

Strategic Management in Civil Construction Industry in Focus on Site Logistics Management

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CHAPTER 1

INTRODUCTION

1.1 General

Building projects may be finished on schedule, but they come with a lot of challenges. To do this, you need to skilfully combine a number of different aspects. One of these aspects is the level of worker productivity, which is one of the most crucial things that decides whether or not building projects are finished on time. A lot of things that happen on construction sites make workers less efficient. These things make the whole workforce less productive. Such a loss of efficiency hurts the performance of the overall project and makes it less likely that management will be able to meet the project's quality, budgetary, and schedule goals.

Construction companies, on the other hand, would be able to get a lot more out of their projects since they would be able to get more work done and get more out of their workers. One of the most obvious reasons for lost productivity is poor management of supplies, equipment, and tools, which is frequently called "logistics management." So, "construction logistics" may be defined as "the management of the flow of materials, tools, equipment, and any other related object from the point of discharge to the point of use or installation." Putting together and coordinating the organization's administration. The analysis found that the cost of materials will probably make up 55 to 70 percent of the overall cost of construction for the engineering project. The delivery service cost, on the other hand, will be around 15% of the cost of the materials.

The cost of physically moving things will be about ten to eleven percent of the entire cost of building the engineering project. It is clear that the physical distribution work on engineering building projects has a big effect on the economy. But in truth, the engineering construction field hasn't really thought about how important delivery services are. Because of this, the level of physical distribution management for the engineering construction project has gone up, the project delivery service has been dug up to become the value fountainhead, and the promotion of the complete engineering construction project benefit has been extremely essential.

At the moment, there are basically two main things that make up the logistics of the building site:

- 1) The logistics of getting materials
- 2) Managing the Supply Chain

1.1.1 Construction Site Logistics

Introduction:

The process of planning, implementing, and controlling the resources of the supply chain is referred to as logistics management. This process typically begins at the point of origin, which may include the collection of raw materials, and continues all the way to the point of destination, which is the delivery of items to the appropriate position on the building site. Having an efficient and productive logistics management system is essential because it may improve efficiency and production, which in turn has a beneficial influence on both time and money. For

instance, effective management of logistics means that the workforce is able to carry out the activities that are expected of them without experiencing delays that are brought on by the delivery of materials to the site.

Planning, coordinating, and supervising the flow of materials to, within, and away from building sites are all tasks that fall under the purview of construction logistics. It is possible to save both time and money on building sites by implementing effective construction logistics. In order to design construction logistics, it is necessary to take into consideration a large number of interferences between the configuration of the construction site and the construction process. In particular, manufacturing logistics are governed by the innumerable alternative work sequences and the several companies that are involved in the outfitting operations. Management of construction site logistics requires the integration of a plethora of activities, including the following:

- ✓ The evaluation of materials.
- ✓ An evaluation of the lead time.
- ✓ Planning for both supply and service.
- ✓ The process of sourcing and purchasing.
- ✓ Strategic planning and scheduling of production.
- ✓ Assembling and packaging things.
- ✓ Inventory management and order fulfilment
- ✓ The management of both incoming and outgoing transportation.
- ✓ This includes warehousing.
- ✓ The management of materials
- ✓ The administration of vehicles and plants on the premises.

1.1.2 Construction Site Logistics Management:

The management of logistics is an essential management technique that is used to guarantee the flow of manufacturing materials and the overall plan. The administration of construction projects and supply logistics are comparable to the management of traditional logistics. This study only describes logistics management from the perspective of on-site logistics management in order to minimise repetition of the traditional theory of logistics management, which is becoming more and more developed. The logistics of the construction project site is an essential component of operations management. In order to accommodate the real site layout and storage arrangements, logistics management necessitates the creation of correct delivery date material plans.

A. Information flow optimization:

The foundation of logistics is information, and the success or failure of logistics is directly impacted by inaccurate information and delays. Basic construction information contains a wide range of topics, including decision-making, design, construction, and so on, as well as the owner, investor, chief contractor, contractor division, design side, and so on, all of which require centralised decision-making from each participant. Additionally, as the project moves along and the field conditions change constantly, so do the basic construction information items. builds the scene, which typically involves significant design changes and scene instructions.

The application must be submitted after the project management team and the owner have given their approval. Only then can the work be completed, which will then alter the outcome and provide different requesters with the instruction back-drive for verification. Each material, piece of equipment, and piece of construction machinery has a direct impact on the flow of materials due to these modifications and changes in orders. As a result, each sophisticated technique must be used, and information technology optimisation information flow is particularly crucial. The information is transmitted in real-time, accurately, and one by one in order to make the response and the revision is the physical distribution smooth operation guarantee promptly.

B. Plans to develop and control:

From an operational perspective, a key component of the production plan is how logistics management affects supply efficiency. There are a lot of unknowns in the construction process, which makes precise planning more difficult. There are three layers of material requirements planning that are frequently used: supply planning, demand planning, and material consumption program delivery. Based on the features of building projects and the

real scenario, the construction schedule's material requirements are planned according to the build. As a result, the precision of material needs planning will be directly impacted by the controls' building timetable.

The supply plan, which is detailed with each supplier and divides the contractor's material coordination, refers to the entire project that will require the material, the fitting, the equipment, and so forth on the planned payment date. This plan's autonomous working method can relate to the material in depth during the detailed design stage formulation.

The supplier, contractor, and designer must collaborate while creating a plan. In order to select the right material and formulate the right plan, the supplier should continue to participate in the design stage. Simultaneously, early seller engagement may result in a superior payment option and a favourable benefit in terms of pricing. The goal of demand planning is to provide the comprehensive version of the materials required to forecast the near future.

All subcontractors must learn to collaborate during the drafting process in order to participate in this program. In between the regular material control meetings, contractors, suppliers, logistics, and the group administrator for materials management work together during the building period. Parties' representatives should decide the supply of materials three weeks in advance, two weeks in advance to ascertain the precise demand, one week prior to the application, and the prediction can be broken down by weeks to establish the materials needed for each day. The material for the follow-up was then presented at the subsequent regular meeting based on the actual situation, construction progress, and on-site documents. Take appropriate action if needed.

C. Site layout and storage:

In most cases, the information regarding the scene has not been registered in any inventory management system. There are several circumstances in which the scene stock is monitored by the computer electronic forms. However, the record is kept in stock since the manual handling process and the information registration for material migration frequently include flaws that are not identical to one another. In light of this, there is a requirement for a system that is more efficient in determining the scene stock and the job level material.

D. Owner, design business and contractor's triple role.:

The logistics department is responsible for the construction of the engineering construction project, which started with the design phase and ultimately includes the installation work on-site. Engineering the processes involved in logistics at the beginning of the the logistics of certainty factors, the management of construction projects through logistics management, and the logistics process itself are all targets of this strategy. As a result, contractors and owners play a significant role in the design of the logistics process.

The entire process, beginning with the construction, is characterised by the presence of triple roles in every aspect. It is the responsibility of business owners to provide designers with the knowledge and needs that are necessary for design. The owners conduct an audit of the program design and material requirements for contractors to supply material specifications and other information. This audit is carried out within the framework of designers for his services.

The contractor for design business clients is responsible for developing business plans and specifications for construction as part of this process. This allows the building owners to provide facilities that are agreeable to the consumers. In the design process of the design business, the construction process of the contractor, and the owner's review process, the design business, the contractor, and the owners all play the role of the manufacturer. The process viewpoint, which is distinct from the traditional view because of the importance of this tripartite view, was well highlighted by this.

E. Specialized logistics management team:

A dedicated logistics management team that is responsible for managing the logistics of the operation, construction, and management as a part of the scene is required to be designated for construction projects that involve a high level of complexity in terms of the logistics. The logistics management team is dedicated to all individuals participating in construction projects by the representatives of the company senior management, sometimes referred to as the Committee.

This is done to ensure that the logistics continue to function effectively. Committee of the entire management process, with the purpose of resolving the conflicts that are unavoidable. The day-to-day operations of the plan that was developed by the Committee in order to provide the required materials, coordinate the work of individual contractors, and ensure that wholesalers cooperate with one another. The following is a list of its primary responsibilities:

- Ensure that the site plan is prepared and that the point of delivery is instructed;
- Ensure that the planning materials that are presented for the weekly meetings are organised;
- Contribute to the definition of the "combined unit" in order to ascertain the level of demand;
- Examine the materials that have been brought to the location;
- Attend daily meetings with the suppliers of the material and keep an eye on the delivery of the material;
- Coordinate the utilisation of the facilities that are used for the common handling of goods;
- Conduct an analysis of the variation in the supply plan. In the event that we in fact require a change in the supply of the material. It is imperative that we take the appropriate action
- PM are responsible for organising the collecting of the material and its return for the second usage;
- Take use of the waste; It is imperative that the relevant parties make use of the principles that pertain to logistics.

