A Potential Practices of Vendor Managed Inventory Elements in Construction Industry

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DOI: https://doi.org/10.37178/ca-c.21.5.08

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ABSTRACT

The construction industry plays an important role in developing infrastructure needs for socio-economic development as well as contributing to economic growth. However, there are some obstacles including weaknesses in terms of level of logistics competence, information sharing efficiency with suppliers as well as poor inventory management. In line with the principles and practices of inventory management (IM), the construction industry needs to consider the best practices to improve the efficiency and effectiveness of its entire supply chain. The study used qualitative approach, which data were gathered from semi-structured questions through interview process. There are two companies involved in this overview study of IM practices, which include a manufacturer of construction building component and a contractor. The finding shows that replenishment decisions, inventory ownership, inventory location, distribution model and information sharing practices are quite similar with VMI practices. Based on the findings, construction industry has high potential to implement VMI practices. Since, project process is unique and always requires new design of VMI, manufacturer,

developer and contractor should consider quantity and size of component in designing their VMI practices

Keywords: Vendor Managed Inventory elements, inventory management, construction industry

INTRODUCTION

The construction industry plays an important role in developing the infrastructure needs for socio-economic development as well as contributing to economic growth. With good economic growth, the need for the construction industry to meet expansion and change in demand becomes increasingly critical. To cope with the challenges of global competition, the Malaysian construction industry needs to respond to changes in demand more responsively. However, there are several barriers including weaknesses in logistics competence, information sharing efficiency with suppliers and poor inventory management (IM). In line with the principles and practices of IM, the construction industry needs to consider the numbers of IM approach to its portfolio to enhance the efficiency and effectiveness of its entire supply chain.

One of the recommended IM approaches to addressing weaknesses related to IM systems is the Vendor Managed Inventory (VMI) program. Improving VMI implementation in the construction industry has been widely discussed and is one of the best practices in developed countries. VMI is a program that allows suppliers to make decisions about replacing inventory including in terms of quantity and when delivery is required. Suppliers usually have ownership rights to the inventory until it is used by the customer. The developer or contractor will only pay for the goods used. This will reduce the cost of materials management in the event of an overuse of materials once the construction project is complete. To ensure that the supply of inventory does not run out that may adversely affect the progress of the project, the VMI system will set minimum and maximum levels of inventory required by the supplier.

IM is an important function that can increase productivity in construction projects. [1] describe materials management functions including material planning and disposal, supplier evaluation and selection, purchase, expenditure, shipping, receipt, warehousing and inventory, and distribution of materials. One of the key issues affecting the performance of construction projects is the improper handling of materials during activity on the construction site. Improper handling and poor material management at construction sites have the potential to impact project performance [2]. Some of the key issues affecting materials management activities include storage area constraints, site logistics related to materials handling and distribution, as well as ordering and delivery of materials to construction sites. Previous research has highlighted issues of material management such as; improper storage location [3], need for greater material storage capacity [4], lack of communication [5]; [6-8], difficulties in transport and delivery of inappropriate materials. Other issues include manual processing of data and non-compliance with specifications, late delivery [9] and lack of materials [10].

It can be concluded that the material management practices, and manual procedures are not satisfactory. Implications of such vulnerabilities will result in waste and excess material, delays, reduced productivity and lack of real and current information [11]. Interestingly, many management-related problems arise among local contractors, especially in developing countries [12].

This is where the need for better materials management techniques comes from exploring potential approaches to managing construction project materials. The recommended approach is Vendor Managed Inventory (VMI). Through this approach the responsibility for managing inventory by contractors is provided to suppliers. No studies have been conducted to explore and discuss the use of VMI in the local construction industry. Therefore, the study needs to be undertaken to address issues related to the inefficiency of inventory management in the construction industry.

