Determination the Key Success Factor for the Success Implementation and Long-Term Sustainability of Vendor Managed Inventory (VMI)

Cheong Shy Huoy[#1], Suzari Abdul Rahim[#2], Nor Aida Abdul Rahman[‡3], Mohd Nasrun Mohd Nawi[§4], Aidi Ahmi[*5]

[#]*Graduate School of Business, Universiti Sains Malaysia*
11800, Penang, Malaysia
[1]shyhuoycheong@yahoo.com.my
[2]suzari@usm.my
[‡]*Universiti Kuala Lumpur, Malaysian Institute of Aviation Technology*
Dengkil 43800, Selangor, Malaysia
[3]noraida@unikl.edu.my
[§]*School of Technology Management and Logistics, Universiti Utara Malaysia*
06010 UUM Sintok, Kedah, Malaysia
[4]nasrun@uum.edu.my
[*]*Tunku Puteri Intan Safinaz School of Accountancy, Universiti Utara Malaysia*
06010 UUM Sintok, Kedah, Malaysia
[5]aidi@uum.edu.my

***Abstract*— The purpose of this study is to understand the key success factor for success implementation and long-term sustainability of Vendor Managed Inventory (VMI). The respondents for this study was employees who work in supply chain related department in electronic and electrical industry in Malaysia. The independent variables include integrated system and common platform, relationship quality and commitment, information quality and clearly outline expectation and communication. While the identified dependent variable is the key success factor for VMI implementation and sustainability. The management commitment is regarded as moderating effect of the relationship between independent and dependent variables. The data is collected using online questionnaire and subsequently analysed using SPSS and PLS. The relationship of variables is tested and examined. The finding demonstrates quality of information have positive and significant relationship with long term sustainability and success implementation of VMI. Besides, the study gives implication that there is positive relationship between relationship quality and integrated system toward VMI sustainability but they do not have significant influence against VMI implementation and sustainability. While expectation have negative and insignificant influence towards VMI implementation. The moderator effect of management commitment been assessed as insignificant as well.**

***Keywords*—** *Vendor Managed Inventory, Relationship Quality, Information Quality and Sustainability, Supply Chain.*

1. Introduction

In 1960s, supply chain concept has been introduced by Forrester but only become popular in early 1980s [1]. Operation supply chain decision made more than hundred times a day and hence the effective management of supply chain activities is critical for ensuring long term success and sustainability of the business. While the key activities in supply chain to be highlighted in inventory management and the benefits for success inventory includes planning accuracy, repeat customer, and lower inventory holding cost which ultimately help to bring down the overall cost of running the business. However, most recent studies suggest that poor inventory management will impact customer satisfaction and contribute to company losses or failure. With globalization, integration become key element of supply chain management to enhance the efficiency and effectiveness of supply chain process [2].

Vendor Managed Inventory (VMI) is one type of "push" inventory management which help to drive closer relationship between vendors and buyers [3]. VMI is first adopted by Wal-Mart and Procter & Gamble in late 1980s which had been developed over time and adopted by many companies such as Dell, Nestle, Tesco, Johnson & Johnson and etc. [4]. VMI model helps to bring down the inventory related cost by passing the responsibilities for managing and replenishment of inventory from customer to supplier [5]. The key difference of VMI model as compared to normal replenishment system supplier will

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be responsible for monitoring buyer's inventory level under VMI and makes periodic replenishment decision including timing of placing order, shipment method and quantities required to fulfil customer forecast [6].

However, a researcher at Harvard University, Susan Cohen Kulp found that the implementation of VMI do not 100% guarantee better return as compared to traditional inventory management process. Based on the interview performed by Aichlmayr [7], in her research, the quotes from the managers are "Out of 10 VMI implementation, only 30 to 40% achieve great benefits while another 30% to 40% receive some benefits and 20% to 30% receive no benefits".

Therefore, it is important to study what are the important elements in driving the success implementation and long term sustainability of VMI. This is mainly due to implementation of VMI involves not only cross-function coordination across procurement, logistics and production department but also the cooperation between buyers and suppliers. If there is no sufficient understanding the success factor of VMI program but continue to push for the implementation of this program may result a gap between the outcome and expectation which subsequently reduce the overall attractiveness of the program.

Given the significance for success implementation and long term sustainability of VMI, there is urgency in understanding its key success factors. There are few success factors have been identified in the research includes quality of information, relationship quality and commitment, clearly outlined expectation and communication and integrated system and common platform. There are numerous studies regarding implementation of VMI in European and US countries but only few studies are in Malaysian context specifically and Asian region generally. Therefore, this study will help to extend the research to this region.