1.2 RESPONSIBILITY OF IDENTIFICATION IN DISTRIBUTION MANAGEMENT:

It is a procedure for information sharing, planning, and interaction between owners, contractors, suppliers, and designers on a construction project. Therefore, everyone must work to improve the physical distribution management. However, the difficulty of identifying the beneficiaries is one of the challenges associated with applying engineering construction projects in physical distribution management.

A. Owners:

Owners anticipate that builders will be able to complete the handover quickly and affordably. Therefore, owners should establish the early-stage project plan ahead of time by designating some specific parties to help with the project's further development. To clearly define the responsibilities, they should also make sure that all important players sign the plan.

Key points for the owners are as follows:

- The project's plan should be made clear by the proprietors early on.
- The guide, which will help participants comprehend the responsibility of the physical distribution providers, should be prepared by proprietors.

B. Designers

In order to establish an effective physical distribution, designers are essential. Drafting the flow sheet early in the project would be beneficial. The bill of materials (BOM), which is a component of the physical distribution project, should also be prepared. Technicians with experience in cost accounting and statistics must participate in this.

The significance of physical distribution must be emphasised to all members by designers and explained through training.

Thus, the responsibilities of designers:

- Create the flow sheet, which is a component of the overall design plan.
- Get the BOM ready for professionals.
- The expert design firm ought to incorporate physical distribution methods that are associated with their Consider a career in designers' early education and training.

C. Professional And Big Contractors:

When it comes to organising physical distribution initiatives, construction managers are always considered an essential team. However, some research suggests that construction managers' contributions to the physical distribution coordinating process fall short of expectations. However, large contractors continue to handle project tasks. They play a crucial role in the early stages of negotiating and creating a physical distribution plan with other stakeholders.

One important piece of information in the plan is MOB. Additionally, each contractor should create plans that are relevant to their field, such as how to maximise the use of skilled labour.

D. Sales, Suppliers, And Manufacturers:

This logistics depends on the unit that supplies the goods and materials as well as the project planners; that is, the suppliers' communication. The improvement of project logistics can be greatly impacted by manufacturers and suppliers working together in full. They will contribute significantly to the project's logistics efficiency if they are involved early on, particularly if they can supply information for the design stage's list of materials and finally input information for the logistics plan.

1.3 CONCEPT SUPPLY CHAIN MANAGEMENT

1.3.1 Introduction

In the manufacturing sector, new managerial tendencies have emerged over the past few decades. These themes generally involve innovative methods for carrying out and managing manufacturing operations and procedures. Instead of focusing on intra-organizational processes, a number of recently developed trends have addressed inter-organizational and cross-organizational manufacturing processes. While the industrial sector has typically been able to successfully implement new ideas, the building sector still seems to be failing to do so. Despite the fact that these two sectors are so different from one another, there is no clear reason why the construction sector shouldn't be able to embrace new ideas and reject its criticised traditionalism.

Lean manufacturing, complete quality management, and just-in-time production are examples of the new trends. These ideas have prompted traditional manufacturing methods to be improved and old habits to be reconsidered. In this regard, supply chain management and co-makership are two innovative manufacturing approaches that have gained popularity. The better idea of co-makership is thought to be supply chain management.

1.3.2 Concept of supply chain management:

A product or service is said to be part of the supply chain when it is comprised of the relationships and actions that are required to bring it to market. The management of supply chains is a method that allows for the organization of various operations in an organised manner. The odds of a project being successful are significantly boosted when the supply chain is built in the appropriate manner.

According to one definition, the supply chain is "the network of organisations that are involved, through upstream and downstream linkages, in the various processes and activities that produce value in the form of products and services that are ultimately in the hands of the ultimate customer."

SCM looks across the entire supply chain, rather than just at the next entity or level, and aims to increase transparency and alignment of the supply chain's coordination and configuration, regardless of functional or corporate boundaries. A basic supply chain consists of a company and an immediate supplier. Supply chain management (SCM) looks at the entire supply chain (Figure 1.1).

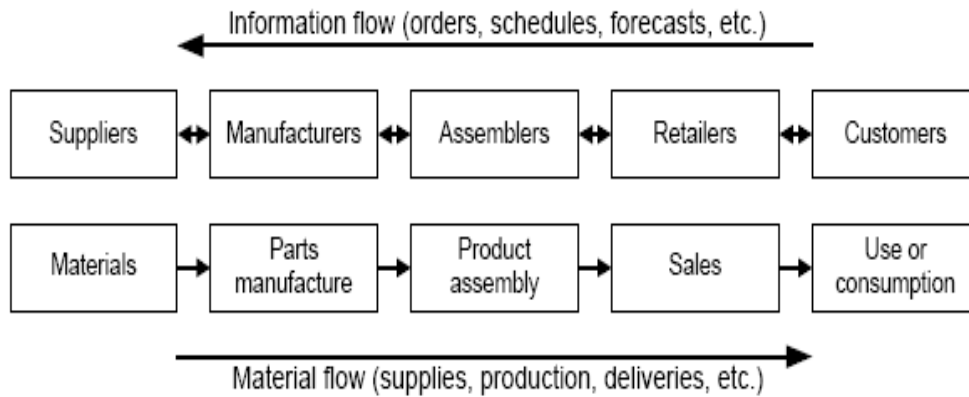


Figure. 1.1. General structure of supply chain

There are a number of components that are included in the transition from conventional methods of supply chain management to supply chain management (SCM), as stated by a few writers (Table 1.1). The conventional method of management, which is outlined in Table 1.1, is fundamentally founded on a conversion (or transformation) perspective on production, whereas supply chain management is founded on a flow perspective on production. When compared to the flow view, which focuses on the control of the overall flow of production, the conversion view implies that each stage of production is regulated independently.

TABLE.1.1
Traditional ways Vs and SCM for Supply Management

Element	Traditional management	Supply chain management
Inventory management approach	Independent efforts	Joint reduction of channel inventories
Total cost approach	Minimize firm costs	Channel-wide cost efficiencies
Time horizon	Short term	Long term
Amount of information sharing and monitoring	Limited to needs of current transaction	As required for planning and monitoring processes
Amount of coordination of multiple levels in the channel	Single contact for the transaction between channel pairs	Multiple contacts between levels in firms and levels of channel
Joint planning	Transaction-based	Ongoing
Compatibility of corporate philosophies	Not relevant	Compatibility at least for key relationships
Breadth of supplier base	Large to increase competition and spread risks	Small to increase coordination
Channel leadership	Not needed	Needed for coordination focus
Amount of sharing risks and rewards	Each on its own	Risks and rewards shared over the long term
Speed of operations, information and inventory levels	"Warehouse" orientation (storage, safety stock) interrupted by barriers to flows; localized to channel pairs	"Distribution center" orientation (inventory velocity) interconnecting flows; JIT, quick response across the channel

1.3.3 Elements for supply chain performance

The major four Element of supply chain performance include:

- 1) Inventory
- 2) Transportation
- 3) Facilities
- 4) Information

1) Inventory

All of the raw materials, work in progress, and finished commodities that are available inside the supply chain are included in this. It is essential to take this into consideration because even a minor modification to the inventory policies can have a significant impact on the efficiency of the supply chain. More inventory results in more costs associated with carrying it, as well as increased reactivity.

- A smaller inventory, which results in lower inventory carriage costs and a decreased responsiveness

2) Transportation

Moving inventory from one location in the supply chain to another is a necessary step in this process. It manifests itself in a wide variety of arrangements of modes and routes, each of which possesses its own set of performance characteristics.

3)The facilities

There are certain locations in the supply chain that are responsible for the storage, assembly, or fabrication of the inventory. Both production sites and storage sites are considered to be the two most important types of facilities. The performance of the supply chain is being significantly impacted by the decisions that are being made regarding the facilities.

4) Details

It is comprised of information and analysis concerning the inventory, transportation, facilities, and customers that are present along the supply chain. Due to the fact that it has an immediate impact on all of the other drivers in the supply chain, information is the most important catalyst. The management team has the chance to make supply chains more responsive and efficient through the utilisation of information systems.

1.3.4 Stages Of Supply Chain Management:

- **Stage 1 (Supply Chain Assessment):** This step involves accessing the current work process and technique.
- **Stage 2 (Supply chain redesign):** During this phase, the shortcomings in the current work process are identified, and actions are performed to enhance the supply chain in order to reach the intended outcome.
- **Stage 3 (Supply chain control):** After the supply chain is reformed, it's critical to closely monitor operations and determine whether or not the intended objectives have been met.
- **Stage 4 (Continuous supply chain improvement):** As an organization's objectives and demands change, it's critical to adapt the supply chain to meet these shifting needs.

Supply chain management encompasses every step involved in meeting a customer's request, whether directly or indirectly. The manufacturer, suppliers, transporters, warehouses, retailers, and consumers are all part of the supply chain. Increasing the total value produced is the primary goal of supply chain management. The needs of the customer and the functions of the phases involved in meeting those needs will determine the proper supply chain design.

