

Linking Human Capital, Information Technology and Material Handling Equipment to Warehouse Operations Performance

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Abstract— Human capital, information technology and material handling equipment are considered as the vital resources needed by organization in operating warehouse effectively and efficiently. However, there are very few previous studies that have proved conclusively the relationships between these resources and warehouse operation performance. Hence, this study is conducted to determine these relationships in order to explain better how these resources should be given priority. A set of questionnaires were developed for a population of 1,589 licensed manufacturing warehouses in Peninsular Malaysia. A total of 800 warehouse managers participated in the study. The data were collected via mail and 102 valid responses were analysed. The study found that all these resources had positive and significant relationship with warehouse operations performance. The study concluded that human capital should be given high priority in the warehouse operations to enable firms achieve high performance.

Keywords— Human capital, information technology, material handling equipment, warehouse operation, logistics performance.

1. Introduction

Warehousing is part of logistics [1] and the supply chain management activities [2, 3] are critical functions to the business effectiveness and efficiency. The performance of the firm can be affected by the warehouse operations due to several factors. For instance, warehouse operation acts as a bridge between the firm and its customers [4] because the warehouse is the starting point for the

movement of firm's products to customers. It is the warehousing operations responsibility to ensure the firm's products are distributed on time and precisely to the customers [1,5]. In addition, Frazelle [1] stated that warehouse management needs to ensure that they are operating at a zero error as it can affect the level of services to the customers.

Furthermore, Dekker, Koster, Roodbergen, and Kalleveen [6] stated that customers tend to make late bookings but expect prompt delivery. The failure of warehouse operations to meet these demands can cause customers to lose confidence towards the firm and in return it can affect the level of sales turnover. In addition, manufacturing operations today are global in nature and it is affected by an unpredictable business environment characterized by rapid technological changes. This scenario demands some degree of flexibility on the part of warehouse operations in order to be ready in facing the uncertainties. Warehouse should be able to adjust and adapt its operations to the constantly changing business environment.

The impact of warehouse operation on business performance can also be viewed from the warehousing costs itself. The cost of warehouse operation has a significant impact on the firm's financial performance. The warehousing cost contributed between 2% to 5% of the total cost of sales [1] or between 25% to 28% of the total cost of logistics [3, 7] or 30% of the total cost of production [8]. Therefore, it is crucial for a firm to minimize the cost of warehouse operations as it

seen to be one of the main contributing expenditure to businesses [1, 9]. The ability of warehouse operations in achieving cost efficiencies could significantly help firms reduce overall operating costs, thus ultimately helps to increase firms' profits.

The ability to show a good level of operational performance is dependent upon proper utilization of the firm's resources. According to Resource-based View (RBV), organization resources are the fundamental driver of firm performance. Among the important resources that needed attention in the warehousing operations are human capital, information technology and material handling equipment [1, 2]. Previous studies from Autry, Griffins, Goldsby and Bobbitt [10] and Rogers, Daugherty, and Ellinger [11] found that the information technology have positive and significant relationship with warehouse operations performance. However, there are scanty studies that examined the relationship between human capital and material handling equipment with warehouse operations performance. Therefore, this study is intended to breach these gaps in the literature.

Deriving from the above discussion, there are two main questions that need to be addressed in this study. First, is there any relationship between human capital, information technology and material handling equipment with operational performance? Second, which resources should be given attention and prioritized in warehouse operations. Hence, the main objective of this study is to provide information and empirical results to assist managers in making decisions related to resource allocation for warehouse operations.

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2. Literature Review

2.1 Human Capital

Employees are main components to the warehouse operational efficiency [12] and it becomes even

more important if the warehouse is labor-intensive in its operations. Employees are important asset to the firm because of their knowledge, skills, experience and competencies. Human capital means the total value of human resources for a firm [15]. The total value of the human capital in a firm involves all staff in the organization and their ability in completing their work successfully [16]. Bontis and Serenko [17] argued that human capital includes three dimensions: competency, experience and knowledge possess by an individual. While Hitt et al., [18] stated that human capital has two dimensions; quality and experience.

