Linked Company and self-employed respondents with a percentage of 1.7% respectively.

Table 1. Summary of the Demographic – Respondent Profile (N=288)

Demographic Profile		Frequency	Percent
Gender	Male	208	72.2
	Female	80	27.8
Age	Under 25	7	2.4
	26-35	156	54.2
	36-50	120	41.7
	51-65	5	1.7
	Over 65	0	0.0
Highest Education Level	Secondary School	0	0
	Certificate/Diploma	2	0.7
	Bachelor's Degree	206	71.5
	Masters	76	26.4
	PhD/DBA	4	1.4
	Others	0	0.0
Employment Status	Government	0	0
	Semi-Government/Government Link	5	1.7
	Private Sector	278	96.5
	Self-Employed	5	1.7
Designation	Engineer	44	15.3
	Senior Engineer	191	66.3
	Manager	45	15.6
	Senior Manager	8	2.8
Working Experience	< 1 year	0	0
	1-5 years	63	21.9
	5-10 years	97	33.7
	10-15 years	85	29.5
	15-20 years	36	12.5
	20-25 years	6	2.1
	25-30 years	1	0.3
	>30 years	0	0

Next, on the respondent profile, the demographic analysis shows 66.3% respondents in this survey are from senior engineer level, followed by manager level (15.6%), engineer level (15.3%) and lastly senior manager level (2.8%). The analysis also shows that 33.7% of the respondents have 5-10 years of working experience. 29.5% of the respondents with 10-15 years of working experience and 21.9% of respondents had worked for 1-5 years. It is also observed that 12.5% of the respondents participated

in this survey worked for 15-20 years, followed 2.1% respondents with 20-25 years of working experience and the minority group of respondents with the percentage of 0.3% in this survey had worked for 25-30years. None of the respondents in this survey had worked for more than 30 years. Table 2 summarises the respondent's company profile demographic while Table 3 summarises the supplier profile demographics, based on the supplier that the respondent picked to describe in this survey.

987

Int. J Sup. Chain. Mgt   Vol. 8, No. 3, June 2019

Table 2. Summary of the Demographic – Respondent's Company Profile (N=288).

Demographic Profile		Frequency	Percent
Company's nature of business	Original Equipment Manufacturer (OEM)	104	36.1
	Electronics Manufacturing Services (EMS)	150	52.1
	Supporting Industries (Support OEM / EMS)	22	7.6
	Others	12	4.2
Company's country of origins	Malaysia	42	14.6
	Asia Country	32	11.1
	USA or Europe	214	74.3
	Others	0	0.0
Duration of Company's operation	< 1 year	2	0.7
	1-5 years	29	10.1
	5-10 years	13	4.5
	> 10 years	244	84.7
Approximate number of employees in respondent's company	< 100 employees	4	1.4
	100-500 employees	36	12.5
	500-1000 employees	71	24.7
	> 1000 employees	177	61.5
Respondent's company sales for year 2016	< 10 Million Ringgit	25	8.7
	10-50 Million Ringgit	16	5.6
	50-100 Million Ringgit	56	19.4
	> 1000 Million Ringgit	191	66.3

Table 3. Summary of the Demographic – Supplier Profile (N=288).

Demographic Profile		Frequency	Percent
Supplier Products	Raw Materials	120	41.7
	Machine Makers	88	30.6
	Machine Maintenance	30	10.4
	Service Providers	20	6.9
	Accreditation Lab	4	1.4
	Product Assemblers	20	6.9
	Logistics (Shipment & deliveries)	6	2.1
Supplier company's country of origins	Malaysia	72	25.0
	Asia Country	185	64.2
	USA or Europe	31	10.8
	Others	0	0.0
Supplier rank in respondent company supplier list	First	30	10.4
	Top 5	196	68.1
	Top10	62	21.5
Years of business with supplier	< 1 year	2	0.7
	1-5 years	63	21.9
	5-10 years	95	33.0
	> 10 years	128	44.4
Approximate number of employees in supplier's company	< 100 employees	75	26.0
	100-500 employees	100	34.7
	500-1000 employees	61	21.2
	> 1000 employees	52	18.1
Supplier's company sales for year 2016	< 10 Million Ringgit	88	30.6
	10-50 Million Ringgit	99	34.4
	50-100 Million Ringgit	43	14.9
	> 1000 Million Ringgit	58	20.1