To accomplish this mission, several objectives of the study were specifically identified as follows:

1. To identify challenges in current inventory management practices in the Malaysian construction industry;
2. To determine the inventory management practices that contributes to success in the Malaysian construction industry;

Literature Review

According to [13], VMI is a trade collaboration initiative in which suppliers are empowered to manage inventory on behalf of buyers and integrate operations between suppliers and buyers through information sharing and business process re-engineering. Meanwhile, [14] sees VMI as collaboration between business partners, with the help of demand information provided by customers, suppliers managing and increasing customer inventory. In contrast, [15] define VMI as inventory planning and replacement techniques, whereby suppliers are responsible for monitoring and refinancing customer inventory at an appropriate time to maintain a predefined inventory level. Sellers are given access to current information and forecasts of customer inventory as well as sales order information for replacements as needed. Although, trust is essential in collaborating program like VMI, the impact of trust is relatively small. Customers tend to replace role of trust with tight inventory control as acontract agreement [16].

Although different terms have been used to describe the process of replacing inventory, attention should be given to the general concepts agreed upon by them. Therefore, this study refers to VMI as an ongoing process by which vendors or suppliers [17]:

1. be responsible for the decision of the replacement based on the agreement entered with the customer.
2. receive or collect required data from customers to assist in making inventory replacement decisions.

The findings of the study indicate that several elements of VMI have been identified [18], which may influence inventory management performance in terms of cost reduction and service improvement. Among the VMI elements are includes:

Replenishment Decisions

Inventory refill decisions raise the issue of power to make decisions in refill inventory. Distributing the power of re-ordering decisions to supplier benefits customers by reducing the costs associated with booking. For suppliers, the benefits of this rule are to optimize manufacturing and distribution activities [19] as well as minimize out-of-stock spend through the possibility of prioritizing orders from customers [20]. In addition, [21] stated that in the early stages of VMI implementation, supplier refill inventories required customer approval; however, the key information of the VMI program was to eliminate the role of customers in determining orders. As a guide to inventory refinement decisions or ordering suggestions, suppliers must adhere to the minimum and maximum levels of inventory, where inventory levels must be maintained within these limits.

Inventory ownership

The question of who owns the inventory relates to the owner being responsible for the cost of capital, including the costs of the entire inventory. In industries such as electronics manufacturing, inventory volatility is a critical issue. In such an environment, if the inventory is owned by the supplier, risk sharing is usually in the

form of, for example, guaranteeing customer quota quotas, or cost sharing with the customer. For customers, the benefit of the supplier is having inventory - also referred to as consignment inventory, where the cost of holding inventory is allocated to the supplier. The benefit of inventory ownership by suppliers is however unclear. [22] argue that supplier ownership of inventory can reduce inventory management costs by lowering inventory costs at the upstream of the supply chain and transferring the inventory management burden on suppliers.

Location of inventory storage

The physical location of the building material is a significant element in VMI. Inventories can be located at a customer's location in a distributed way, for example, directly at a construction site or at a construction site's storage location. Here suppliers add sub-inventory to each construction site or source location where raw products or materials are used. However, suppliers may also manage customer inventory in a centralized way by ensuring that the inventory level in the customer's storage center is at a fixed level. Other alternatives are customer inventories placed on their own suppliers or on third-party premises.

Distribution model

Distribution models determine the physical distribution of raw products or materials within the VMI system. The key issue to consider here is whether distribution activities are carried out by suppliers themselves or outsourced to third parties by suppliers. The important question here is the importance of interaction between suppliers and customer representatives during the distribution process. Issues like requirement of machinery carriers and high transportation costs can be major barriers in the construction industry [8]. A material supplier can play a role as a consultant to the customer in the process of designing and assembling a material to help suppliers find new materials or materials that meet the needs or development of new products. Meanwhile, in a more stable environment the role of the supplier will be less important and can provide distribution activities to third parties, usually because third parties are more economical to facilitate distribution activities through the implementation of economies of scale.

Information sharing

Information sharing in VMI related to requests made by supplier including access of customer’s data on current inventory levels and future demand. The benefits of monitoring the level of inventory and visual demand can be an advantage to suppliers especially in reducing the bullwhip effect or Forrester which can have adverse effects on demand volatility [23] [24]. Customers can also reduce problems of running out of stock and increasing costs [2] and increase competition between suppliers. In practice, inventory level monitoring also can be accomplished through scheduled visits to the construction site, for example, regular reports on product acquisition or monitoring of customer inventory levels. Hight visibility of important information in VMI program can provide better services performance [14].

