The Mediating Effect of Management Information System (MIS) on Warehouse Layout and Efficiency in Small and Medium Enterprises (SMEs)

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ABSTRACT

Due to the globalize business, the warehouse activities are now becoming the centre of important to ensure the effective receiving, storing and handling of goods and materials efficiently in the manufacturing firms. Thus it creates the pivotal roles of logistics support in exporting the goods to other destination as excellent hubs with accurate information of timely delivery, receiving of materials and goods through efficient MIS networking. This paper focus on the warehouse efficiencies in relation with the warehouse layout among SMEs manufacturing firms and its mediating effect with Management Information System (MIS). Overall 187 SMEs were involved in this study. Questionnaires (42 questions) were given to owners, factory managers or warehouse managers or warehouse section heads. All the SMEs involved came from various sectors such as food & beverages, metal & metal products, wood & wood products, paper and printing publication, machinery & engineering, plastics products, electrical & electronics, non-metallic mineral product, petro chemical and chemical, transport equipment, rubber & rubber products, and leather. Findings shows that the Warehouse Efficiency (AWE) correlates significantly with the Warehousing Layout variables above 0.7 while Warehousing MIS (AMIS) above 0.5. As for multiple regression test, variables AL and AMIS, the effects were significance with the $R^2 = 0.758$ or 75.8 percent to explained in model AWE. In this test, it is found that there are significance value of variables AL (0.623) and AMIS (0.03). This reflects of the significance role of AL and AMIS in maintaining the warehouse efficiency. The results indicate the important of warehouse efficiency in the manufacturing firms. The warehouses Layout and MIS are the main basic variables for process management improvement in making the warehouse to be efficient and firm performance achievable. It is through the Warehousing MIS mediation to the Warehousing Layout that mediates positively to its relationship over the Warehouse Efficiency.

Keywords: Warehouse efficiency, Layout, MIS, SMEs

I INTRODUCTION

Issues on warehouse efficiency (or logistics management in general) specifically are not comprehensively studied until after the business globalization process takes place (Ali, Jaafar & Mohamad, 2008, Jusoh & Kamis, 2009, Ismail, Hashim, Ghani, Zulkifli, Kamilah & Rahman, 2009). The problems keep on developing and continuing with the evolution of the logistics roles which took place actively during that time (Gundlach, Bolumole, Eltanway & Frankel, 2006). This especially happened actively in the last two decades in the supply chain networks which warehouse is part of the logistics major service providers (Sink, Langley & Gibson, 1996; De Koster, Le Duc & Roodbergen, 2007; Lambert, Stock & Ellram, 1998). Tomkins and Smith (1998) described that warehouse efficiency has now become a core competency, a strategic weapon that many companies is using to enhance their positions. At the same time, the warehouse efficiency is undergoing unbelievable challenges that make it excellence become harder to achieve. Warehousing before this has been viewed as a supportive industry to other functional areas but it has now been regarded as a strategic industry on its own (Gundlach *et al.,* 2006; Sum, Teo & Ng, 2001). With the current condition of global competitiveness and supply chain concepts, it has greatly changed the direction of warehouse efficiency perspective as the research proved to be as that (Harmon, 1993). Hamel and Pralahad (1994) regarded this development when the business activities becoming more complex, competition for the future are considerably an opportunity sharing rather than market sharing. Due to the enormous challenges being faced by the warehouses efficiency, it requires much more

professional approaches than the previously adopted in planning, managing and improving in today's warehouse operations (Tomkins and Smith (1998).

Malaysian companies would continually increase their capabilities in the logistics services in the near future through the implementation of activities such as warehousing management, inventory replenishment and order fulfillment (Sohail & Sohail, 2003). In today's competitive business environment which many companies are strategizing to gain and share the global markets, the companies are actively taking advantage of higher production and sourcing efficiency. Keys to that success are determined by the role of the logistics function (which warehouse is one of the major service providers) in ensuring the smooth flow of materials, products and information throughout a company's supply chains (Sum *et al*., 2001). This has greatly contributed to the changes of warehouses business perspective which required warehousing to be more efficient in their operations, HCM, layout and MIS. Due to the increasing importance of the logistics industry and warehouse efficiency, it has resulted to the expansion of the international trade as well as an active endorsement of the company's and business's globalization strategy (Ali *et al*., 2008).