But, Wright et al. [19] claimed that human capital has three dimensions involving experience, judgment and intelligence. Carmeli and Tishler [20] and Castro and Saez [21] also measured human capital through education, work experience and competency. This study argues that there is a possibility of relationship between human capital and warehouse operations performance. The possibility of this relationship is tested as the following hypothesis:-

H1: There is a positive and significant relationship between the human capital and warehouse operations performance.

2.2 Information Technology

Information technology (IT) can be defined as the technology use to acquire, process and disseminate information to ensure decision making becomes more effective [22]. Information technology is seen as crucial as it provides a major contribution to the performance of warehouse because it assists managers to support employees in managing and operating more efficiently [1]. Emmett [2] emphasized information technology could reduce the operational costs and improved services delivery to customers.

Stock [23] stated that the information technology provides strategic impact on warehouse operations mainly on cost and material purchasing aspects. Information technology improves asset utilization and appropriation through accurate, fast and timely information via the usage of computerized forecasting techniques. Relevant knowledge, information and data can be disseminated to all concerned parties and stakeholders; hence, it will

improve the budget planning, costing and warehouse operations performance.

Stock (1991) also argued that IT allows organizations to reduce cost when they have and utilize accurate and timely information. The rapid development in technology makes IT an asset that can be acquired at lower cost, consequently helping warehouses to reduce inventory holding cost (due to accuracy in predicting the demand and supply) and purchase of fixed assets (such as maximizing tools and machineries utilizations as a result of better planning and scheduling by computer, WMS) [23].

Many studies were conducted in examining the relationship between warehouse operations performance and information technology such

as Autry et. al [10] and Rogers et. al [11]. Since a lot of development and changes are happening in the IT and business environment these days, a relook at this relationship is a necessity. Therefore, the question of relevancy of IT to the operation of the warehouse is answered through testing the following hypothesis.

H2: There is a positive and significant relationship between the information technology and warehouse operations performance.

2.3 Material Handling Equipment

Material handling equipment is a machine that moves goods in a restricted area for the purpose of manufacturing or warehousing [24]. Moveable items consist of raw materials, semi-finished goods and finished goods. It can be operated manually, or through semi-automation as well as fully automation. Material handling equipment could help warehouse operations to be operated efficiently [2, 25] and effectively [2].

Frazelle [1] agreed that material handling equipment has positive contribution to the performance of warehouse operations. However, he doubted whether the warehouse operation that uses equipment intensively can show better performance level than warehouse that uses lower level of handling equipment. The usage of handling equipment without going through careful study may cause negative impact on operations performance.

To overcome the problems raised by Frazelle [1], Emmett [2] opined that the choice of material handling equipment must be suitable to the type of materials and operational objectives of the warehouse. A good level of performance only can be achieved if the use of equipment is appropriate to the circumstances which were mentioned earlier.

Suggestions by Emmett [2] was also supported by Coyle et al. [25] which stated that material handling equipment can help towards cost reduction because it can improve productivity. From the above discussion, it was found that there is no conclusive empirical evidence to show that higher or lower level of material handling equipment can impact warehouse operations performance. Hence, the following hypothesis is tested:

H3: There is a positive and significant relationship between the material handling equipment and warehouse operations performance.

3.0 Research Methodology

The data were collected from 1,589 manufacturers in Peninsular Malaysia who obtained license from the Royal Malaysia Custom Department to operate bonded warehouse. The license is granted to manufacturers who produce dutiable goods and it has not been declared yet to Customs. Dutiable goods should be stored in the area (warehouse) gazette (licensed) by the Customs Department. The gazette area is for license holder's use only and not to be rented as in the case of bonded warehouse.

Based on the number of the population of 1,589 manufacturers. 800 manufacturers were randomly selected to participate in this study. Simple random sampling was applied because of the homogeneity of manufacturers in the population. The uniformity of manufacturers is achieved because they have to fulfill regulations and procedures set by the Customs Department as prerequisite criteria in obtaining the license.