METHODOLOGY OF STUDY

A qualitative was used to provide the opportunity for the researcher to obtain an accurate explanation of the phenomenon and thus help the researcher answer the question of 'why' and 'how' [25]. This method can help researchers understand why inventory management is inefficient and how to shape VMI-based inventory management practices in the construction industry. The research used in this phase is based on in-depth interviews as well as direct observation.

Contractors and suppliers in the Malaysian construction industry has been chose as sampling frame which represent an organization as a unit analysis. The sample of the study was selected either on purpose-based sampling [26] or on specific criteria. In addition, researchers have made filters for respondents who want to be involved, where the selection is based on the operating period of an organization that has been in business for over five years. Researchers selected two samples from respondents representing organizations in the construction industry, one from contractors and one manufacturer, which supply building materials to the construction sector.

Interviews were conducted with two representatives from the experienced construction industry. [27] suggested that in qualitative research, mostly sample size relies on the idea of saturation. The focus is to see how the implementation of inventory management works in each respondent organization. In fact, researchers are also trying to identify the factors that are contributing to the failure of inventory management. Researchers also brought in recorders (MP3s) to record interviews conducted. A transcript of the conversation is then provided each time the interview is completed. The duration of the interview session lasts between one and a half to two hours.

Direct observations are made in each case company after the interview session run. It is intended to obtain additional relevant information. Direct observations include visits to construction sites and warehouses at the supplier's premises, reviewing available facilities and observing the communication and communication between top leaders and organizational staff. All information obtained through direct observation in the organization visited will be recorded to avoid data loss problems.

Data Analysis Procedures

This process of analysis involves: data transcription, data filtering, theme building, theme coding, and display of results. The interview conversation was recorded and then transcript using Microsoft Word program. Then the data this transcription has been included in the NVIVO program for analysis. Researchers have read interview transcripts on a phrase-by-phrase basis for encoding the phrase based on the themes in the main node. Reading Repeated transcriptions were performed to check the existence of the implied meaning. After the interview session with several respondents of the study was completed, the researchers had compared the themes obtained with the other themes coded to examine patterns and alignments. Once researchers find that no new themes emerge, the researchers decide that the data obtained is saturated.

Validity and Reliability Test - Case Study

In this research, researchers have applied construct validity to test the validity of the data obtained. Two stages of construct validity have been conducted. In the first stage of construct validity, interview transcripts were submitted to the respondents of the study to obtain confirmation that the content of the interviews provided by the researcher was the same as that of the respondents of the survey during the interview session. Subsequently in the second stage, the researchers brought back the findings of the case study which were summarized to the respondents for the purpose of review. The purpose of implementing the validity of the second stage is to get the views and criticisms of the respondents of the study as to whether the findings are consistent with the respondents' actual experience in inventory management. In this research reliability tests were conducted through coding discussions and findings obtained with several research partners in the same field of study. In addition, the researchers have also asked other research partners to give their consent based on the values provided.

Findings

Challenges in current inventory management practices in the Malaysian construction industry

Waste can directly increase the cost of materials management in the construction industry. Among the major causes of damage to building materials are due to lack of experience in handling and storage. In addition, design changes also contribute to waste, especially when it involves with IBS components, which need to be manufactured according to customer's requirements. Communication problems also contribute to waste. When the information presented is unclear and accurate. Apart from waste issues, delays in shipping are also a major challenge in materials management in the construction industry. Respondents agreed that poor interactions between contractors and suppliers, as well as neglect of material delivery controls in the field of project management can contribute to problems in delays in delivery of materials to construction sites. Respondents also agreed that the need for experienced and responsible workers for managing construction materials, improving communication levels between contractors and suppliers, and introducing an effectiveinventory control system to register receipt of materials at construction sites.

Material management practices in the construction industry.