1.3.5 SCM Implementation Requirements

a. Three crucial strategic areas must be harmonised in order for an organization (or organisational unit) to "effectively collaborate":

- (1) business,
- (2) people, and
- (3) technology.

b. Typically, collaboration allows participants to build capacity to complete a set of tasks that one single organization would find difficult to accomplish. The cooperation gets rid of mistrust, duplication, and fragmentation. This is accomplished by spreading the many project risk factors across several domains, making

sensible use of the resources that are available, and improving organisational and employee motivation. Only by combining and coordinating the three strategic domains of business, people, and technology can this be accomplished "effectively."

c. The success or failure of working together can be influenced by a variety of factors, and no two collaborations will proceed exactly the same manner or in the same amount of time. Every cooperation needs to figure out how to move forward in a way that is appropriate for its particular situation and makeup.

d. In general, the following six areas are seen to be essential for productive collaboration: **(1) Vision.** The collaboration's goals and objectives are shared by all of its members. **(2) Interaction.** When deciding on the practices to be used during the collaboration, collaboration leaders must make sure that all important players are consulted. **(3) Have faith.** To enable all participants to create enduring relationships, time and resources are required. **(4) Interaction.** All of the important players in the partnership settle on a single communication channel. **(5) Methods.** Both the project and the business explain to all important stakeholders how the relationship will operate on a daily basis. **(6) Technology.** a consensus on those to be employed in order to guarantee the collaboration's ease of implementation and upkeep.

1.4 PROBLEM STATEMENT

The construction sector is vibrant, competitive, constantly evolving, and difficult. Numerous factors might cause construction projects to be delayed. From the perspective of structure and function, construction project logistics differs from typical logistics in the following ways:

P] The collecting logistics is a one-way process that involves the physical distribution of all the materials and equipment needed to build the scene and finish the product. builds the factory to produce this one product. Owners and investors are consumers. Typically, before the construction process begins, the owner or investor determines that the construction product has been completed through the quality testing department and, after examination, is deemed qualified, indicating the project to be completed, basic construction items on reassignment for the first party or owner, and expression of the entire physical distribution process conclusion.

As a result, the material inflow physical distribution typically just sells the physical distribution or does not have the product to flow out of the physical distribution. This contrasts with the physical dispersion of production in a conventional industrial firm. In general, the physical distribution of an industrial enterprise's production involves not only the intake of materials but also the outflow of products, each of which is assigned to several clients or downstream producers during plant production. Some also have physical distribution for recycling, thus the loop of physical distribution activities continues.

Q] Significant uncertainty in logistics plans: The production process for engineering projects and the transportation process Non-uniformity, frequent project changes, non-uniform supply and demand for resources, and a high degree of uncertainty lead to large-scale fluctuations in the type and quantity of resources used in the construction process. The unpredictability of the construction process, the mobility of the delivery service location, the accuracy of the demand projection, the difficulty of frequent plan changes, the high degree of material demand uncertainty, and the extremely challenging elephant Conventional businesses find it difficult to control the stock while simultaneously creating an exact material thorough list. The physical distribution plan is subject to external factors that require periodic revisions.

R] The troublesome nature of the administration of logistics: The building of the engineering project is often performed in accordance with the order form production procedure. The contract provision states that the stipulation time disposable is what completes the project in accordance with the function aim and the quality objectives. This is the case in specific investment quota amounts. Because of this, the project function and the quality targets have the explicit constraint that they require, in addition to the resources and the duration of the project.

Both the complexity of the physical distribution management and the construction of the process by the dispersivity of the suppliers are reflected in the parallel decision. Furthermore, with regard to the design that is associated with physical distribution, the processing and other activities are carried out in the various enterprises and scenes independently; the raw materials that are supplied by the physical distribution provider are distributed in each region via the outsourcing supply transport network. Beginning with the planning phase and continuing through the building of each link, the engineering construction project and the many sub-items projects are carried out in simultaneously.

These require the physical distribution system to be rigorously adhered to in accordance with the plan coordination dispatch movement instructions. The management and control of these behaviours are a significant challenge for an engineering building project that involves the management of physical distribution.

S] Service mode more flexible, diverse: There are many different types of construction materials needed for the job. Large, wide-covering bulk goods, such as steel, cement, sand, etc., require extensive logistics infrastructure and equipment to finish loading and unloading, as well as additional storage space. In order to maintain the construction's regular operation, certain supplies must be supplied. Certain materials need to be packaged, transported, stored, and warehoused in particular ways. These factors significantly increased the logistics of construction projects in the areas of warehousing, packaging, transportation, and other technical requirements, making logistics more challenging and complex. As a result, the logistics of construction projects have higher requirements.

T] Storage costs highly: Storage is expensive and scarce on building sites, particularly on crowded metropolitan construction sites. Typically, warehouse construction sites are constructed temporarily and then removed after the project is over. Thus, the amortised cost of significant is not just extremely limited. Increase the expense of on-site storage.

1.5 BIM FOR CONSTRUCTION SITE LOGISTICS MANAGEMENT:

This is accomplished through the utilisation of cutting-edge 3D modelling software, open access to information, and the integration of multiple disciplines. Given that the deadline for compliance with Building Information Modelling (BIM) level 2 on all construction projects that are centrally procured by the public sector has passed, many construction companies are eager to implement BIM.

The most prevalent documented uses of building information modelling (BIM) have been in the fields of architectural and structural design, quantity surveying, construction project management, and sustainability. On the other hand, there have been very few studies that have been peer-reviewed that focus on construction logistics management. Specifically, the purpose of this research is to evaluate the ways in which BIM can be utilised for the management of construction logistics. This study takes a desk-top method, and the publications that are used as sources come from well-known scientific databases such as Science Direct, Google Scholar, and Emerald.

Ultimately, the purpose of the study was to determine the advantages and disadvantages of utilising BIM for the administration of construction logistical activities. Given that only a desk-top technique has been utilised, the advice for future research is to build on this in order to carry out an empirical study that makes use of both qualitative and quantitative data. In addition to opening up chances for additional research, this will provide a comprehensive understanding of the application of BIM for the management of construction logistical procedures.

The Logistics Plan for Construction:

According to current policy documents, a typical CLP's contents are summarised as follows:

- **Project Overview:** A synopsis of the development and overall site location, together with suggested site layouts and rudimentary maps of nearby highways and transportation lines.
- **Introduction to the Supply Chain:** A succinct explanation of the main products needed for the development, their source, and the mode of transportation. An overview of anticipated material waste, recovery, and removal.

• **Supply Chain Planning:** This section outlines the rules and guidelines that suppliers and trade contractors must follow in order to minimise traffic on the roads both before and during construction. Here are a few instances:

1. **Materials:** A list of every item anticipated to be brought to and removed from the location, together with the anticipated method of transportation;
2. **Pre-fabrication and consolidation centers** (also known as off-site manufacturing);
3. **Integration with nearby locations**—information on any possible delivery consolidation accessible through
4. **Combining loads for different locations** that are close to one another. describes which sites will be working together and the procedures that will be shared;

• **Route Planning:** Information on the precise paths that cars will take to arrive and depart, such as:

1. **Strategic Access Routes:** To lessen local traffic congestion and the impact on local air quality, certain route networks should be used for cars entering from outside a busy city center.
2. **Local Access paths:** Describes the paths that local distributors or those in the immediate area of the facility should follow, along with how they connect to the Strategic Access Route.
3. **Vehicle entry gates, vehicle holding spaces, and pit lanes and unloading locations** throughout the site.
4. Any analysis of safety concerns related to the designated vehicle routes.
5. Local restrictions on foot and car traffic, which may be impacted by designated routes.
6. **Swept Path Analysis (External):** These show the calculated turning circles and trajectories of several heavy-duty trucks. The Swept Path Analysis identifies the locations on traffic routes leading to or away from the facility when precise turning actions are necessary.

Project phase	Guidelines and tools
Design	Logistic guidelines for the conception Analysis of technological alternatives Definition of the plan of attack for on-site work Production design, site design As-built design
Planning	Gantt physical chart Gantt materials consumption chart Gantt equipment chart Histogram of own labour Gantt subcontractor chart Gantt chart of implementation of work safety-related preventive measures
Supplies	Materials specification plans for materials delivery to the site Gantt chart of the start-up of the purchasing process Materials/supplies purchasing rules Materials and services suppliers qualification Guidelines for equipment purchasing or leasing Use of indices of material losses and wastage
Execution	Plan for the execution of work Documentation, implementation and maintenance of the information system Use of labour and equipment productivity indices Work safety and health rules

Table

1.2: Guidelines for Logistics Production Plan

1.6 NEED OF PROJECT:

Previous studies have shown that there is a clear requirement for improved logistics solutions in the construction industry with regard to projects. Not only does ineffective logistics cause projects to be delayed, but it also contributes to a negative public perception of the construction industry.