Saleh and Ndubisi (2006) analyzed that SMEs have accounted for more than 80 percent of the total manufacturing establishments in Malaysia. With favourable environmental factors, the SMEs in Malaysia are expected to transcend from their present state to undertake a more important role in order to support the requirements of Malaysia's industrialization process. However, Jusoh and Kamis (2009) cautioned that in order to survive, the SMEs must be able to reduce costs, improve quality and provide a rapid response to the customer's needs. One of the ways of achieving that competitive edge is through the implementations of the best logistics (and warehousing) practices (Jusoh & Kamis, 2009).

Issues and challenges affecting warehouse efficiency processes are becoming seriously focused in managing the logistics industry, in which warehousing is part of the major logistics activities in the service providers. Other major activities related are transportation, inventory management, order processing, information system and packaging. Instead, warehousing has been a neglected area of business activity in Malaysia (Ali *et al.*, 2008). It becomes worst as the business environments are becoming more challenging, wider and global markets have contributed to producing a large scale of products by any organizations. This creates the increase of inventories in order to meet these demands for company operations and customer satisfactions (Ismail *et al*., 2009).

II OBJECTIVES

To examine the mediating effect of warehousing MIS in the relationship between warehousing layout and warehouse efficiency.

III LITERATURE REVIEWS

SMEs in manufacturing sector were involved in activities such as the processing of raw materials, including food, beverages, textiles, petroleum, wood, rubber and the assembly and manufacturing of electrical and electronics appliances and components (Saleh & Ndusi, 2006).The Annual SME Report 2008 emphasized that Malaysia's target is to increase the contribution of SMEs to Gross Domestic Product (GDP) from the 32 percent charted in 2005 to 37 percent, exports from 19 percent to 22 percent and employment from 56 percent to 57 percent in 2010. In practice warehouse is defined as a planned space for the storage and handling of goods and materials (Emmett, 2005), with large building and it plays an important part in the organization related to its business purpose (Tompkins & Smith, 1998; Frazelle, 2001). Lambert *et al.* (1998) described warehouse activities are more focus on the core competencies of the operational which could satisfy customers' expectation on the shorter delivery of time and more accurate services. Stock and Lambert (2001) added that there are six types of public warehouses; general merchandise for manufactured goods, refrigerated or cold storage, bounded, household goods and furniture, special commodity and bulk storage.

Rouwenhorst *et al.* (2000) mentioned that the efficiency and effectiveness in any distribution network in turn is largely determined by the operation of the nodes as the warehouses. Koster and Warffemius (2005) argued that complexity of a warehouse operation has a large impact on the performance of the warehouse, and in this case the efficiency of the warehouse. Gunasekaran *et al.* (1999) mentioned warehousing comprises six major operation throughput activities which are receiving, transfer, handling, storage, packing and expediting. Conclusion, timely and accurate information about

products, resources and processes are essential to operate a planning and control structure to achieve high performance of warehousing operation in today's marketplace (Faber *et al.*, 2002).

Murphy and Poist (1993) argued that warehouse as the most costly activities in logistics because a major part of its operations is labor intensive thus to improve operational and organizational performance. Ellinger, Ellinger and Keller (2005) believed that firms wishing to remain competition effectively in the logistics (and warehousing) industry would increasingly evaluate the feasibility of adopting more people oriented to focus on the growth and development. This might produce more groups of front line logistics and warehousing employees.

Autry, Griffis, Goldsby and Bobbitt (2005) specified that the need for data management to support logistics processes has created demand for specialized information systems and custom-designed for logistics management needs. As results, many firms begun to invest in technologies that enhance decision make capabilities for transport management, warehouse management, and demand forecasting and planning among others (Bowersox, Closs, and Stank, 1999). Conclusion, in warehousing, information on inbound and outbound flows, weight and volume of stored products by type and cost of inventory are necessary (Pokharel, 2005).

