

An Overview of Construction Logistics: Main Issues and Factors That Influence Its Efficiency

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Abstract

Improving logistics management in construction project is becoming more challenging as the construction industry is getting more complex than what we have had then. However, the construction industry is left behind as compared to other industry such as manufacturing and retail industry. The logistics issues in construction project have hindered its performance thus the construction project goals (time, cost, and quality) cannot be achieved. The purpose of this paper is to highlight the logistics issues that occur in a construction project. An overview of construction logistics is being presented in the paper followed by defining of construction logistics. After that, the factors contributing to efficient of construction logistics are presented in this paper. Four academic databases namely Google Scholar, Science Direct, Emerald Insight and Elsevier were used to collect literatures. The literatures were explored in-depth to come up with write-up. Twenty (20) numbers of research papers were used to explore the logistics issues and factors that influence its efficiency in construction project. At the end, the factors that have been discovered in these papers are used to come up with conceptual framework.

Keywords: Construction, Logistics, Efficiency.

Introduction

Looking at the concept of logistics within the construction project, a factor which needed to be taken into consideration is the characteristic of the industry. Distinctiveness, immobility and variety number of the everyday features of the industry's output, that are the result of the current fragmentation within organization (Samuelsson & Ahmetasevis, 2014). Because of those traits the supply chain has not been integrated and consequently this causes transaction volumes at decrease common values. This has resulted in the creation of a huge

quantity of new businesses because of the low boundaries of entry. Moreover, adverse relationships and fragmented processes hinder performance and innovation inside the industry.

As we all know, the construction industry is a project-based industry which makes them unique from other industry. This reflect that, the uniqueness of a certain project will determine the resources needed in that project and the most supply chain. In addition, the materials and the components which need to construct the project normally come from various supplies. In order to produce a product for a specific client, the suppliers have to incorporate a range of discipline and technologies. Each product technologies needs to be rationalized to suit new construction project. A necessary rearrangement and discontinued of demands from clients has caused short term relationship between demand and supply in the industry.

Chenthoorun & Me, (2017) add that by reducing the activities, the company can improve logistics. The activity that does not give significant value to the production could be a solution to lower down the production costs. They also distinguish the activities, for example if one activity does not add a value of the production, this is considered as a “waste” that relates to logistics issues. They conclude that the production cost can be reduced by 30-35% if the total amount of waste is minimized.

Definition of construction logistics

Logistics can be defined as the process of planning, operating and controlling and managing of resources of supply chain, from original point to the point of destination, such as raw material gathering and distribution for example delivering goods to the correct location at the right time, in a right amount of quantity and quality and at a reasonable price. In a bigger picture, Gattorna & Day, (2006) demonstrate logistics as a term covering the management of materials and physical distribution. Lundesjo, (2015), adds that there are five elements that he

labels as “five right” that needed to be considered to define logistics that are right place, time, quality, quantity and price. Therefore, to define logistics is seen to be vary. However, the fundamental of logistics is concerning on goods movement and storage, that includes the information flow throughout the supply chain.

As for construction industry, logistics can be elucidated as interdisciplinary process that is being practiced in a construction project in ensuring all the logistics activities such as supply, storage, processing and availability of material resources at construction site, to structure the production team and administer the physical flow of production (Serra & Oliveira, 2003). Likewise, a recent study has been done by Chenthoorun & Me, (2017) and they define construction logistics as optimizing the practices of design, procurement and construction to improve the efficiency of materials and components delivery, movement and its installation that require various disciplinary processes that aim for right time, cost and quality. Additionally, Ghanem, Hamzeh, & Zankoul, (2018), add that delivering quality, providing safety and preparing environment to perform construction activities are also parts of construction logistics. In a nutshell, it can be summarized that construction logistics is an integrated process optimizing the practice of logistics activities of pre-construction and on site to improve the efficiency of delivery and movement of material and components including its installation by delivering best cost, time, quality quantity and safety.