988

Int. J Sup. Chain. Mgt   Vol. 8, No. 3, June 2019

4.2 Descriptive Statistics

From Table 4, it is observed that the range of scale used for each variable is 1 to 5. Besides that, we can observe that most of the variable has mean value more than 3, which explains that most of the respondent ticked, agreed for each of the variable's questions in the survey questionnaire. Buyer-supplier long term relationship scored the highest mean (4.26) while Supply Service has the lowest mean (2.93). While for standard deviation, it is the other way round from the mean, whereby Supply Service scored the highest value (0.89), and Buyer-supplier long term relationship scored the least value (0.54). However, in general, all the standard deviation value is below 1, which indicating that most of the respondents agreed to each variable question evaluated in this research.

Table 4. Descriptive Statistics

Variables	Scale	Mean	Std. Dev
SQ	1-5	3.34	0.72
PD	1-5	3.46	0.73
SS	1-5	2.93	0.89
Cost	1-5	3.95	0.75
BS	1-5	4.01	0.55
BSLTR	1-5	4.26	0.54

4.3 Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) was performed using Smart PLS 3.0 in order to validate both measurement and structural models by applying partial least squares. From Table 5, it is confirmed that the measurement model demonstrates convergent validity (AVE > 0.5) and high internal consistency reliability (CR > 0.7). It is to note that constructs such C*BS represents a moderating effect. It is to note that some of the items with poor outer loadings were removed to improve AVE.

Table 5. Composite Reliability and Average Variance Extracted (AVE) of Constructs

Construct	Composite Reliability	Average Variance Extracted (AVE)
B-S Long Term Relationship (BSLTR)	0.925	0.756
Buyer Satisfaction (BS)	0.923	0.800
C*BS	1.000	1.000
Cost (C)	0.786	0.555
PD*BS	1.000	1.000
Performance Delivery (PD)	0.838	0.518
SQ*BS	1.000	1.000
SS*BS	1.000	1.000
Supplier Quality (SQ)	0.858	0.609
Supply Service (SS)	0.760	0.523

Besides that, Table 6 shows that the constructs of the variables were found to have discriminant validity since all the heterotrait-monotrait ratio of correlations (HTMT) are below 0.85. Based on the convergent validity, internal consistency reliability and discriminant validity done so far for the measurement model is fit to be used as the structural model to examine the hypotheses.

Table 6. HTMT Ratio for All the Constructs

Variables	BSLTR	BS	C*BS	Cost	PD*BS	PD	SQ*BS	SS*BS	SQ	SS
BSLTR										
BS	0.534									
C*BS	0.062	0.065								
Cost	0.217	0.242	0.116							
PD*BS	0.164	0.270	0.416	0.132						
PD	0.434	0.408	0.092	0.363	0.174					
SQ*BS	0.102	0.359	0.095	0.098	0.556	0.163				
SS*BS	0.175	0.302	0.258	0.071	0.521	0.109	0.700			
SQ	0.585	0.753	0.134	0.181	0.188	0.521	0.335	0.177		
SS	0.396	0.538	0.067	0.253	0.096	0.309	0.124	0.165	0.556	

4.4 Hypotheses Testing

The structural model is used to test the hypotheses of the research model. Figure 2 shows the finalised structural model. This structural model allows finding out the significance value or p-value for each of the arrows in the construct of the model. We run the bootstraps with resampling technique using subsamples of 5000, the results to conclude the hypotheses can be obtained. Table 7 shows a summary of the structural model with the hypotheses concluded with the decision.
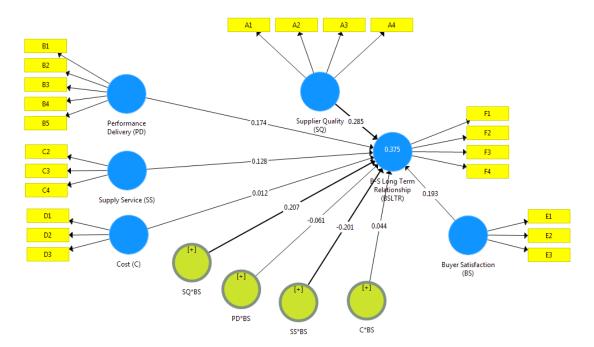
989

Int. J Sup. Chain. Mgt   Vol. 8, No. 3, June 2019

Figure 2. Structural Model of the Constructs

Table 7. Summary of the Structural Model with Hypotheses Decision.