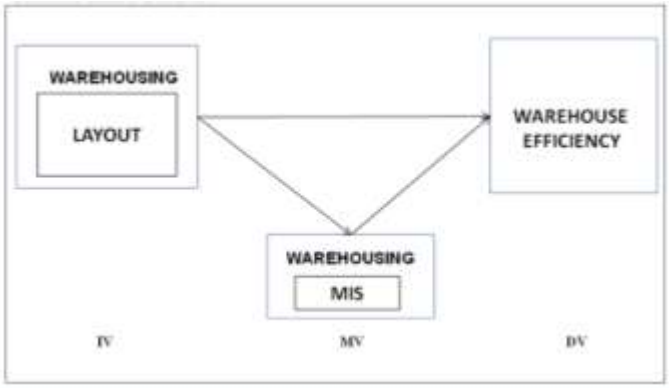
Modern warehousing concerns speed and efficiency related to automation, computerization and new means of communication (Jenkins, 1990). Warehouse efficiency and effectiveness could be measured by safety, shipping errors, on-time shipments, customer problems, cost per line shipped and total warehouse expenses (Lambert *et al.*, 1998). To create efficiencies, warehouse quality performance is used to determine warehouse efficiency which are put away, inventory, picking and shipping accuracy (Frazelle, 2002).

Based on the past literatures and research, Lewin's Force Field Theory explains the imperative transformation in production process, product design and quality, service delivery and other aspects of business enterprise (Elsey, Barry and Tse, 2007). This impacts the structures strategies, policies, budgets, reward systems, learning and competence, the attitudes and behavior of the work force that could be related to warehouse efficiency. Elsey *et al*. (2007) analyzed that the contribution of Lewin's Force Field theory lays in its emphasis on the dynamics of organizational change which suited the overall thinking as it deals with two forces impacting each other or Lewin (1946) called "quasi stationary equilibrium". This theory led to the development of Lewin's 3-Steps Change Model: Unfreeze, Freeze and Refreeze. Therefore, Lewin's Force Field Theory is all about effectiveness of change. With additional 3-Steps Change Model, these theories could determine that such supports to improve the changes of activities in the organizations have encouraged everyone to focus on the intended situation to enhance the plan to be achieved.

IV THEORETICAL FRAMEWORK

This study recognizes that the warehouse management related to its Layout and MIS play crucial roles in achieving the desired warehouse efficiency and performance.

Figure 1.1:
Theoretical Research Framework



V HYPOTHESES

There is a mediating effect of warehousing MIS in the relationship between warehousing layout and warehouse efficiency.

VI METHODOLOGY

The target population for this study is SMEs manufacturing firms in Malaysia which are listed under the SME Business Directory (2009). It is obtainable at http://secure.smeinfo.com.my. According to BNM (2007), cited by UNDP (2007), a total of 16,515 SMEs in Malaysia are listed according to the business sectors with manufacturing dominated the sector with 5,947 SMEs, including Agro based. Specifically, the study used all the firms listed in the SME Business Directory in various manufacturing sectors: food & beverages, metal & metal products, wood & wood products, paper and printing publication, machinery

& engineering, plastics products, electrical & electronics, non-metallic mineral product, other (jewellery), petro chemical and chemical, transport equipment, rubber & rubber products, and leather. Owners, factory managers or warehouse managers or warehouse section heads are given the questionnaire surveys for them to response.

In this research, the total numbers of SMEs manufacturing sectors are 5,947 and through postal services, 1,000 questionnaires are sent to SMEs manufacturing owners / factory managers / warehouse managers / warehouse section heads throughout Peninsular Malaysia. However, out of 1,000 questionnaires posted to the population, only 220 responded and only 182 are found to be useful for the studies, which the overall response rate is 18.9 percent or 19 percent (round-up). This is deemed acceptable response rate for top management or their representatives' questionnaires in social science research (Menon, Sundar & Roy, 1996; Baruch, 1999).

Data are analyzed using the SPSS Version 19 program. Non-respondent characteristics are studied in order to check if the lack of response is significant. The collected data are summarized, analyzed, interpreted and presented to address the research objectives that prompted the entire research process. Linear regressions and Sobel test are used.

It is necessary to gauge the extent of reliability of the instrument used in the study. Thus the necessary test is carried out. Ideally the Cronbach α coeffiecient of a scale should be a least 0.7 (Hair *et al*., 1995). The pre-testing exercise is done in mid-May 2010 with 50 SMEs manufacturing firms listed in the SMI Business Directory (2009) but only 36 of the pre-tested sampling are returned with only 30 are found useful. According to Roscoe (1975), a sample size of more than 30 but less than 500 was appropriate for most research. **Table 1.0** gives the alpha coefficient of reliability in the pre-test and post-test analysis of the research instrument. Based on the pre-testing exercise, all the items for each construct post a Cronbach α value of as low as 0.70 as high as 0.99. This means the rules tests in the pre-test and post-test modes indicate that the instruments are highly reliable.