The respondents are warehouse managers and a set of questionnaire was developed to capture their responses on the said variables. The questionnaires were mailed to 800 respondents and 107 respondents responded. Thus, the response rate of the survey is 6.7% of the total population, or 13.4%

of the 800 respondents which were contacted by mail. However, only 102 responses were usable for data analysis.

3.1 Measure

The human capital is measured from three dimensions which are competency, education and work experience. The items were obtained from Carmeli and Tishler [20]. They are four items on education and work experience and four items for competency. The Cronbach Alpha for this variable is 0.867.

Information technology and material handling equipment have been measured by adopting measurement from Technology Acceptance Model (TAM). The model consists of two dimensions which are ease of use and usefulness. The items used in the study are a revised version from Venkatesh and Davis [27]. Each dimension has four items respectively.

The respondent is required to response on the ease of use and the usefulness of the warehouse information technology software and hardware. The score of internal consistency from Cronbach Alpha is at 0.793. For material handling equipment the score of Cronbach Alpha was at 0.972.

The warehouse operations performance is measured from four dimensions, namely as service quality, delivery, cost and flexibility. Items for these dimensions were obtained from [28-38]. There are 11 items that represent all dimensions of warehouse operation performance. To ensure these items have a proper degree of internal consistency, the Cronbach Alpha test was performed and found to obtain a score of 0.756.

4.0 Findings

Pearson correlation analysis was conducted to identify the relationship between human capital, information technology and material handling equipment with warehouse operations performance. Table 1 reports the result of the analysis.

Table 1
The relationships among variables

Variables	Warehouse Operations Performance
Human Capital	0.393**
Information Technology	0.269**
Material Handling Equipment	0.313**

Note: ** The mean difference is significant at the 0.01 (2-tailed)

The study found all variables have positive and significance relationship with warehouse operation performance. Hence, all the hypotheses are accepted. The result indicates the strength of association between human capital and materials handling equipment with warehouse operations performance is considered as moderate as suggested by Cohen (Pallant, 2005). But the strength of association between information technology and warehouse operations performance is weak.

The result of analysis also revealed that the directions of associations are positive. This indicates that additional efforts to enhance human capital of warehouse operational workers would result in the increase in the level of warehouse operations performance. The improvement of IT software and hardware or acquisition of material handling equipment with newest technology would also help to increase the level of warehouse operations performance.

5.0 Discussions

The empirical findings of the study help managers to understand the importance of having workers with good and relevant knowledge, skills, experience and academic qualification. Academic qualification manifests the cognitive ability of the workers in performing the simplest to the most complex tasks. The ability to perform the given tasks demonstrates the competencies of the workers. Thus, perception of having low qualified, inexperienced and incompetent workers in warehouse operation is a myth that needs to be corrected.

Materials handling equipment is empirically proven to be one of the important assets in the warehouse operation. The ability of the machine to handle stocks which are impossible to be handled by human or it take considerable amount of time to finish the task, make it special for warehouse operations. Furthermore, the material handling equipment can be utilized for long hours, hence operating warehouse 24 hours and 7 days a week is made possible.

The important of warehouse IT related software and hardware to manager is due to its ability to collect, analyze and disseminate information to other parties. Information helps managers in areas such planning, scheduling and organizing manpower and machine for the operations. Furthermore, IT helps to maximize the utilization of space and assets in the warehouse.

Theoretically, the human capital, material handling equipment and information technology are considered as important organizational resources. From the RBV perspective, the organizational resources are fundamental drivers of performance [39, 40].

Among all identical resources in this study, human capital is the most valuable asset to the warehouse operations. Investing in human capital will create continuous learning and growth within the organization. When workers have more knowledge and experience, they can perform better and at the end it helps to increase satisfaction among internal and external customers and enhance performance [41].

Hence, this study has some limitations. Firstly, it is a cross sectional study, secondly, only manufacturers in Peninsular Malaysia participated in the research and managers are the respondents. Because of these limitations therefore, future research should look into other types of organizational resources and its association with warehouse operations performance. It is also recommended that future research should use longitudinal method, consider other types of firms, and replicate the research in other parts of the country and other economies. Lastly, to get a better insight, future research should considers the views of employees as respondents in the research.

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