Hypotheses	Path Coefficient	Significance (P-Value)	Significance (T-Value)	Decision
H$_1$: SQ → BSLTR	0.285	0.000	3.736	Supported
H$_2$: PD → BSLTR	0.174	0.001	3.220	Supported
H$_3$: SS → BSLTR	0.128	0.012	2.245	Supported
H$_4$: Cost → BSLTR	0.012	0.412	0.223	Not Supported
H$_5$: SQ * BS → BSLTR	0.207	0.004	2.662	Supported
H$_6$: PD * BS → BSLTR	-0.061	0.237	0.714	Not Supported
H$_7$: SS * BS → BSLTR	-0.201	0.001	3.102	Not Supported
H$_8$: Cost * BS → BSLTR	0.044	0.283	0.574	Not Supported

Based on the analysis, it can be concluded that Supplier quality (SQ), performance delivery (PD) and supply service (SS) had a positive and significant influence on buyer-supplier long term relationship (BSLTR). With this, the structural model supports the hypotheses of H$_1$, H$_2$ and H$_3$. Nevertheless, for moderating effect only buyer satisfaction (BS) on supplier quality (SQ), had a positive and significant influence on buyer-supplier long term relationship (BSLTR), indicating the model supports the hypotheses H$_5$. While buyer satisfaction (BS) on performance delivery (PD) and supply service (SS) towards buyer-supplier long term relationship (BSLTR) has negative and insignificant influence. Thus, it can be concluded that H$_6$ and H$_7$ are all not supported.

4.5 Moderating Effect Analysis

In moderating effect analysis conclusion can be made on the moderating effect of buyer satisfaction (BS) with the relationship between Supplier quality (SQ), performance delivery (PD), supply service (SS) and cost (C) towards buyer-supplier long term relationship (BSLTR). The R^2 value of buyer-supplier long term relationship (BSLTR) with the moderator interaction included in the model results 0.375. R^2 value of buyer-supplier long term relationship (BSLTR) with the moderator variable excluded from model results 0.332. The moderating effect is calculated with the formula shown below.

$$f^2 = \frac{R_i^2 - R_m^2}{1 - R_i^2}$$

where,
i = interaction model
m = main effect model

In this case, the calculated moderating effect is just 0.07, which is considered small. According to Cohen (1988), f^2 values of 0.02, 0.15 and 0.35 is considered as small, medium and large, respectively. In conclusion, the moderating effect of buyer satisfaction (BS) on the relationship between Supplier quality (SQ), performance delivery (PD), supply service (SS) and cost (C) towards buyer-supplier long term relationship (BSLTR) is significantly small.

4.6 Goodness of Fit Analysis

The goodness of Fit (GoF) can be calculated by using the formula below. From the PLS algorithm $R^2 = 0.375$ while average communality is obtained by averaging all the AVE values of the latent variables which accumulate to 0.627. Applying these 2 values into GoF formula shown below results GoF value of 0.485 which is considered large according to baseline values (GoFsmall = 0.1, GoFmedium = 0.25, GoFlarge= 0.36) [23]. Hence, the structural model developed in this research had large Goodness of Fit.

$$GoF = \sqrt{\overline{R^2} \times Average\ Communality}$$

5. Discussions and Conclusions

Concerning the statistical analysis, the conducted hypotheses testing shows Hypotheses H_1, H_2 and H_3 are well supported with positive path coefficient and p-value less than 0.05. This result indicating the criteria has a positive and significant effect in establishing buyer-supplier long term relationship, which in other word; the selection criteria helped buyers to choose their suppliers in the semiconductor industry in Penang. For H_1, which focuses on the supplier quality, the result positively in line with the previous researches by Leenders and Fearon [24] who founds that supplier quality is a competitive tool that can give a significant contribution to the organization. Similarly, Dobler and Burt [25] and Sharif et al. [10] also defined supplier quality is one of the purchasing supplier performance management major responsibilities. While for H_2, which focuses on the performance delivery, the result positively in line with the previous researches by Stank et al. [26] who founds that performance delivery provides their benefits in terms of cycle time and a significant reduction in new product development time when dealing with supplier alliances.