This paper is organised as follows. The next section will discuss about the literature review and hypothesis development. The research method is presented in Section 3, followed by results and discussion in Section 4. A conclusion is presented in Section 5 and concludes with the limitations of the study and recommendation for future research.

2. Literature Review

The theories use to understand the key success factor for vendor managed inventory are resource based theory and Theory of Planned Behaviour (TPB). According to resource based theory, the master of relevant resources will help to achieve competitive advantage due to unequal distribution of resource [8]. Therefore to drive VMI strategy, the firm need to make proper allocation of resources. Besides, the understanding of the behaviour of employee and management involve in VMI implementation is very important in driving the long term sustainability of VMI. Theory of Planned Behaviour explained the intention is influenced by attitude, perceived norm and perceived behaviour control.

2.2 Vendor managed inventory

Vendor managed inventory or VMI is a business model where vendor or supplier is responsible for managing the inventory at agreed inventory level and buyer preferred location accordingly to the details that shared by the buyer [9]. Besides, VMI also allow supplier to better align their manufacturing processes accordingly customer demand. In another word, VMI also represent some sort of outsourcing activities by shifting the traditional inventory holding burden from customer to supplier [10].

2.3 Integrated system and common platform

Information system integration played an important role for sustaining vendor managed inventory process in long term as automated connectivity between supplier and customer is the foundation for successful vendor managed inventory program. Haavik [11] had mentioned in his study that the use of integrated system is required to realize the full benefits of VMI.

2.4 Clearly outline expectation and communication

Communication is a key for long term sustainability of VMI process. According to Power [12], and Vigtil [13], strong communication within VMI partners is important for information integration and ensure success adoption of VMI [14]. There should have open communication channel to discuss about it [15].

2.5 Relationship quality and commitment

The qualities of relationship quality is described by Barratt [16] to include trust, openness, mutual interdependency, frequency of interaction and commitment. To maintain long term sustainability of VMI relationship, trust between supplier and customer is the prerequisite to ensure both parties will fulfil the responsibilities and maintain the relationship in long term [17]. The information shared by customer with supplier is sensitive and confidential such as product details, demand or forecast and hence high level of trust is required.

2.6 Quality of information shared (forecast accuracy)

The main objective of VMI is to align demand and supply through increased information sharing between buyers and suppliers in the supply chain. Timing and completeness of the information is also important to reduce overall total supply chain cost. The earlier the information been made available to the supplier, the faster supplier able to react to volatility which ultimately reduce the required lead time [18].

2.7 Hypothesis development

Integrated system and common platform is positively related to success implementation and long term sustainability of vendor managed inventory. Onyango and Mwangi [19] concluded that the investment into developing integrated system and common platform is required for success implementation of VMI so that single point of contact for data is setup to ensure the availability and visibility of data.

Relationship quality and commitment is positively related to success implementation and long term sustainability of vendor managed inventory. Based on Radzuan, Othman and Udin [20] it is concludes that mutual trust, honesty and commitment is important for the partners involve in VMI relationship where customers should trust the vendors can fully support the inventory level required while vendors should trust the forecast shared.

Quality of information shared is positively related to success implementation and long term sustainability of vendor managed inventory. Angulo et al. [21] also believe that there is strong relationship between information sharing and the performance of VMI. The results shown that the delay of information transmitted from buyer to vendors will significantly impact VMI performance while accurate information would help for VMI sustainability.

The key success factor for VMI sustainability is mediated by management commitment. Radzuan, Othman and Udin [20] had concluded in their research that management commitment has positive relationship for success implementation of VMI. Management commitment been defined as the willingness and dedication from top management to invest in their manpower and other resources for the support of the project which start from planning till implementation and long term sustainability.

3. Method

The approach been applied in this study is on quantitative approach which intend to study the key success factor of vendor management inventory in Malaysia. The study used in the research is explanatory study which concentrate on establish the causal relationship between variables. Besides, survey design is used for data collection and the tool used is questionnaire for collecting primary data. The data analysis tool used to analyse the collected data is Smart PLS and SPSS. By using SPSS and PLS, several statistical techniques were used such as descriptive statistics, bootstrapping analysis, validity and reliability test, and correlation analysis.

The population for this study is employees working in supply chain related department such as procurement, logistics, inventory, planner/buyer and finance supporting the these department under electrical and electronics industry in Malaysia. Besides, all employees regardless of ranking and position been considered as part of the study as the success implementation of vendor managed inventory not only depend on managerial direction but also the cooperation and commitment of employees from every level in the organization.