Table 1: Definition on construction logistics

Author(s)	Definition
Serra & Oliveira, (2003)	Interdisciplinary process that is being practiced in a construction project in ensuring all the logistics activities, to structure the production team and administer the physical flow of production
Gattorna & Day, (2006)	Covering the management of materials and physical distribution

Lundesjo, (2015)	Concerning on goods movement and storage including the information flow throughout the supply chain
Chenthoorun and Me, (2017)	Optimizing the practices of design, procurement and construction to improve the efficiency of materials and components delivery, movement and its installation that require various disciplinary processes that aim for right time, cost and quality
Ghanem et al., (2018)	Delivering quality, providing safety and preparing environment to perform construction activities are also parts of construction logistics

Division in construction logistics

In construction project, logistics is divided into two divisions that are supply logistics and on-site logistics. In early 90s, (Silva, Fred Borges Da; Cardoso, 1998), classified logistics in construction were based on terms of scope that are supply logistics and on-site logistics. Basically, construction logistics can be included externally and internally. This is also supported by Chenthoorun & Me, (2017), that portrayed construction logistics function can be divided into two approaches namely supply logistics and site logistics.

Supply logistics

According to Serra & Oliveira, (2003), supply logistics involves purveying of resources of human and materials that are essential for building production. The most crucial activities in this division are purchasing items (planning and processing), management of suppliers, movement of resources to the site, and the maintenance of materials that has been a forecast in planning.

Site logistics

Site logistics covers the management of the physical flow and information flow relating to on-site activities. The most essential elements in site logistics are the activities that relate to management of physical flows, management of interface between parties that communicate in the process of construction, and management of the construction site (Serra & Oliveira, 2003). Figure 1 below summaries the logistics activities on construction site.

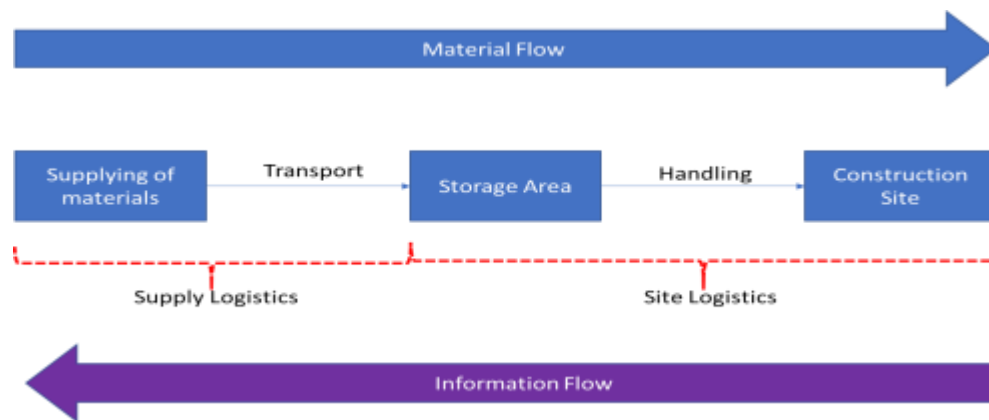


Figure 1: Logistics process in construction project

Source adopted from (Chenthoorun & Me, 2017; Duiyong, Shidong, & Mingshan, 2014; Usman & Ibrahim, 2015)

Generally, Figure 1 shows a basic structure of logistics in a construction project. It involves a process of information flow from inception stage to completion stage of construction that incorporate with the physical distribution of material from supplier to construction site. The supply physical distribution in the production process circulates the work activity related, that includes: resources (material, equipment and man-power) specification, supply plan, resources purchase, storage control, ex works: the movement and delivery, the processing, the operating system management, the safety and security of equipment, the site layout, the work order's arrangement, as well as communication among various parties in the construction project.

Main Issues in construction logistics

The logistics management in construction industry takes a large part of the total costs and affects the total lead time in any construction project. Large amount of money can be saved if supply chain operations are made in a more standardized way, learning from previous projects or using standard solutions. Today, however, it seems that every new building project is reinventing the management of supply chains.