On the other hand, the H_4 which test on the cost criteria, even though it has a positive path coefficient, it does not seem to support the hypotheses testing as the p-value are more than 0.05. This could be due to the fact that the cost might not be the main deciding factor when selecting their potential suppliers. This result very much in line with the previous research by Benyoucef, Ding and Xie [27], who had emphasized that traditional single criterion approach based on lowest cost bidding is no longer supportive and robust enough in contemporary supply management in their research.

Hypotheses H_5, H_6, H_7, and H_8 which states that buyer's satisfaction positively moderating each of the independent variables for buyer-supplier long term relationship shows only H_5 is well supported with positive path coefficient and p-value less than 0.05. The finding also matches the previous researches by Stank et al. [26] who founds that supplier quality enhance buyer's satisfaction, when the service provided by suppliers are very good in quality. Narasimhan and Nair [28] also supported that supplier quality impacts the buyers' satisfaction level. However, H_6, H_7, and H_8 was not significant and not supported. H6, H7, and H8 are not supported as path coefficient shows negative value and p-value results in more than 0.05.

For the H_6, the findings contradict with other researches findings, whereby Larson and Kulchitsky [29] have demonstrated gains to the buyers from successful relationships with suppliers due to the performance delivery. At the same time Martin and Grbac [30] mentioned the relationship is further developed with buyer's satisfaction. However, for H_7 and H_8, the hypothesis is not supported due to the negative path coefficient value. This finding contradicts with Kannan and Tan [16], who mentioned that buyers attain benefits by developing a close relationship with their key suppliers which comes in the form of supply service together with the combination of improved quality, delivery performance and reduced cost [20]. Besides, Prahinski and Benton [31] and Ahmad, N.F. et al. [32], also mentioned quality service, performance delivery, price, responsiveness, and supply service had positively affected supplier commitment and long-term relationship with buyers. In short, all these research findings did not match the expected hypotheses of having a positive and significant moderating effect for each of the independent variables which are performance delivery (PD), supply service (SS) and cost (C) for buyer-supplier long term relationship.

Based on the moderator effect analysis conducted in the previous section, it was observed that the moderating effect value is just 0.07, which is considered small. According to Cohen [33], f^2 values of 0.02, 0.15 and 0.35 is assessed as small, medium and large, respectively. In conclusion, the moderating effect of buyer satisfaction (BS) on the

relationship between performance delivery (PD), supply service (SS) and cost (C) towards buyer-supplier long term relationship (BSLTR) are significantly small. It can also be said that when buyer satisfaction is treated as a moderating variable, it has a minimal impact on the research model on buyer-supplier long term relationship.

In short only H_1, H_2, H_3, and H_5 show a significant and positive effect for a buyer-supplier long term relationship. Whereas H_4, H_6, H_7, and H_8 seem does not support the hypotheses testing as it shows the variables are insignificant for a buyer-supplier long term relationship. Hypotheses testing also shows the moderating variable buyer's satisfaction has only positively moderated the supplier quality for the buyer-supplier long term relationship. To note only the cost criteria, show the insignificant effect to the buyer-supplier long term relationship. This could be due to the fact that with the evolution of technology has reduced the cost of bidding in current supplier selection criteria. At the same time hypotheses testing also shows the moderating variable buyer's satisfaction failed to moderate the performance delivery, supplier service and cost for the buyer-supplier long term relationship. This is due to the fact that moderator effect analysis conducted in the previous section shows small moderating effect value of 0.07. This result means that when buyer satisfaction is treated as a moderating variable, it has a minimal impact on the research model on buyer-supplier long term relationship.

At the end of this investigation, there are several conclusions to be drawn for the supplier selection criteria, especially for suppliers who are already in the company's preferred supplier list for the semiconductor industry in Penang. First of all the intention of this investigation arises from the struggles and challenges that the buyers in semiconductor company faced in choosing their suppliers even for suppliers who are already in company's preferred supplier list, as there is a large pool of available suppliers in the industry who are capable of providing similar goods and services. This intuit the researcher to list some critical, crucial supplier selection criteria especially for suppliers who are already in company's preferred supplier list which will generally fit for semiconductor industries, specifically in Penang, Malaysia, which will result in buyer's satisfaction and lead to buyer-supplier long term relationship.