The total sample size is 134 for employee from supply chain related department where 200 questionnaires been distributed through email across electrical and electronic companies in Malaysia by assuming that 30% of respondents do not currently working in supply chain related industry. By using G power software, the minimum sample size recommended would be 98 (significant level of 0.05, effect size at 0.15 and statistical power of 0.80).

Online method has been chosen as a data collection medium mainly due to the information is collected from a large group of employees working in supply chain department in electrical and electronic industry in Malaysia and it is relatively cheaper and faster method. A five point Likert scale is used to measure the variables in the questionnaires where respondents been given the scale ranged from Strongly Disagree (1) to Strongly Agree (5) to indicate their agreement and alignment to each section.

Relationship quality and commitment, clearly outline expectation and communication and quality of information sharing been identified as independent variable for the research. While the moderating variable for this study is managerial commitment towards success implementation of VMI.

4. Results

Out of 97 respondents received, 68 respondents are valid responds which contributes 51% respondent rate. Harman's single factor was conducted to test the common bias and with the result of 17.546% cumulative total variance which is smaller than 50% and prove that the result is not affected by the common bias test toward the variance.

Cross loading and loadings are used to test the validity of the constructs. According to Campbell and Cabrera [22], path coefficient higher than 0.5 should be used to define construct validity. Based on the results run from Smart PLS 3, all items have at least two factors with loading value > 0.5 as which means that the constructs are valid. According to Joe Christian and Marko [23], AVE with the value equal or greater than 0.5 show that there is sufficient degree of convergent validity as the variables have explained more than half of the indicator variance. Based on the PLS Algorithm results run from Smart PLS 3, AVE for all variables are greater than 0.5 except for information quality variables. Information quality variable is with AVE < 0.5 but it is still considered as adequate for convergent validity as it have high Cronbach's Alpha (>0.70) [24].

AVE - SE comparison is the recommended approach by Fornell and Lacker [26] to test the discriminant validity on the constructs level. Based on the results shown in Table 1, all constructs indicates strong relationship with each other with AVE square root > 0.7 except for information quality. As suggested by Joe Christian and Marko [23], Heterotrait-Monotrait (HTMT) ratio was recommended to test discriminant validity and based on the results, all constructs have HTMT score < 1 and hence it is concludes that the constructs are adequate for discriminant validity.

Table 1. Discriminant validity of construct (Fornell-Larker criterion)

	EC	IS	KSF	MC	QS	RQ
EC	**0.722**					
IS	0.594	**0.866**				
KSF	0.183	-0.047	**0.789**			
MC	0.721	0.723	0.015	**0.710**		
QS	0.369	0.121	0.865	0.128	**0.561**	
RQ	0.748	0.519	0.090	0.725	0.301	**0.802**

*EC – Expectation, IS – Integrated System, KSF – Key Success Factor, MC- Management Commitment, QS – Information Quality, RQ – Relationship Quality

R^2 (R-square) which is also known as coefficient of determination usually use to measure the goodness of fitness for the model. Based on R^2 value shown in Table 2, the relationship of dependent variables (Key Success Factors) with independent variable displayed substantial strength with R^2 of 0.8 which is > 0.75. However, the relationship of moderating variables (Management Commitment) with other variables (dependent and independent variables) is moderate with R^2 at 0.721 which is close to substantial strength. Generally, the strength of relationship among variables are considered as strong.

Table 2. Summary of coefficients determination

	R Square (R^2)
Key Success Factor	0.800
Management Commitment	0.721

The relationship between dependent variable, independent variable and moderating variables is explained in Table 3 and it is assessed based on whether P value is less than 0.05 is considered as significance. The table shown that Key Success factor (dependent variables) has significant relationship with only one of the Independent variables - information quality with P-value of 0.000 but not with other independent variables such as relationship quality, integrated system and expectation. While moderating variable (management commitment) has significant relationship with all independent variables but has insignificant relationship with dependent variable –Key Success Factor with P-value 1.622.