Poor logistics practices

Segerstedt and Olofsson (2010) conclude that the construction industry is lagging in terms of logistics practice and performance. Several authors have discussed these logistics problems at sites. Almohsen, Ca, Ruwanpura, & Ca, (2011), argue that one of the most obvious causes of lost productivity in construction “is the poor management of materials, equipment and tools”. Agapiou et al. (1998) brings up severe obstacles that impact negatively in this respect. According to Sundquist, Gadde, & Hulthén, (2017), in order to store building materials, a large storage area is required. However, it is rarely available at the site. The way how the materials are stored often leads to damage due to the presence of water, movement of people and machineries on site.

Lack of logistics planning

According to (Fadiya, 2012), poor planning and scheduling can cause wrong materials supply, quantity and material delivery. Based on a study conducted by Ying, Tookey, & Roberti, (2014), it shows that lack of planning contributes to logistics problem. They also find that the important logistics resources for its management was minimal. In their case study, they have discovered that delivery of some materials is made with a short notice; at least 10 minutes before delivery time. As a result, site manager has to call for ad hoc team to unload materials and this causes a conflict within schedule of activities and makes unloading be inefficient. Furthermore, it is also supported by Sundquist et

al., (2017), that kind of material of delivery method can cause additional handling to transfer the material to the assembly area to work stations.

Error in delivery service

According to Thunberg & Persson, (2013), it shows that less than 40% of total supply of the delivery services to a site was being delivered with the accurate volumes, at the precise time, location, without damage and appropriately documented. Behera et al. (2015, p. 1337), states that the main problem causing dissatisfaction between contractor and suppliers is delivery which is not in accordance to planning, incorrect and defective deliveries, old stock materials (not very good quality), bad packaging and enormous shipments. Fadiya, (2015.), concludes that the current's practice still ad hoc and instinctive though many construction firms know the importance of materials management.

Table 3: Main issues in construction logistics

Issues	Author(S)
Poor logistics practices	Segerstedt and Olofsson (2010),. Almohsen, Ca, Ruwanpura, & Ca, (2011), Agapiou et al. (1998), Sundquist, Gadde, & Hulthén, (2017)
Lack of logistics planning	Ying, Tookey, & Roberti, (2014), Sundquist et al., (2017), (Fadiya, 2012)
Error in delivery service	Thunberg & Persson, (2013), Behera et al. (2015, p. 1337), Fadiya, (2015.)

Factors contributing to efficient logistics in the construction industry

In order to ensure that the logistics in construction project is more efficient, it should be designed in the most efficient way to meet the client's requirements

and it is the process that should consider the following factors: (adopted from Usman & Ibrahim, (2015) and (Chenthoorun & Me, 2017))

Number of suppliers: The number of suppliers should be rationalized by decreasing its number. According to Moneka (1993), determining the number and most suitable suppliers for a company can optimize the supply base. A research done by Cousins, (1990) reveals that an extensive supply based on reduction strategy has been used by many companies in various sectors. Many of these companies have claimed that they have reduced the size of their supplier bases to become more competitive, flexible and cost-effective. This will ensure that the delivery material will be more efficient. Rationally, a chain with a fewer number of suppliers is easier to manage thus logistical barrier can be reduced.

Involvement of supplier at the design stage: A clear understanding of implication of design, components and choices of material is very crucial (Usman & Ibrahim, 2015). A report written by Michael, (2017), states that a collaboration with each party in construction project in an early stage is needed to create innovation. The complaisance of procurement and logistics relates to design specification. Thus, the involvement of strategic suppliers as early as design stage will enhance the process of logistics.

Communication: The success of the logistics in construction holistically indicates the success of each phase in logistics management. (Greenwood & Wu, 2012) states that to achieve the objectives related to quality, precise time delivery and cost, it is recommended to have a close relationship with suppliers. The communication of suppliers, design team and construction team should not be fragmented to ensure that the information flows from one to other. Thus, the plan or method of communication in the project should be deployed, mobilized and productive at every stage of logistics management.

