LOGISTICS OPTIMIZATION IN ROAD CONSTRUCTION PROJECTS OF PAKISTAN

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Abstract

Road construction all over the world especially in the developing countries is considered to be one of the most important projects for a country. As important as they might be it becomes more important to execute them with utmost care as to optimize the logistics and minimizing the waste to optimize the cost and ultimately planning in such a way to maximize the productivity of the construction team which depends mainly upon different aspects relating to materials access to the workers on site, cost of them, choice of materials etc.

Logistics optimization is one of the major factors for successful delivery of road construction projects. Logistics comprises the flow of information and material, optimization can be achieved through effective planning in terms of material planning, material delivery, material management and material handling. This research paper is aimed at studying the importance of material in logistic process of road construction projects in Pakistan. The study may be applicable to any developing or developed country as the logistics optimization for road construction remains same.

A case study approach is taken to study two major road construction firms operating in Pakistan, the data is collected through observation and semi structured interviews of project managers, directors and on site managers. The in depth analysis presented with critical aspects of material management, as per MATRACON Pvt ltd and Marksons Pakistan. A comparative analysis provided us with a lot of components which are important for logistics optimization out of which this research focuses on the most important factor which is Material optimization in Logistics.

Keywords: Logistics optimization, Road construction, Material management, Material planning.

1. INTRODUCTION

Large number of road projects are in planning or execution phase in developing and underdeveloped countries. A misconception in terms of success of any project is the key factors affecting the project directly or indirectly, which normally are considered in terms of cost, time, and scope for big projects especially for success of road construction projects, absence of material planning was found to be a major cause of failure in road projects (Cheng, 2014). A large amount of material is used and transported during road construction projects, material movement is happening throughout the supply chain which requires an in depth and detailed logistics and material procurement planning in the project (Choudhari & Tindwani, 2017).

Logistic optimisation has been an area of major concern in project management; researchers have presented many optimisation models specifically for construction projects. One of the examples can be the model proposed by Salem et al. (2007) for minimizing the cutting waste of steel bars used in construction projects; the practical application of this model helped in major cost savings. Similarly, Hazir (2015) argued that there is a clear need of optimisation models pertaining to all kinds of problems and issues in project management.

The solution to major logistics problems is logistic optimization. This paper is aimed to find out how logistics optimization is helpful in achieving cost efficiency. Logistics optimization is also one of the drivers to attain optimal project performance. The proposed model will be helpful in determining optimization factors of material in logistics of the road construction projects.

2. LITERATURE REVIEW

Mayer and Stark in 1981 initially originated the LP model in logistics management which was also referenced by (Easa, 1988; Jawardane and Haris, 1990; De Lima et al., 2013). Its objective is to cut down the logistics costs of earthwork in road construction. Decision variables are used in such optimization models to achieve the demanded objective while meeting the material requirements at several consumption stages from the available supply at multiple sources. Later on, Son *et al.* (2005) presented an LP model and a way out to find out the accurate shortest routes among locations of cut-and-fill areas to move soil in earthmoving. The model was used for minimizing the cost of earthwork at a golf construction site. In a road construction work, transportation model is suggested by Sobotka *et al.* (2012) that enhancing the transport of aggregate from suppliers to terminating station is based on two main criteria which are reducing cost and time in a logistics network of construction projects.

Jayawardane and Harris (1990) presented the variables of choosing the right equipment fleets in the Mixed Integer Linear Programming (MILP) model to minimize cost. The MILP model also indicated the sensitivity of total cost (i.e. reduce cost) for varying completion time (i.e. by extending the project time). However, the study of (Jayawardane and Harris) worked on representative data with more focus on the model and did not probably include real cases because of a lack of sophisticated computer software/computing power.

Seppänen, O. and Peltokorpi, A. in one of his paper in 2016 says that according to contractors, decreasing logistics cost is very important factor. (Arbulu et al. 2005) supports this notion by stating that other than transportation, logistics cause extra cost when material is not available on site when required or wrong materials are delivered on site for carrying out the construction. A number of case studies of Make-to-Order producers indicate that the suppliers minimize their cost by producing one type of element in long runs and shipping the materials by type (or size) (Salagnac & Yacine 1999; Nguyen et al 2008).

The literature review related to logistics optimization and key factors related to optimization in construction projects revealed the possible approach in logistics planning. The current research has been conducted with an objective of identifying the key factors in logistics optimization of road construction projects. The other objective of this research is to help out the project managers of road construction projects in Pakistan to provide them some model to prioritize the key factors utilized in logistics optimization in road construction projects especially for those who are new in this industry.