When it comes to traditional procurement, the only way for enterprises to be connected is through contracts that have been obtained at the lowest possible price and according to predetermined requirements. It has been requested of the provider that they provide the predetermined product or service at the lowest possible cost. On the contrary, there is no incentive to act in the client's best interest. It is possible that the supply chain is not even tied by contract in certain instances. The advantages that are available to individual businesses in the supply chain are as follows:

- ✓ Real costs have been reduced while margins have been maintained.
- ✓ An incentive to streamline the process and eliminate waste.
- ✓ A higher degree of confidence regarding the costs of the output.
- ✓ It is the delivery of improved underlying value to the customer.
- ✓ An increase in the number of additional recurring customers.

As a result of our effort, we anticipate that construction enterprises in the Pune region will be able to view the logistics problem from a different perspective and become aware of the opportunities for future progress in the field of material and site logistics. It is likely that this will lead to the development of more efficient logistics solutions.

1.7 SCOPE OF WORK

The study's primary goals are to examine the construction logistics process and the state of logistics in India's construction industries. Additionally, we will analyse and optimise site transportation and material flow.

The majority of construction projects suffer from pointless on-site operations. This suggests that building logistics need to be improved. Consequently, the following research questions have been examined:

- How does an apartment block project's construction logistics actually operate?
- How much time is spent handling materials by construction workers?
- What impact does the present logistical solution have on the building process?
- How can construction logistics be improved to cut down on the amount of time employees spend managing materials?
- To create a methodical model for an effective logistic system.

1.8 AIM AND OBJECTIVES OF THE STUDY:

Identifying, ranking, and making recommendations regarding the primary factors that lead to cost overruns and escalations in construction projects is the purpose of the study.

The objective of this project are,

1. To Study Construction Logistics Process with the help of literature
2. To identify the today's Logistic Situation in Construction project
3. To understand logistic concepts for designing and planning in Construction Project
4. To prepare a model for Improvement in the site logistics.

1.9 METHODOLOGY CHART FOR PROJECT

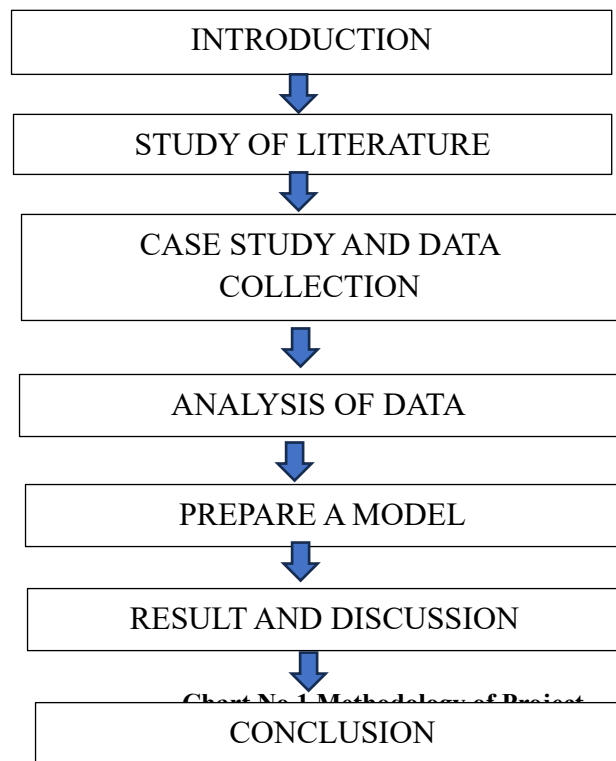


Chart No.1 Methodology of Project

LITERATURE REVIEW

2.1 COMPONENTS OF THE SITE LAYOUT PLANNING PROCESS

1) An increase in productivity and safety, 2) a reduction in the area(s) required for temporary construction, and 3) an increase in utilisation are all outcomes that can be achieved by careful planning of a site that incorporates all temporary facilities and utilities. For a well-designed website, the following considerations ought to be taken into account.

1. Safety Protection against fire:

On building sites, fire is one of the most significant causes of damage. Therefore, fire extinguishers are essential components that must be present on any building project. A first aid pack is an absolute necessity for any construction job that involves medical services. In remote projects, it is essential to have a medical room that is well-equipped and staffed with a physician and a nurse.- Construction safety clothing: Workers are required to wear fundamental safety supplies such as safety shoes, hard helmets, gloves, and goggles.

2. Availability of the Website

The drivers of the equipment and vehicles will have a higher morale, the risk of accidents will be reduced, and the amount of time spent entering and exiting the project will be reduced. All of these benefits will be achieved through easy accessibility. For projects of a significant scale, it is necessary to engage in careful planning in order to design the roads that lead from the closest highway. In order to facilitate the flow of work, internal roadways are essential. Additionally, parking lots are made available for the proprietor, office staff, and craft personnel; nevertheless, this facility must be developed in areas where there is available space.

3. Signs of Information- The site map should be exhibited at the office of the site superintendent or project manager, and it should also be placed at the entrance gate. It should also include specifics associated with the project.

- Traffic regulatory signs: When it comes to huge projects, traffic regulatory signs are quite helpful in directing traffic on the site and preventing accidents to a significant degree.

Displaying the policy and safety norms pertaining to labour relations will be of great assistance in reducing the number of disagreements that arise between management and labour. As the structure grows, it is essential to highlight the emergency escape routes on each floor. Additionally, it is essential to provide subsurface services. In order to prevent damage to subsurface services, the locations of those services should be identified.

4. Safety and protection- The presence of a booth that serves as a proper guard entrance to the site is required in order to ensure the safety of users. In addition, it is essential to maintain a record of all individuals who visit the project.

In order to keep the site's illumination operational, it is essential to have a generator that is always ready to go. In order to ensure the safety of the area, the boundary ought to be enclosed by a line of fencing.

5. Providing allowances – When significant construction projects are being undertaken, it is essential to provide camp accommodations for all of the many types of staff that are involved in it.

6. Offices- In addition to being in close proximity to one another, the offices ought to be situated in a secure location. In addition to that, outfit the offices with the appropriate office equipment. It is possible that the offices at the site will consist of a job office, an office for the general contractor, as well as offices for sub-contractors and consultants.

7. Sanitation and the Production of Water - For the purpose of accommodating the workforce, it is essential to position water and lavatory facilities in areas that are easily accessible.

8. The Handling of Materials- The operations that fall under the category of material handling account for at least one third of all construction activities. The utilisation of appropriate equipment for the handling of materials and the planning in advance to minimise the number of times that multiple handlings are performed will result in direct cost and time savings.

9. Storage and cleaning of the location- For the purpose of preventing the repeated transportation of materials, it is essential to plan and reserve storage facilities for the purpose of storing items.

- ✓ Laydown spaces are locations that are set aside for the purpose of storing heavy materials and equipment, and they can be kept for either a short or a long period of time.
- ✓ They are sheltered storage facilities where goods are stored until they have been distributed to the work. Warehouses are also known as storage facilities.
- ✓ The term "material staging areas" refers to the locations where items are temporarily held in close proximity to the activity being done. Typically, they are located as close to the workplace as is feasible.
- ✓ Site cleaning is something that is required at a place of employment, particularly in situations when there is a significant amount of debris produced. It is vital to dispose of debris on a regular basis.

10. Change-Houses for Craft-Work- The craft change-houses offer a protected environment for the individuals working in the craft industry to change and store their garments, wash their hands, and relax during waiting intervals.

11. Fabrication Shops and Batch Plants respectively- A batch plant that is located on the premises will be accompanied by admixture tanks, cement silos, and aggregate storage piles. In order to fabricate materials and equipment on-site, shops are utilised within the facility. Paint businesses, electrical shops, mechanical shops, and the like are included in this category. Moreover, testing shops were utilised to house the workers and testing equipment that were required for the project respectively.

2.2 LITERATURE REVIEW OF DIFFERENT JOURNALS:

According to Boateng Leslie Appiah (2021), Focusing on logistics management is crucial for successful and timely project execution in the construction sector. Logistics management in construction involves managing time, cost, quality, material supply, schedule, infrastructure, equipment location, traffic, and information across all physical and service flows. This article examines issues affecting logistics management in the construction sector, as well as inventory management techniques and their impact on envisioned logistics management by construction staff and stakeholders.

A descriptive survey was conducted using structured and unstructured questionnaires. The survey findings were analysed and presented using SPSS software, including tables, bar charts, column charts, and pie charts. Research survey participants included Project Managers, Coordinators, Foremen, Site Managers/Officers, Logistics Managers, Inventory Managers, and Labourers. The survey findings indicate that most respondents are Logistics Managers with 5-10 years of experience and a Master's degree. Logistics management is significantly impacted by the inability to adapt and integrate new technologies and approaches.

Most respondents were unsatisfied with the inventory management system in general. The construction sector need better inventory management systems and processes to enhance accuracy, minimise cycle times, and restock stock. This often leads to poor work delivery, delays, and related losses in project construction. To improve logistics management in the construction business, contemporary technologies should be prioritised by industry participants.