Based on all the previous researches literature reviews, four main crucial selection criteria such as supplier quality, performance delivery, supply service and cost were investigated. Buyer satisfaction was also included in the measurement model to evaluate if it is able to moderate the relationship between the independent variables and dependent variables. Based on the developed theoretical framework and hypotheses, it can be concluded that buyers in Penang semiconductor industries could use supplier quality, performance delivery and supply service as a general crucial selection criteria when selecting their suppliers especially for suppliers who are already in company's preferred supplier list as these criteria has significant, positive effect, and great influence in establishing long term relationship with their suppliers. However, as per the result of the investigation and findings from other researchers, the traditional criterion approach based on lowest cost bidding is no longer supportive and robust enough in contemporary supplier selection method. Nevertheless, the buyer satisfaction factor seems to have an insignificant moderating effect on performance delivery, supply service and cost to establish buyer-supplier long term relationship.

Finally, the results from this study provide sets of essential supplier selection criteria especially for suppliers who are already in company's preferred supplier list for the semiconductor industry in Penang, which over time will enable the buyer-supplier long term relationship and provide great mutual benefits for both the buyers and supplier to excel in their business field. From the research findings, it is definitely recommended and worthwhile for the buyers to evaluate more relevant criteria's in line with the evolving technology in semiconductor industry to allow flexible and sustainable selection criteria to be realized to select existing suppliers who are already in company's preferred supplier list and potential suppliers for semiconductor industry in the very near future.

References

[1] Lin, C., Chen, C., & Ting, Y. (2011). An ERP model for supplier selection in Electronics industry. *Expert Systems with Applications, 38*(3), 1760-1765. doi: 10.1016/j.eswa.2010.07.102

[2] Monczka, R. M., Handfield, R. B., Guinipero, L. C., & Patterson, J. L. (2010). *Purchasing and Supply Chain Management*. New Tech Park: Cengage Learning.

[3] Mendoza, A. (2007). Effective methodologies for supplier selection and order quantity allocation. *A Thesis Submitted in Partial Fulfilment of the Requirements of Pennsylvania State University for the Degree of Doctor*, Pennsylvania State University, Pennsylvania.

[4] Borges de Araújo, M. C., Hazin Alencar, L., & Coelho Viana, J. (2015). Structuring a model

for supplier selection. *Management Research Review, 38*(11), 1213-1232. doi: 10.1108/MRR-04-2014-0076

[5] Ellram, L. M. (1990). The supplier selection decision in strategic partnerships. *Journal of Purchasing and Materials Management, 26*(4), 8-14. doi: 10.1111/j.1745-493X.1990.tb00515.x

[6] Li, L., & Zabinsky, Z. B. (2011). Incorporating uncertainty into a supplier selection Problem. *International Journal of Production Economics, 134*(2), 344-356. doi: 10.1016/j.ijpe.2009.11.007

[7] Harland, C. M. (1996). Supply chain management: relationships, chains and networks. *British Journal of management, 7*, S63-S80. doi: 10.1111/j.1467-8551.1996.tb00148.x

[8] Ho, W., Xu, X., & Dey, P. K. (2010). Multi-criteria decision making approaches for supplier evaluation and selection: A literature review. *European Journal of operational research, 202*(1), 16-24. doi: 10.1016/j.ejor.2009.05.009

[9] Weber, C. A., Current, J. R., & Benton, W. C. (1991). Vendor selection criteria and Methods. *European Journal of Operational Research, 50*(1), 2-18. doi: 10.1016/0377-2217(91)90033-R

[10] Sharif, A. M., Abdul-Rahim, S., Gallear, D., & Irani, Z. (2009). A supplier selection strategy within the Malaysian telecommunications industry, *7th International Logistics and Supply Chain Congress.* 324–331.

[11] Rahman, N. A. A., Mohammad, M. F., Rahim, S. A., Hassan, R., Ahmad, M. F., & Kadir, S. A. (2017). Shipper's perceptions of aviation Logistics Service Quality (LSQ) of air freight provider. *Journal of Engineering and Applied Sciences, 12*(3), 699-704. doi: 10.3923/jeasci.2017.699.704

[12] Tan, K. C., Kannan, V. R., Handfield, R. B., & Ghosh, S. (1999). Supply chain management: an empirical study of its impact on performance. *International Journal of Operations & Production Management, 19*(10), 1034-1052. doi: 10.1108/01443579910287064

[13] Anderson, E., & Weitz, B.A. (1989). Determinants of continuity in conventional Channel dyads. *Marketing Science, 8*(4), 310-323.