Table 1.0:
Cronbach α Coefficient of Reliability (Pre-Test and Post-Test Analysis)

Constructs	No. of Items Pre-test	No. of Items Post-test	Reliability Index Pre-test (n: 30)	Reliability Index Post-test (n: 182)
Warehouse Efficiency (AWE)	21	18	0.814	0.945
Warehouse Layout (AL)	5	5	0.900	0.926
Warehouse MIS (AMIS)	12	10	0.835	0.859

Nunnelly (1978) defined validity as the degree to which measurement scale measures what it is intended to measure. Peter (1981) stated that validity refers to the extent to which a measurement tool actually measures the construct that is used to measure. In this study, the Bartlett test of sphericity and the Kaiser Meyer Okin (KMO) measure of sampling adequacy (SMA) or > 100 are used to investigate the validity of the constructs. The statistical scores of this test for all constructs are shown in **Table 1.1**. Therefore, it is concluded that all the questions used in the questionnaires are mostly valid as the results are 0.50 and above is sufficiently large to permit factor analysis to represent the validity constructs (Hair *et al*, 2006)

Table 1.1:
Investigating Validity: Results of KMO Measure of Sampling Adequacy and Bartlett's Test of Sphericity.

Constructs	Kaiser Meyer-Okin Measure (KMO) of Sampling Adequacy	Bartlett Test of Sphericity
Warehouse Efficiency	0.887	3950.906
Warehousing Layout	0.845	1196.652
Warehousing MIS	0.790	1223.955

VII FINDINGS

A correlation analysis is used to evaluate the strength and direction of the linear relationships between two variables (Pallant, 2007). Based on this study, summary analyses of the overall Pearson Correlations (as referred to Table 1.2) are conducted**.** The best value or perfect correlation is $-1 \leq \rho \leq 1$.For the correlation coefficient, anything that is below 0.05 or $\leq$ 0.05 is considered significant or positive and anything that is above than that is considered not significant or negative. The study found that the Warehouse Efficiency (AWE) is significance with the Warehousing Layout variables above 0.7 while Warehousing MIS (AMIS) above 0.5.

Table1.2:
Pearson Correlation Results

		AWE	AHCM	AMIS
AWE	Pearson Correlation	1		
	Sig.			
	N	182		
AL	Pearson Correlation	.240(**)	.071	.199(**)
	Sig.	.001	.339	.007
	N	182	182	182
AMIS	Pearson Correlation	.518(**)	.405(**)	1
	Sig.	.000	.000	
	N	182	182	182

Upon the completion of correlation analysis and multiple regressions analysis using the SPSS Version 19 are performed to find any influence between the independent variables (Warehousing layout), mediating variable (Warehousing MIS) and the dependent variable (Warehouse Efficiency). The steps taken in analyzing the relationships of the variables are based on the recommendations of Baron and Kenny (1986). The results of the analysis are explained in the applications of multiple linear regressions formula ($Y = B_0 + B_1 X_1 + \ldots\ldots B_p X_p + \varepsilon$) (refer to **Table 1.3** and **Table 1.4).**

Table 1.3: ***Model Summary***

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.871(a)	.758	.753	.15465	.758	138.847	4	177	.000

a Predictors: (Constant), AMIS, AL
b Dependent Variable: AWE

Table 1.4:*Correlations Coefficients*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.420	.157		2.677	.008
	AL	.010	.020	.024	.492	.623
	AMIS	.122	.041	.161	2.999	.003

a Dependent Variable: AWE

AWE = 0.420 + 0.010Al + 0.122AMIS. All the coefficients are significance with R^2 = 0.758. Therefore there are 75.8 percent of total variations in AWE explained by AL and AMIS in maintaining the warehouse efficiency.

For variables AL and AMIS, the relationships are significance with the R^2 = 0.758 or 75.8 percent to explained in model AWE. In this test, it is found that there are significance value of variables AL (0.623) and AMIS (0.03). This reflects of the significance role of AL and AMIS in maintaining the warehouse efficiency.