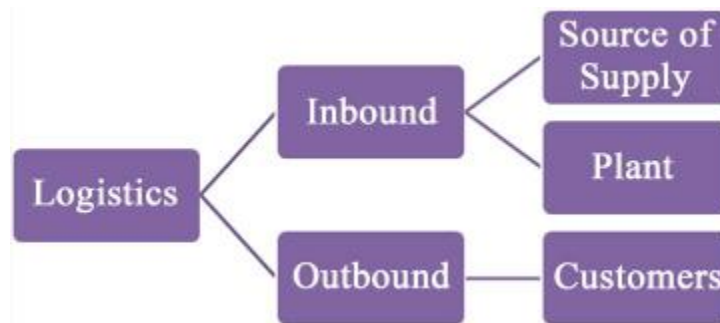


Figure 2.1. logistical activities Scope.

The study survey revealed that technology impacts logistics management efficiency and performance in building, trading, and distribution organisations. According to the report, technology significantly impacts logistics management efficiency and performance. The study reveals that technology will enhance the industry's future viability by enabling logistic enterprises to operate more efficiently, accurately, and cost-effectively, while also improving customer happiness. Conclusion: Ineffective inventory management and inability to adopt new technology can significantly impact logistics management, as indicated by study respondents.

To improve logistics management in the construction industry, the study suggests introducing modern technology. This will simplify logistics management and make it more convenient for stakeholders and industry players.

Industry participants may invest in contemporary machinery, computers, software, accessories, internet, and Wi-Fi to improve logistics management efficiency. Innovative ideas must be implemented into logistics management systems to ensure effective operations in the building sector. To maximise resource utilisation, the research suggests enhancing inventory management systems and processes.

Logistics managers may boost staff efficiency by equipping them with current technology and offering in-service training, seminars, and conferences to construction logistics professionals.

As per K. Whitlock, et. al.(2018), This study aims to explore the use of BIM to construction logistics management. The study's findings included the advantages and disadvantages of using BIM for construction logistics management. It is advised that future research expand on this by doing an empirical study combining both qualitative and quantitative data, as just a desk-top technique has been employed. This will offer up possibilities for more study and give a thorough understanding of the application of BIM for construction logistics management.

When it comes to ensuring the highest possible levels of efficiency and safety on construction sites, as well as reducing waste, it is essential to have a logistics management plan that is both sturdy and well thought out, as was demonstrated in the sections that came before this one. Additionally, it is evident that Building Information Modelling (BIM) has a variety of applications to both the logistical management of materials supply and distribution, as well as dynamic site layout design. Notably, some of these applications are already being utilised on significant constructions in the United Kingdom.

The rising usage of building information modelling (BIM) will result in the construction sector in the United Kingdom coming progressively closer to the performance objectives set by the government. However, it is feasible that substantially more may be done to speed this development. The acceleration of this evolution may be accomplished via the increased use of approaches for construction logistics management that are strengthened by systems and working processes that are based on building information modelling (BIM). The establishment of a policy that mandates the training of site-based project management staff in the use of BIM software is one way in which this task might be accomplished.

The objective of this study was to provide a comprehensive overview of the present state of the relationship between CLM and BIM, as well as the challenges that are impacting the acceptance and deployment of these two methodologies. Based on a survey of the relevant literature, this study has brought to light a number of subjects, including the advantages and disadvantages of using BIM applications in CLM. Future research should expand on this to perform extensive quantitative and qualitative research in order to develop a knowledge of how building information modelling (BIM) systems may be used to manage construction logistics. This should be done through additional investigation. In addition, the data presented above stimulates future investigation into whether or not the efficiency of logistics may be improved by enhancing the interaction between site-based workers and 4D digital building information modelling models.

As per Swapnil Raut et.al. (2025), Due to the fact that the smooth and timely flow of building materials is very important to the performance of civil construction projects, material logistics is considered to be one of the most important drivers of project success. Inefficiencies in procurement, transportation, storage, and handling at sites can result in an increase in costs, delays, and the waste of resources for the organization. Therefore, it is no longer possible to escape the necessity of process improvement in these areas in order to achieve efficiency, sustainability, and competitiveness in building supply chains. As a solution to the problems of compartmentalised supply chains, fluctuating demand, and geographical limits at project locations, the current research proposes a framework of integrated optimisation that is based on a Genetic Algorithm (GA). In order to lower Total Logistics Cost (TLC), the strategy incorporates the timing of procurement, the design of sites, and the migration of facilities depending on dynamics. Additionally, the technique integrates the costs of ordering, financing, stock-out, and handling. When it comes to curtain wall systems, AAC blocks, and reinforcing steel, a case study was conducted using a project that involved the construction of a medium-sized office structure. When compared to the baseline planning, the optimised model resulted in a reduction of 17.8 percent in TLC. Additionally, significant cost savings were achieved through the utilisation of customised procurement cycles, dynamic storage allocation, and reduced resource travel. Through the use of sensitivity analysis, the robustness of the model was authenticated across a variety of site and supply situations. The findings highlight the fact that integrating data-driven procurement with spatial optimisation ensures cost savings, significantly decreases risks, and significantly boosts the sustainability of supply chains for civil engineering.

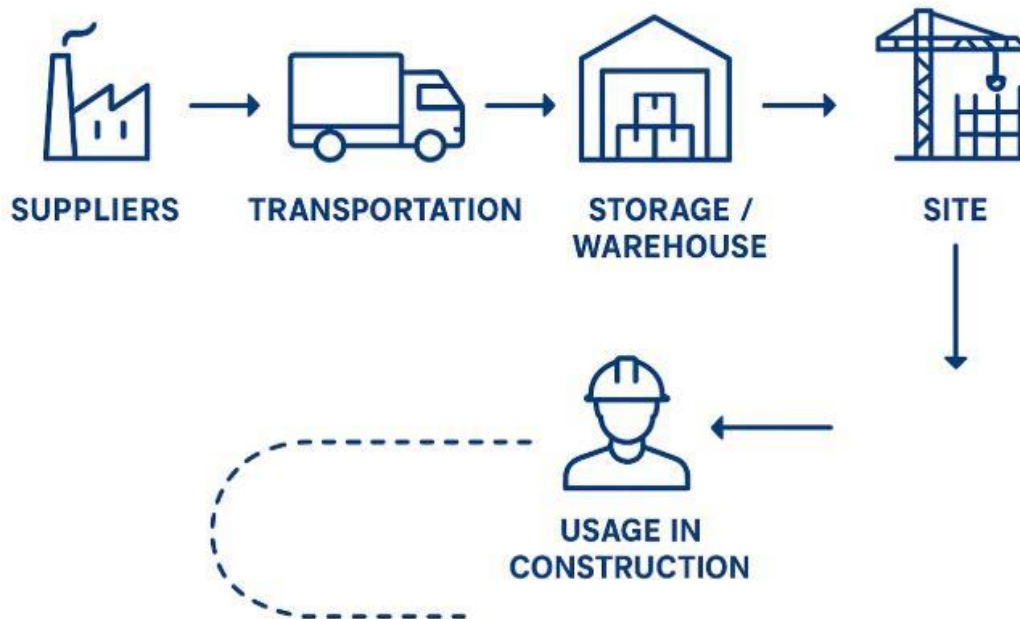


Figure 2.2: Representation of Supply Chain for Construction Material

The optimisation of material logistics in supply chains for civil engineering projects is vital for improving the efficiency of the project, lowering costs, and avoiding delays that are expensive. A working model for integrating procurement scheduling, spatial layout, and Genetic Algorithm decision support within an informed framework was developed as a result of this research. The goal of this model was to address persistent challenges in construction logistics, such as segmented supply chains, uncertain demand, and restricted space on-site. The case study revealed the benefits of employing hybrid procurement techniques based on material characteristics and dynamically shifting temporary facilities during the building period. These benefits include considerable cost reductions in material handling and increased utilisation of resources.

The combination of an improved decision support system with relevant real-world restricting variables resulted in a decrease of 17.8 percent in the total cost of logistics. The resilience of the integrated framework, which is based upon varying site circumstances, has also been proven by sensitivity analysis testing, which validates an adaptive and flexible planning approach to the management of building projects. In conclusion, the research contributes both empirically based knowledge and methodological knowledge to contribute to a self-sustaining pathway for construction companies to improve their logistics performance, follow sustainable practices, and continue to be competitive in an environment that is becoming increasingly complex in the field of civil engineering.

As per Sruthi Suresh Babu and Sahimol Eldhose (2022), Material flow refers to the efficient movement of materials at locations in a fair quantity and time without interruption. Today, sites have challenges in managing resources owing to scarcity, delivery delays, poor transportation facilities, waste, and limited storage space. Data on material flows and inventory levels aims to boost circular economy and resource efficiency in construction. This article gives a case study in Kerala, India to assess material and stock movement at building sites. A questionnaire study was undertaken to identify parameters influencing material flow in the construction sector. Out of 65 responders, personnel, equipment, materials, time, and cost are the primary elements affecting material flow.