3. METHODOLOGY

The importance of logistic optimization was identified through literature review; semi structured interviews were conducted from two largest road construction firms of Pakistan. The large road construction firms were shortlisted and contacted through telephone, out of four shortlisted companies i.e. Matracon Pvt Ltd, Marksons Pvt Ltd, Zkb Pvt Ltd & Habib Construction Services Ltd, two firms agreed to share information and give detailed interviews to conduct research on material optimization in logistic of road construction projects. The initial meetings were arranged through telephone, during meeting research topic, objectives and nature of research was discussed. It was explained to respondents that semi structured interviews will be conducted & recorded as well as data collection through observation will be made. Once given consent, interviews were taken from project managers, material managers, director of the company, onsite manager, logistics manager, project officer etc, Interview items were designed with respect to issues in material handling, procurement, delay, and optimization strategies being implemented in road construction projects.

The first few questions were about background of the company, experience of individual and other demographics. In other sections, logistics processes, material management, critical factors, optimization strategies, material procurement, vendor selection, material pricing and delays were discussed

The two road construction firms were selected for this study. Both companies i.e. MAAKSONS Private

Limited and MATRACON Private Limited are one of the most reputable for implementing largest road construction projects in Pakistan. The sole reason for their selection was the two companies having big number of clients including National Highway Authority (NHA), Govt. of Pakistan, CDA and numerous high profile clients. They have executed number of successful road construction projects all over Pakistan and are dealing with many other road construction projects.

Material is the main aspect of doing road construction projects successfully, material is critical, the selection of material is based on detailed planning of customer requirements, and it is then approved by customer as per availability and requirement of the project. The tender is published to call for prices from various vendors and usually the lowest bidder providing right quality of material is awarded with the contract. The transportation of material to site is usually outsourced but in some cases organization uses its own transportation fleet.

4. KEY FINDINGS AND DISCUSSION

The detailed literature review and data collection helped us identify most key factors in terms of material in logistics optimization. With the help of literature review we shortlisted a number of key factors of logistic optimization in terms of material which were then presented to both organization respondents. Then in the next step the short listed key factors were presented to both of the companies project members, project managers and directors by the help of who again the short listing of the key factors were done,

The key factors as identified by both firms were then ranked in order of importance by the company management by using L-shaped matrix , which provided us with five main aspects of material optimization in logistics; Material management, resource management, material delivery, material pricing and government policies & unknown risks.

The main objective of road construction projects is to plan, procure, organize, and control the activities of the projects and equipment resources. In order to ensure the successful delivery of projects, regardless of project's type, size, and timeline, each project has to meet the objective of logistics optimization in terms of time, cost and performance. The main identified factor was found out to be material management.

Material is the main aspect of doing road construction projects successfully, material is critical, the selection of material is based on detailed planning of customer requirements, and it is then approved by customer as per availability and requirement of the project (Voordijk, 2000). The interview participants mentioned that material management includes many sub elements such as material procurement, material quality, and transportation of right material on site at right time. Material procurement comprises of the bidding processes and for that the tender is published to call for quotes from various vendors and usually the lowest bidder providing right quality of material is awarded with the contract. Since both the companies deal with multiple vendors, they prefer to select those vendors which are in nearest vicinity of the location where project is being executed.

Similarly, the transportation of material to site is usually outsourced but in some cases organization uses its own transportation fleet. The golden rule of cost efficiency according to the director of MATRACON is "efficient material handling". As he explained " for us efficiency in material handling is very important and it starts with taking right requirements from the client, then following the procurement processes, receiving, testing and then approval; the material has to store in a right manner, we keep reserve stock to rule out the chance of delay & we reorder accordingly."

Material quality is another critical sub element of any construction project and specifically for road construction projects, it is also considered as the pillar for making the construction project successful (Said & El-Rayes, 2010). Many companies compromise over the quality of the material to save the cost and earn the profits but in longer run, this strategy doesn't work as this strategy lead towards losing the company clients and company's earned reputation (Choudhari & Tindwani, 2017). As MARKSONS logistics manager said "we cannot afford to use lower quality material, the bench mark is already established by government and we have to follow that".

5. CONCLUSION

The companies working on the road construction projects have placed appropriate logistic optimization techniques, the importance of material handling, material transportation, material procurement, storage and reserve stocks. The major factor highlighted is the time, as firms taken for research purpose support this notion by planning in detail and taking requirements in timely manner. Moreover, they always have reserve stock to keep their on-site operations going on. This study lacks generalizability as the limitation of this study is that only two companies were studies in depth. Material optimization is the backbone of logistics in road

construction projects. The time and effort invested in road construction projects requires careful planning of material, its storage and usage.

6. FUTURE DIRECTION

Future studies can focus on studying logistic optimization through material by including more number of firms in research process and conducting qualitative research through semi structured interview rather than case study method. The study of other elements can be taken like how cost optimization can help in achieving logistic optimization. Moreover a comparison of local and international road construction projects can be studied to find out key factors of logistic optimization. The most important key factors can also be studied in detail which could include but not restricted to recourse management and material delivery.

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