Hypothesis: There is a mediating effect of Warehousing MIS (WM) in the relationship between Warehousing Layout (WL) and Warehouse Efficiency (WE).

Table 1.5 shows that the results for the significant unstandardized regression coefficient (B=0.160) indicate the AL affects the AWE significantly ($p<0.01$). Step 2 is to test whether the AMIS (predictor) is related to the AL (outcome). The results of the unstandardized regression coefficient (B=0.347) indicate the AL affects the AMIS significantly ($p<0.01$). Step 3 is to test whether the AWE (predictor) is related to the AL (outcome) and AMIS (mediator). The results of the unstandardized regression coefficient associated with the relation between the AMIS and AWE are significant (0.062, $p<0.01$). This regression equation also provides an estimate of the relation between the AL and the AWE, controlling for the AMIS (B=0.465). Table 1.6 shows that the Step 4 of the Sobel, Aroian and Goodman tests show the results are significant, $p < 0.05$. Figure 1.2 indicates the relationship of tested variables (AL, AMIS and AWE) after mediation that Warehousing MIS mediates the relationship between the Warehousing AL (0.347) and Warehouse Efficiency (0.394) with 0.032 between Warehousing AL and Warehouse Efficiency. Therefore, the study found that there is a mediating effect by Warehousing MIS in the relationship between Warehousing Layout and Warehousing Efficiency.

Table 1.5: ***Measuring the degree of influence of AMIS in therelationship between AL and AWE***

	F	R^2	B	SE B	Beta	T	Sig
Step 1							
Outcome: Warehouse Efficiency	10.97*						
Predictor: Warehousing Layout		0.057	0.160	0.030	0.240	5.313	0.00
Step 2							
Outcome: Warehousing MIS	120.43						
Predictor: Warehousing Layout		0.401	0.34*	0.032	0.633	10.9*4	0.00
Step 3							
Outcome: Warehouse Efficiency	35.106						
Predictor: Warehousing Layout		0.057	0.062	0.034	-0.148	- 0.504	0.02
Mediator: Warehousing MIS		0.282	0.465	0.062	0.612	7.4*6	0.00

Table 1.6: ***Using Sobel test as to measure the ediating effect of AMIS in the relationship between AL and AWE***

	Input		Test statistics	*p*-value significance
A: Warehousing Layout	0.347	Sobel test:	6.544	0.00
B: Warehousing MIS	0.394	Aroian test:	6.527	0.00
Sa: Warehousing Layout	0.032	Goodman test:	6.562	0.00
Sb: Warehousing MIS	0.048			

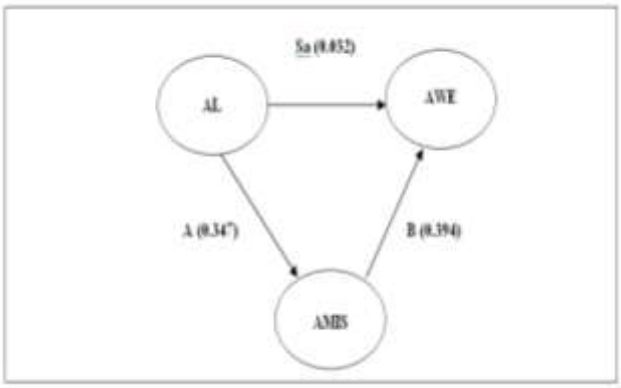


Figure 1.2:
Relationship of tested variables (AL, AMIS and AWE) after mediation

VIII CONCLUSIONS

The results indicate the important of warehouse efficiency in the manufacturing firms. The warehouses Layout and MIS are the main basic variables for process management improvement in making the warehouse to be efficient and firm performance achievable. It is through the Warehousing MIS mediation to the Warehousing Layout that mediates positively to its relationship over the Warehouse Efficiency. Thus this concludes that the manufacturing firm achievement is realistically depending on the warehouse performance in ensuring mainly good results of inventory accuracy and space optimization that reflects the firm operational process performance. Hopefully the research would open the horizon clearly to the top management of the manufacturing firm of the importance of warehousing management and its process operations. With the globalize business is getting more competitive and volatile, the functions of warehouse is realistically could not be denied of its pivotal role. The remarks in practice that warehouse is liked a 'bank' and 'heart of the factory' speak the volume of its contributions to the manufacturing firms or any organizations.

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