Using selected parameters, a material flow pathway is created for the case study. It illustrates logistics management and issues affecting material transit on work sites. This aids in analysing aspects affecting material efficiency in infrastructure projects. The parameters affecting successful material management in house construction plans were identified. The investigation categorised elements affecting material management into small, medium, and big firms.

Nine small, big, and medium-sized enterprises in Maharashtra were studied in a study article. To alleviate worries, organisations should incorporate materials management into their worldwide approach by analysing all collected data. Insufficient material management leads to task delays, capital expenditure overruns, decreased labour productivity, and material waste.

Issues with material flow on building sites have increased owing to incorrect handling, transportation, and usage. The case study suggests that COVID-19 has led to increased material flow issues at building sites. Scholarly surveys suggest that only specific measures should be used to evaluate material flow. Factors such as geography, access to raw materials, labour skills, storage, and disposal impact material flow, as identified in a questionnaire study. Improper material flow can lead to cost inflation, decreased efficiency, waste, and longer project completion times.

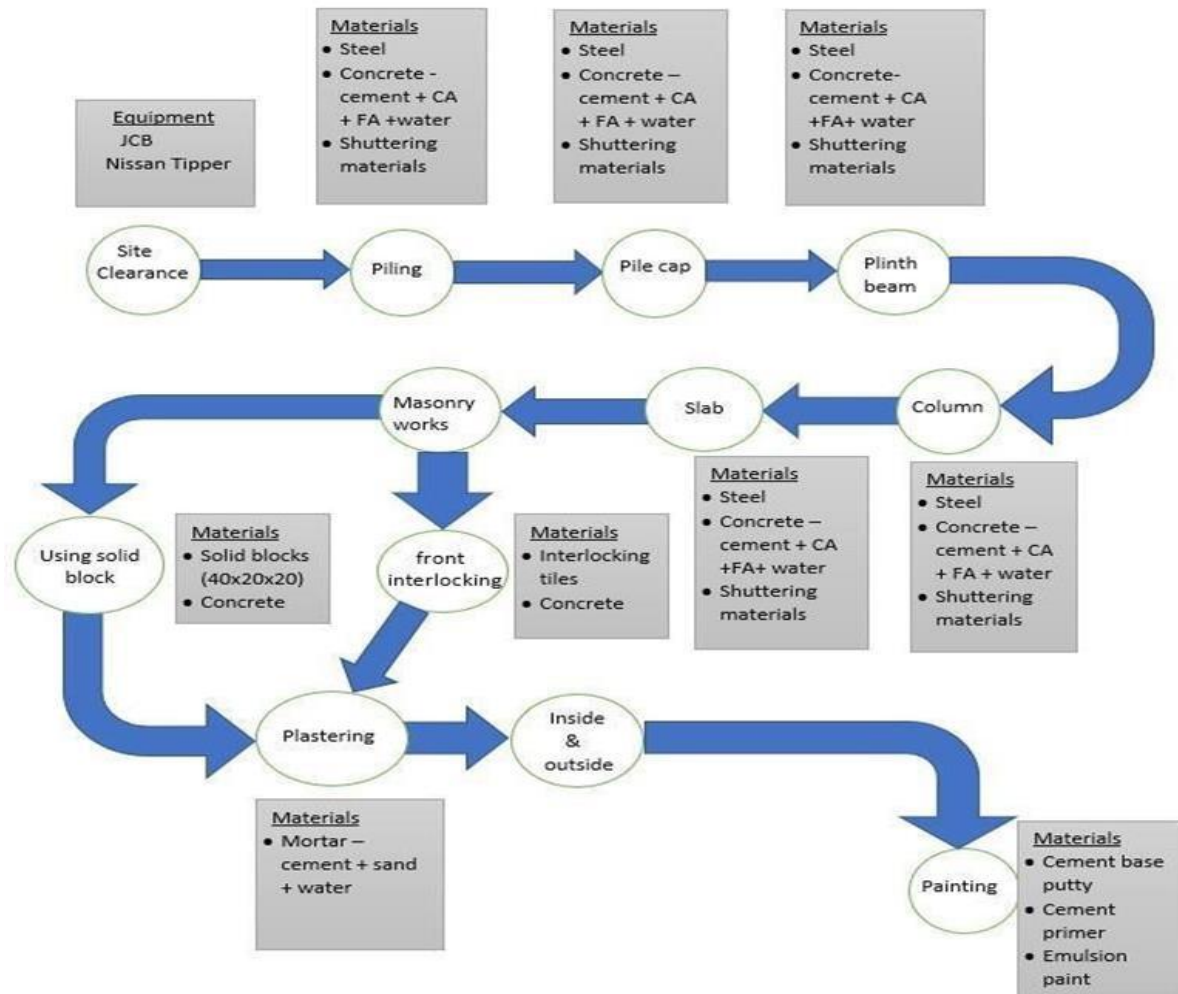


Figure 3: Flow of Construction Materials on Site

As per O Maatar et.al.(2022), Traditional construction logistics are managed in silos, which results in time losses on building sites and increased project costs owing to the frequent handling and movement of supplies. Furthermore, these unregulated flows of delivery have been shown to have an influence on the ecosystem. It is the intention of alternative ways to centralise these processes by utilising a Construction Consolidation Center (CCC), which enables the delivery of material just-in-time as a kit, directly at the workplace. This study's objective is to determine whether or not the supply chain management strategies being investigated have the potential to propel the construction industry towards more environmentally responsible and efficient practices. Therefore, the purpose of this paper is to present, from the point of view of the General Contractor, the implementation of a Commercial Construction Contract (CCC) for the first time in Luxembourg for a Residential Tower project between the years 2019 and 2020.

As a result of the steps taken during the entirety of the project, it was seen that the transportation flows contributed to increased productivity, decreased costs, and a reduced carbon footprint. In addition to these evidences that more sustainable practices are attainable in the construction industry, the article covers the adherence of workers and subcontractors, as well as the prerequisites and viewpoints of organisations and technologies. Consequently, this collaborative model appears to be an appropriate method for constructing and strengthening relationships amongst the many players in the construction industry by enhancing the day-to-day work situation.

As a result, CCC and kitting appear to be a feasible answer for the present economic and environmental difficulties, and there should be greater awareness made on this topic in order to allow its spread throughout the whole industry. Traditional construction logistics are managed in silos, which results in time losses on building sites and increased project costs owing to the frequent handling and movement of supplies. Furthermore, these unregulated flows of delivery have been shown to have an influence on the ecosystem. It is the intention of alternative ways to centralise these processes by utilising a Construction Consolidation Center (CCC), which enables the delivery of material just-in-time as a kit, directly at the workplace.

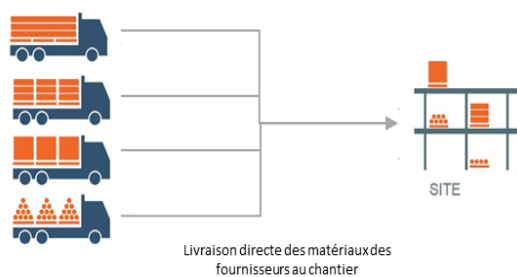


Figure 4. Situation without CCC.

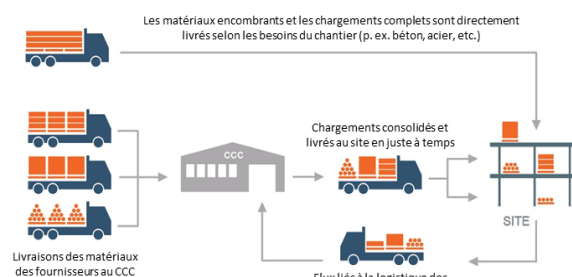


Figure 5. Situation with CCC.

This study's objective is to determine whether or not the supply chain management strategies being investigated have the potential to propel the construction industry towards more environmentally responsible and efficient practices. Therefore, the purpose of this paper is to present, from the point of view of the General Contractor, the implementation of a Commercial Construction Contract (CCC) for the first time in Luxembourg for a Residential Tower project between the years 2019 and 2020. As a result of the steps taken during the entirety of the project, it was seen that the transportation flows contributed to increased productivity, decreased costs, and a reduced carbon footprint. In addition to these evidences that more sustainable practices are attainable in the construction industry, the article covers the adherence of workers and subcontractors, as well as the prerequisites and viewpoints of organisations and technologies. Consequently, this collaborative model appears to be an appropriate method for constructing and strengthening relationships amongst the many players in the construction industry by enhancing the day-to-day work situation. As a result, CCC and kitting appear to be a feasible answer for the present economic and environmental difficulties, and there should be greater awareness made on this topic in order to allow its spread throughout the whole industry.

As per Abdulla Subhi Ruzieh et.al. (2025), This research examines logistical roles in construction and the problems that impact project performance. Unlike previous research that focused on logistics solutions, this study identifies issues hindering efficient logistics management, leading to delays and cost overruns. A thorough literature assessment of 40 sources identifies important logistical roles and their problems. A comprehensive literature evaluation categorises and analyses logistical functions and difficulties in the building sector.