This section discusses material management practices in the construction industry from the perspective of contractors and suppliers.

Inventory replacement decision

Sharing information between manufacturer, developer, contractor, and third-party logistics is important to assist in deciding quantity and delivery time. Both respondents stated that the decision in replacing inventory generally do not solely require customer confirmation. The manufacturer will decide inventory replacements based on the progress of project. The shipment quantity and shipment time will strictly follow the project plan schedule and progress of the project. Construction site is always confronted with limited spaces to hold inventory. The IBS components was delivered directly at installation site and consumed immediately in installation process especially for the large component. Therefore, sharing information of delivery schedule help to ensure the construction site is ready to receive IBS components from suppliers.

Inventory ownership

There are two approaches related to inventory ownership in the construction industry; first, for raw materials the ownership of the inventory is transferred to the customer as soon as the materials are received at the site; for certain IBS components, ownership of the inventory is transferred to the customer only when it has been used in construction. Some IBS components require supplier expertise for installation purposes. The supplier is solely responsible for material defects until the installation is complete on the building structure.

Location of inventory storage

Both respondents thought the storage location of the construction materials should be close to the customer's location or construction site. This will facilitate the delivery and use of building materials. However, in construction industry, the construction site moves from completed project to new location of construction site. So, supplier in construction industry chooses to be closed to source of raw materials and their supplier location. Therefore, cost associated with getting the input for production process can be reduced.

Model of distribution

Here efficiency of logistics plays an important role. Normally manufacturer will decide whether to use own transportation or third-party services are based on quantity and size of component. In the case of shipment of building materials in small quantities of small size component, suppliers are more likely to use their own transportation. However, when it comes to large quantities and large construction materials, suppliers will use third-party logistics services. According to supplier, owning many transport vehicles and carrying large building materials is not economical in terms of cost of ownership, maintenance, and labor cost. In fact, the volume for large size component normally low compared to small size component. So, it is not cost effective to own specialized transportation and crane with competent workers to handle the vehicle and machines.

Information sharing

In order to ensure sufficient building material requirements are met, suppliers will need to have project management knowledge. The contractor or customer will share information with the supplier regarding the project planning schedule. The knowledge of the manufacturer to understand the progress of the project based on the project planning schedule is important. In addition, the interaction or communication between customers and suppliers should be clear and prompt. Especially, when it involves late project progress. For IBS component, meeting between manufacturer and clients is critical in discussing project schedule changes and design material changes. Delays in project progress should be informed early and updated the project schedules for the installation process of IBS can be completed on time by the installer. The contractor also should also consider manufacturer opinion in determining the appropriate installation process. There have been cases where contractors had to demolish IBS structures because of IBS component could not be installed properly. Hence, lead to delay and high cost of waste in project construction.

Conclusion and Recommendations

Replenishment decisions, inventory ownership, inventory location, distribution model and information sharing practices are quite similar with VMI practices with several exclusions. Although, most of time manufacturer as a supplier has decided the replenishment decisions, developer, and contractor also must have mutually agreed on replenishment decisions by providing and updating project schedule to avoid excessive and shortage of inventory at construction site. Meanwhile, inventory ownership provides more flexible of cash flows for manufacturer, developer and contractor depending on installation process approach. While proximity of inventory location is requiring for reducing cost associated to raw materials and logistics. Better choice of distribution model based on quantity and size of component will provide cost effective for manufacturer in handling their logistics activities. In addition, sharing information also crucial to avoid delay in project progress due to shortage of materials and wrong design of IBS components. Any delay in project delivery will increase the cost not only for developer but also entire supply chain of the project.

Based on the VMI literature and research findings, construction industry has high potential to implement VMI practices. Since, project process is unique and always requires new design of VMI, manufacturer, developer and contractor should consider quantity and size of component in designing their VMI practices. It is not individual roles in determining the success of construction project but collaboration among party

is required in contributing effective inventory management. By continuously assessing inventory practices this in turn can sustain their performance in project delivery.

Acknowledgements

This research was supported by Universiti Utara Malaysia with Grant No (So Code: 13911).

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