[14] Fynes, B., & Voss, C. (2002). The moderating effect of buyer-supplier relationships on quality practices and performance. *International Journal of Operations & Production Management, 22*(6), 589-613. doi: 10.1108/01443570210427640

[15] Monczka, R. M., Callahan, T. J. and Nichols, E. L. (1995). Predictors of relationships Among buying and supplying firms. *International Journal of Physical Distribution & Logistics Management, 25*(10), 45-59. doi: 10.1108/09600039510101799

[16] Kannan, V. R. & Tan, K. C. (2006). Buyer-supplier relationships: The impact of supplier selection and buyer-supplier engagement on relationship and firm performance. *International Journal of Physical Distribution & Logistics Management, 36*(10), 755-775. doi: 10.1108/09600030610714580

[17] Narver, J. C., & Slater S. F. (1990). The Effect of a Market Orientation on Business Profitability. *Journal of Marketing, 54*(1), 20-35. doi: 10.2307/1251757

[18] Dahlstrom, R., McNeilly, K. M., & Speh, T. W. (1996). Buyer-seller relationships in the procurement of logistical services. *Journal of the Academy of Marketing Science, 24*(2), 110-124. doi: 10.1177/0092070396242002

[19] Kannan, V. R., & Tan, K. C. (2006). Supplier selection and assessment: Their impact on business performance. *Journal of Supply Chain Management: A Global Review of Purchasing and Supply, 38*(3), 11-21. doi: 10.1111/j.1745-493X.2002.tb00139.x

[20] Huoy, C. S., Rahim S. A., Rahman, N. A. A., Nawi M. N. M., & Ahmi. A. (2018). Determination the Key Success Factor for the Success Implementation and Long-Term Sustainability of Vendor Managed Inventory (VMI), *International Journal of Supply Chain Management, 7*(2), 62-67.

[21] Olsen, C., & St George, D. M. M. (2004). Cross-sectional study design and data analysis. *College entrance examination board, 26*(03), 2006.

[22] Haron, H., Khalid, S. N. A., Ganesan, Y., & Fernando, Y. (2017). *A Handbook for Business Research Methods.* Kuala Lumpur: Pearson Malaysia Sdn. Bhd.

[23] Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern Methods for Business Research, 295*(2), 295-336.

[24] Leenders, M., & Fearon, H. (1997). *Purchasing & Supply Management.* The United States of America: McGraw-Hill Companies.

[25] Dobler, D. W., & Burt, D. N. (1996). *Purchasing and Supply Management: Text and Cases.* The United States of America: McGraw-Hill Companies.

[26] Stank, T., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of Business Logistics, 22*(1), 29-48. doi: 10.1002/j.2158-1592.2001.tb00158.x

[27] Benyoucef L., Ding H., & Xie X. (2003). *Supplier selection problem: selection criteria and methods.* (Doctoral dissertation, INRIA).

993

Int. J Sup. Chain. Mgt   Vol. 8, No. 3, June 2019

[28] Narasimhan, R., & Nair, A. (2005). The antecedent role of quality, information sharing and supply chain proximity in strategic alliance formation and performance. *International Journal of Production Economics, 96*(3), 301-313. doi: 10.1016/j.ijpe.2003.06.004

[29] Larson, P. D., & Kulchitsky, J.D. (2000). The use and impact of communication media in purchasing and supply management. *Journal of Supply Chain Management, 36*(2), 29-39. doi: 10.1111/j.1745-493X.2000.tb00249.x

[30] Martin, J. H., & Grbac, B. (2003). Using supply chain management to leverage a firm's market orientation. *Industrial Marketing Management, 32*(1), 25-38. doi: 10.1016/S0019-8501(01)00192-4

[31] Prahinski, C., & Benton, W. C. (2004). Supplier evaluations: communication strategies to improve supplier performance. *Journal of Operations Management*, 22(1), 39-62. doi: 10.1016/j.jom.2003.12.005

[32] Ahmad, M.F., Hoong, K.C., Hamid, N.A., Sarpin, N., Zainal, R., Ahmad, A.N.A., Hassan, M.F. & Nawi, M.N.M. (2018). The Impact of Product Design and Process Design towards New Product Performance in Manufacturing Industry: A Survey Result in Malaysia. *International Journal of Supply Chain Management*, 7(2), 102-105.

[33] Cohen, J. (1988). Statistical power analysis for the behavioral sciences Lawrence Earlbaum Associates. Hillsdale, NJ, 20-26.