The report highlights six key logistical functions: planning, resource allocation, communication, coordination, materials management, inventory management, warehousing, transportation, and reverse logistics. Each function has unique obstacles, including insufficient supplier integration and unclear communication and coordination duties. Highlighting these obstacles seeks to enhance building performance and fill a vacuum in the literature, which generally prioritises solutions above identifying fundamental issues. The study provides a framework for researchers to explore difficulties, develop solutions, and implement mitigation methods to enhance productivity and cost control in the construction industry.

The construction sector confronts logistical issues that impact project efficiency, cost, and delivery dates due to its complexity, high-risk environment, and fragmented structure. A thorough literature analysis found 16 main problems in this investigation. Challenges in logistics encompass planning, resource management, transportation, inventory control, communication, and reverse logistics. Challenges in logistics include insufficient coordination and supervision, inadequate planning and management of resources, and lack of devoted workers.

Issues include inexperienced staff, unclear work plans, cost-focused outsourcing, poor material handling, volatile markets, unsuitable vehicle use, and lack of systems to manage unqualified or surplus materials. These findings reveal shortcomings in logistics processes, including material procurement, supply chain integration, on-site logistics, and technology adoption. This study provides significant insights and highlights topics for additional research to improve logistics efficiency and resilience in building projects.

As per O. Olugboyege, O. T. Wemimo (2018), In this research, a site layout model is proposed by integrating building information modelling (BIM) with construction approach. For this study, an illustrative case study approach was chosen as the way of investigation. In this approach, the assumptions and procedures utilised in the site layout model were elaborated upon, and an example was provided to illustrate the point. According to the findings of the study, it is necessary to include construction techniques for projects into the BIM-based modelling of construction site layout plan. Additionally, it is necessary to emphasise the possibility of rethinking the processes of planning, construction, and administration of projects.

Construction site layout modelling through the integration of BIM tools and construction processes is an all-around illustrative and practical approach for building site layout models for construction projects, as can be inferred from the example presented in this article.

As per Walther Ploos van Amstel, Susanne Balm (2015), From an economic, environmental, and social point of view, there is a pressing need to organise building logistics in a manner that is both more efficient and more sustainable. About thirty percent of all deliveries made in the city are connected to construction logistics. Enhancing construction logistics begins with the design and contracting of the project; the attitude of all players involved, including the government, is also important. In order to encourage environmentally responsible building logistics, what kinds of instruments might be utilised throughout the period of tendering and contracting? Consider the following topics as we move on with our investigation: ideas, blind spots, cases, and teamwork.

The authors of this article have written on the necessity of organising the logistics of building in a manner that is both more environmentally friendly and more efficient from the economic, environmental, and social points of view. The primary focus of their research has been on the development of tools that may be utilised throughout the phase of government projects that involves tendering and contracting.

As per Chen Duiyong, Jia Shidong and Sun Mingshan (2014), The logistics management of an engineering construction project includes the planning, organization, coordination, and control of the logistics activity. This management is carried out in accordance with international standards. Using the function angle minute, it is feasible to separate the physical distribution of the engineering construction project into two distinct categories: the supply physical distribution and the scene physical distribution.

This is accomplished through the analysis of the characteristics of the engineering construction project physical distribution, which is elaborated with an emphasis on the scene physical distribution's key question, which is the optimisation of the information flow, the plan to formulate and control, the scene arrangement, the owner, the design business, and the contractor's tertiary role, where the preliminary discussion has been carried on. In addition, it was proposed that a particular physical distribution management group be established in order to supervise the management of engineering components that are vital to the building's physical distribution.

Consequently, this would guarantee that the physical distribution system would operate in an effective manner. It divides the fundamental roles of owners of logistics management, designers, major contractors, and speciality contractors, as well as manufacturers, suppliers, and vendors. This is the last but not the least of its functions.

In the context of construction projects, the authors of this work have investigated a wide range of topics that are associated with construction site logistics. For the construction project, the method of Supply Chain Management

has also been elaborated upon. Additionally, the many parties involved in the management of physical distribution have been identified, and their separate roles have been specified. All of these things have been done in relation to the construction project.

As per Abdulmohsen Almohsen, Janaka Ruwanpura (2013), Construction is typically one of the industries that is slowest to adopt new technologies compared to other industries. In spite of this, the construction sector needs to adopt these technologies to a significant degree in order to keep up with the advancements that have been made in other fields. When it comes to construction management, productivity is one of the most important factors to consider. Additionally, the implementation of new technologies, such as mobile-based applications, has the potential to boost the efficiency of construction projects in areas such as the management of resources, the amount of time spent using tools, and the incentives of workers. However, logistics management and its contribution to building productivity have not been fully examined, particularly with regard to the use of sophisticated technology.

The majority of these topics have been thoroughly investigated in academic institutions. Within the scope of this article, we suggest the creation of a new platform that would allow the construction industry to make use of contemporary technologies. Therefore, the primary purpose of this research is to introduce mobile-based application technologies into the construction sector. These technologies will boost construction productivity by enhancing logistics management practices, which is the primary objective of this work. Furthermore, the implementation of this model would not only contribute to the enhancement of productivity within the construction industry, but it will also make this sector more competitive in comparison to other sectors. In order to accomplish the primary objective of the article, a number of different construction sites for buildings have been chosen as the locations from which data will be collected through the use of direct observation, interviews, and questionnaire requests.

The writers of this research have conducted an analysis of the various sites in relation to logistic management. Additionally, they have incorporated mobile-based application technologies into the construction sector. These technologies have resulted in an increase in construction productivity achieved through the enhancement of logistics management practices. Additionally, it has been suggested that the implementation of this model will not only contribute to the enhancement of productivity within the construction industry, but it will also make this sector more competitive in comparison to other market sectors.

As per Mats Janne (2015), an ever-increasing number of people are being relocated to metropolitan regions or are already residing in urban settings. Due to the fact that people are drawn to metropolitan regions, there is a demand for new homes and places of employment. It is natural for a city to develop in a fashion that involves the construction of new homes or the renovation of ageing housing stock. It is important to note that the final products of construction projects are manufactured at the location where they will be consumed. This indicates that a large quantity of materials and resources need to be transported to each building site, as well as delivered to and removed from those sites. As a consequence, this results in the formation of new transport flows in metropolitan areas. Space constraints, environmental requirements, accessibility requirements, and noise restrictions are some of the challenges that various modes of transportation face in metropolitan environments. This has resulted in a situation in which the delivery of materials to building sites needs to be coordinated and controlled in a manner that minimises the impact that these deliveries have on the urban transportation system while also managing to ensure that construction projects are carried out effectively.

CHAPTER 3

DATA COLLECTION

3.1 Introduction

Our study focuses on material transportation, storage, and site logistics. We have conducted observations and recording of all major deliveries to the construction sites on a regular basis. This made it easier to look at how material deliveries are managed when they arrive at the site. Additionally, we have assessed how long it takes employees to select the appropriate material and transport it to the appropriate location.

Information is derived from site observations, where we decided to watch every major delivery to the construction site over a six-month period. Additionally, we tracked employees who managed material deliveries. It has been reported how long it took construction workers to transport materials. During the project's architectural phase,

observations were made. Interviews with project participants, including employees, managers, and supervisors, have been done for our study.

Project Information

Two projects have been utilised for the purpose of data collection. Both of these projects are building projects for residential properties. The following is a quick summary of the details:

Table 3.1 Information of Projects

Project	A	B
Name of Project	ABC	PQR
Location	Pune	Pune
Developer	XYZ	LMN
Total B/u Area	9,40,000 sqft	5,40,000 sqft
Number of Buildings	Ph1 – 4 nos and Ph2 – 4 nos	2 nos with Commercial
Number of Floors	3B + 12 and 3B + 20	3B + 20
Number of Units	680 nos	282 nos
Construction Period	June 2023 to Dec 2029	Aug 2023 to Dec 2028

3.2.1 Project A – “AAA”, in Pune



The East region of Pune is where this project is located. Three buildings with fifteen stories each and one building with twenty-three stories each make up this complex, which has a total of 680 apartments. Reinforcement concrete is used for the structure of the building. An approximate total of 5,15,000 square feet is devoted to the construction project.

The time frame for the construction project is from June 2023 until Dec 2029. Material deliveries to this Project are organized in a traditional way. The building site is being served by lorries that are coming directly from the point of supply. These deliveries do not have a reserved time, and the contractor is not aware of the exact moment that the items will arrive at the construction site.

3.2.2 Project B – “PQR” in Pune



The South West neighbourhood of Pune is where this project is located. It is made up of two buildings with twenty-three stories each and one building with twelve stories, and it has a total of three hundred apartments. Reinforcement concrete is used for the structure of the building. It is estimated that the overall construction area of Phase 1 is roughly 2,15,000 square feet.