Table 3. The significance of the relationship between variables

	P Values	T Statistics	Relationship
Expectation → Key Success Factor	0.378	0.310	Insignificant
Expectation → Management Commitment	0.034	1.822	Significant
Integrated System → Key Success Factor	0.093	1.324	Insignificant
Integrated System → Management Commitment	0.007	2.483	Significant
Management Commitment → Key Success Factor	0.052	1.622	Insignificant
Information Quality → Key Success Factor	0.000	4.621	Significant
Information Quality → Management Commitment	0.058	1.570	Insignificant
Relationship Quality → Key Success Factor	0.063	1.528	Insignificant
Relationship Quality → Management Commitment	0.002	2.897	Significant

Path Coefficient and T-value was run to confirm the results of the hypothesis. For the assessment of T-value, the decision is supported if T value is higher than 1.65 as single tailed test is run with significance level of 5%. Based on Table 4. For H_1 till H_4, only one hypothesis is accepted which is H_4. H_5 proposed that the key success factor for VMI sustainability is mediated by management commitment. However, H_5 results indicate that management commitment is not mediate the relationship between independent value and dependent value where all T-value are < 1.65 as shown in Table 4.

Table 4. Path Coefficient, T-value and Hypothesis decision

Hypothesis	Path	Path Coefficient	T-value	Relationship	Decision
H_1	Integrated System → Key Success Factor	0.127	1.324	Positive	Not Supported
H_2	Expectation → Key Success Factor	-0.173	0.310	Negative	Not Supported
H_3	Relationship Quality → Key Success Factor	0.133	1.528	Positive	Not Supported
H_4	Information Quality → Key Success Factor	1.019	4.621	Positive	Supported
H_5	Expectation → Key Success Factor	0.058	1.018	0.154	Not Supported
	Integrated System → Key Success Factor	0.088	1.523	0.064	Not Supported
	Information Quality → Key Success Factor	-0.028	0.939	0.174	Not Supported
	Relationship Quality → Key Success Factor	0.080	1.133	0.129	Not Supported

H_1 suggests that integrated system and common platform is important in driving long term sustainability of VMI. Although the results show that integrated system have positive relationship with key success of VMI, the results found that integrated system is not significant in influencing the long term sustainability of VMI. The results do not support integrated system as significant factor mainly due to the customer demand is more stable in electronic and electrical industry.

H_2 suggest that clearly outlined expectation is important in driving the long term sustainability of VMI. However, the study suggest that the relationship between clearly outline expectation and VMI implementation is negative and insignificant. Buyer and vendors has different objective and expectation in the alignment for VMI implementation.

H_3 suggest that relationship quality and commitment is the key success factor for driving the long term implementation of VMI. The study found that relationship quality and commitment is positively related to the implementation of VMI but not significant in influencing the long term sustainability of VMI. The result is consistent with previous study carried out by Irungu and Kenneth [3] which has positive but insignificant results.

H_4 suggest that quality of information shared is significant in influencing the success implementation and long term sustainability of VMI. The findings shows that quality of information has positive and significant relationship with VMI implementation and sustainability. This is consistent with the findings from Irungu and Kenneth [3]. The study from Omar et. al [25] indicates that three important dimension for information quality that drive the success implementation of VMI is accuracy, adequacy and timeliness.

H_5 suggests that management commitment helps to moderate the long term sustainability of VMI. However, the findings proposed that management commitment generally has positive effect in moderating other variables towards success implementation of VMI except for quality of information but the impact is insignificant. With the commitment from top management, it will help to moderate the effect of relationship quality, common platform and expectation towards VMI implementation as these factor requires significant financial and managerial resource to drive these factors. However, management commitment would not significantly influencing these factors towards VMI implementation as commitment from management is not sufficient whereby the implementation of these factor by itself is a challenge.

5. Conclusions, Limitations and Recommendations

As a conclusion, information quality has positive and significant relationship in driving the success implementation and long term sustainability of VMI. Besides, management commitment helps to moderate the effect of common platform, relationship quality, clearly outline expectation towards long term sustainability of VMI but the moderating effect is not significant.

As similar to other research studies, this research also has several limitations. The current study only focused on respondents from electronic and electrical industry where majority of them are manufacturing company which is more cost concentration with low margin and hence forecast accuracy and information quality will be the key driver. However, different industry may have diverse factors influencing them. This study is concentrated on small sample size with only 147 samples to employee in electronic and electrical industry in Malaysia. Although proper selection of research methodology and analysis had been used against the small sample size, but the conclusion may represent less solid result.

It is also suggest to extend the study to understand the motive of customers and the driver of supplier in support VMI implementation in long term. The understanding of the objective and motivation of customers and suppliers is very important as the motive and success factor is interlink with each other and it will better help to address the study with these understanding. Besides, it is also recommended to extend the study to other industry such as food and beverage where they have very short

turnaround time for stock and hence the key driver may be different as well.

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