Tracking facilities on site: Technology has brought changes in construction industry that improves previous construction industry practices and method of

construction that acquires large amount of labour, time consuming, prone to error. (Navon & Berkovich, 2005). Kasim, et al. (2012), supports the statement by saying that construction project could also be managed properly to reduce labour and material costs, and time through implementation of technology. A real-time tracking and monitoring facilities for materials and equipment should be adopted in construction project. Material tracking progress should trace goods movement from original point to site that is essential to overcome delay and cost efficiency, and to lower the chances of inaccuracies in processing payment.

Performance measurement: Proper performance measurement should be implemented to benchmark and maintain the performance of construction logistics (Chenthoorun & Me, 2017). some example of activities in construction logistics that should be measured are delivery performance, stock availability, timeliness, quality and storage.

Cost transparency: Cost in construction should be more transparent in what other industries do, for example retail and manufacturing industries. Usman & Ibrahim, (2015) state that decision making depends normally on cash flow of the project. A non-value-added activity that do not benefit logistics in a project should be eliminated to minimize waste. (Chenthoorun & Me, 2017)

Methodology

To come up with this paper, the researchers have gathered several literatures from electronic database namely google scholar, science direct, emerald insight and elsevier. Keywords “construction logistics”, “material management”, and “logistics in construction” were used to search for the paper related to this study. Those procedures were resulted from twenty (20) numbers of papers (that include 17 paper; research paper, proceeding paper, conference paper, one thesis and one report) and used to give in-depth understanding in definition of construction logistics and issues in construction logistics. A “snowballing technique” was used to collect and trace relevant literatures to prepare the write-

up. Next, factors that influenced the logistics in construction project were identified and described in this paper. At the end of this paper, a conceptual framework was proposed based on the factors that had been discovered in this study for further research.

Proposed conceptual framework on efficient construction logistics

Based on this proposed framework above, it indicates that three main logistics issues normally occur in a construction project. These three main issues in construction logistics affect the performance of process. Those issues are raised because of the fragmentation of the construction industry; ‘collaborative culture’ for the integration and collaboration of the supply chain within the construction industry is still weak. Nevertheless, many construction firms have identified the importance of effective logistics management, “today’s practice and decision still tend to be ad hoc and intuitive”. In overcoming logistics issue in the construction project, six (6) factors have been introduced by researchers to enhance the efficiency of logistics process.

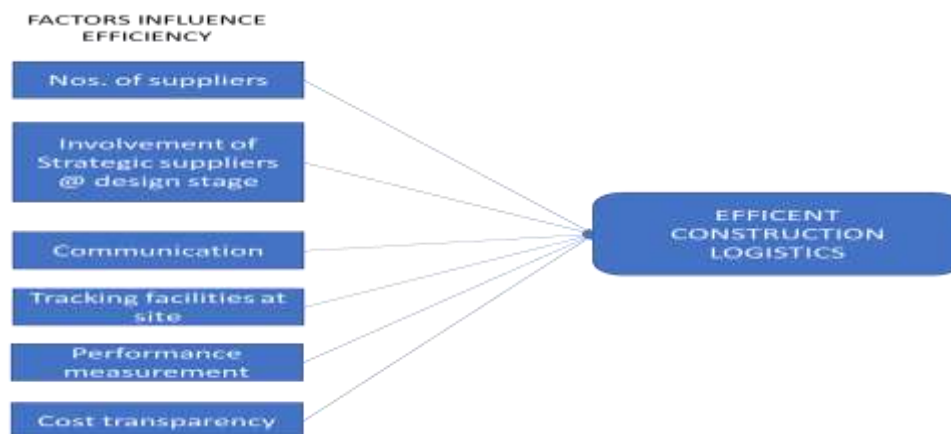


Figure 2: Proposed Conceptual Framework on Efficient Construction Logistics

Conclusion

In a nutshell, the literatures have portrayed the issues that are typically faced by construction project regards on logistics in construction which will indirectly affect the construction schedule that has been planned at inception stage and this may cause over budget to a project. Three (3) main issues that have been discovered in this paper basically come from the nature of construction project which have been stated earlier. Based on the literatures gathered, six (6) factors that have been discovered contribute to efficient logistics in the construction project as discussed in the beginning and may overcome the issues that have been mentioned above to improve efficiency in construction logistics in a project.

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