This project will be carried out during the months of August 2023 and December 2028. Traditional methods are utilised in the organization of the delivery of materials to this project. The building site is being served by lorries that are coming directly from the point of supply. These deliveries do not have a reserved time, and the contractor is not aware of the exact moment that the items will arrive at the construction site.

3.3 SITE OBSERVATIONS:

3.3.1 Project A – “ABC” by PQR Developer at Pune

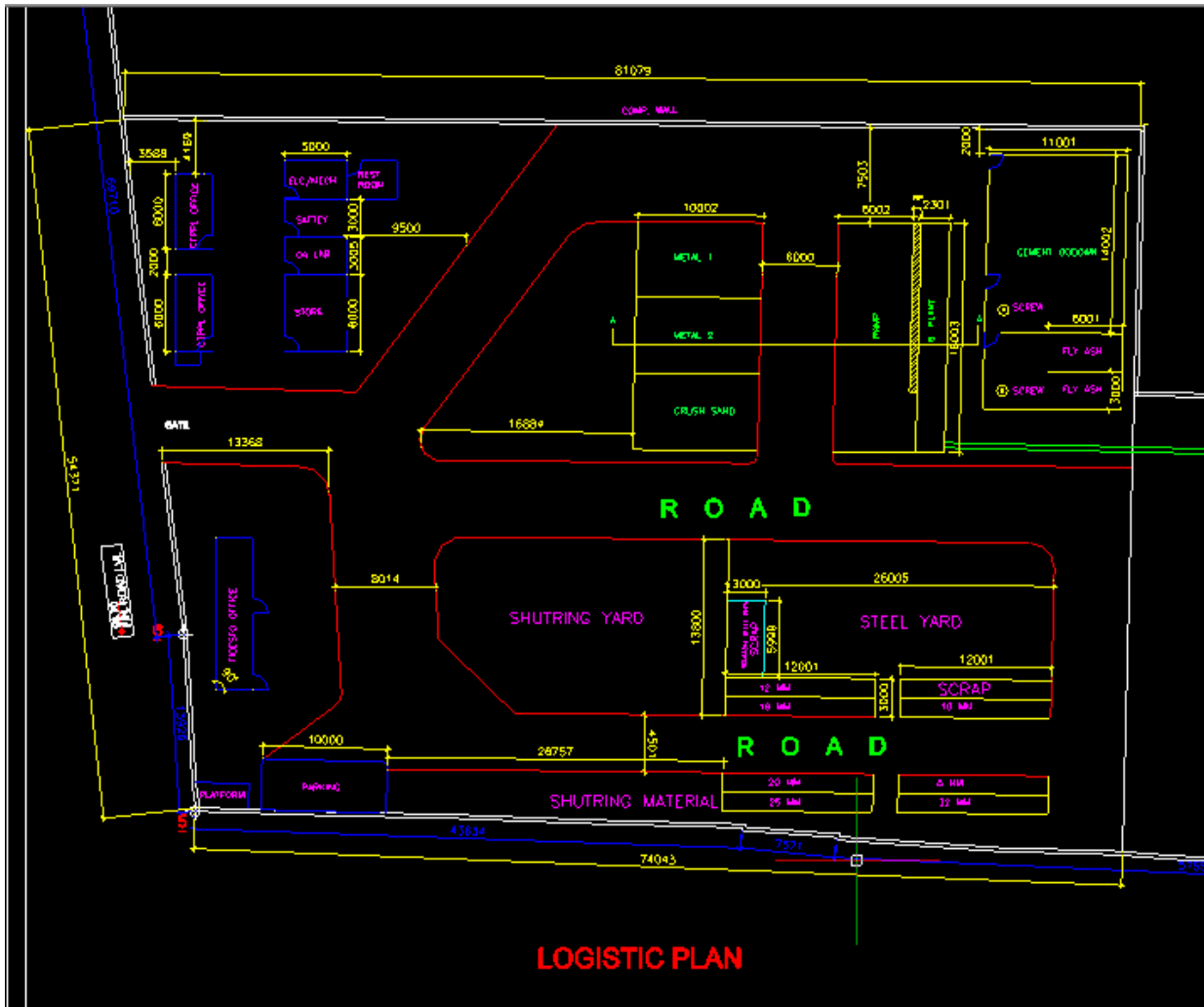


Fig 3.1: Logistics Planning at Site ABC



Fig 3.2: Actual Photograph of Logistics at Site ABC

Safety Signage On Site





Testing of Steel before unloading



Steel Stacking In Racks For Each Dia. Of Bar



Stacking of Stirrups on Wooden Plank in Steel Yard.



Diameter Wise Re- Steel Scrap Yard Bin



Fig 3.3 Site Observation Pictures– Project ABC (Stored)

Project 2 – “PQR”, LMN Developer at Pune

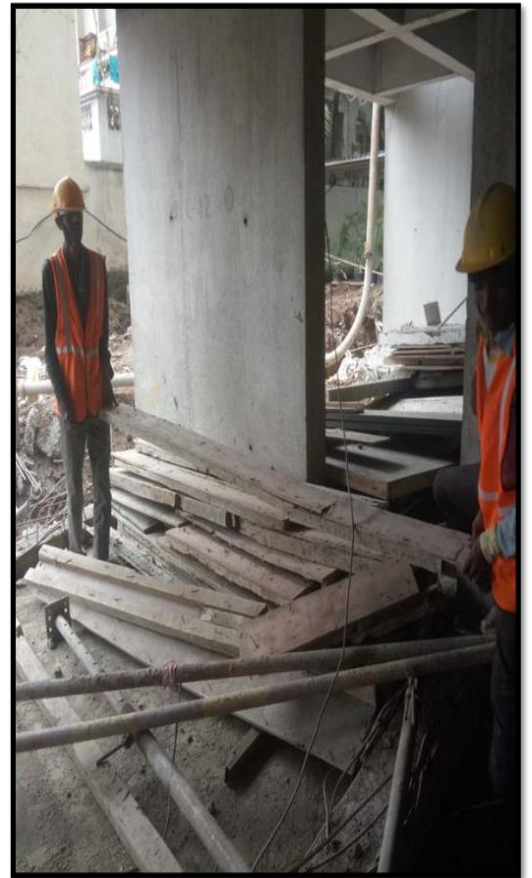




Fig 3.4 Site Observation Pictures – Project PQR

3.3.3 An overview of the observations and the current condition is presented in the following:

1) The Project A-

I. During the beginning stages of the project, the logistics of the site were laid out, and they are still being maintained at the site. All the same, there are still some flows.

Additionally, materials are sometimes positioned in the appropriate location in order to facilitate accessibility to the working environment.

II. Furthermore, the quantity of material that is stored is so neatly organised that it is possible to move it to a different location with ease. The consequence of this is that the time that is spent by carpenters and fitters on transporting supplies from one location to another is substantially reduced.

III. When placing an order in advance, cement and steel rods should be ordered specifically with the required length. In order to stake the steel rods, diametrically equivalent steel racks of 12 meters in length have been built. The steel rods are full-length rods, which means they are 12 meters in length.

IV. In order to cut down on the amount of time needed to sort it at a later point, it is piled in a clockwise direction during the unloading process. In addition, a separate shuttering yard is being maintained so that the shuttering and formwork materials can be stacked in a distinct manner.

V. Two times a week, heavy-duty trucks carrying goods arrive. For example, use fly ash brick, aggregates, and cement, among other things. For the purpose of transporting or shifting the materials or fabricated steel from the casting yard to the actual site location, one compact truck and one excavator are made available at the site.

2) The Project B-

I. During the beginning stages of the project, there was no planning done for the logistics of the site, and there is also no planning done for the material handling and storage.

II. Materials are sometimes positioned in an inappropriate location, which results in a reduced level of accessibility to the working environment. Additionally, the quantity of stuff that is being stored is so enormous that it is not possible to readily relocate it to another location. Consequently, as a result of this, fitters and carpenters are required to spend additional time transporting items from one location to another.

III. Access to the location and anywhere within the premises is not being maintained and has to be addressed.

IV. The enormous quantity of materials that are ordered at the beginning of the project, regardless of whether or not they are required, results in an additional load on the logistics department and drives up the overall cost of the project.

V. In addition, the movement of goods from the fabrication yard to the real site location is made more difficult on occasion due to the fact that the logistic process is not being managed as effectively as it should be.





Fig 3.5: Stacking Of Formwork Material In Hazardous Manner On Site

3.4 Data Analysis

In order to investigate and analyse the present logistic process at the aforementioned locations, the following sample study is taken into consideration. In this study, the entire process of analysing construction materials, beginning with the phase of procurement and ending with the phase of using them on site, was watched and documented.

Table 3.2: Data Observation – Material Management – AAC Blocks

Sr No	Material	Project A	Project B
1	Type of Material	AAC Blocks	AAC Blocks
2	Quantity Required	1800 Nos	2300 Nos
3	Procured Quantity	1800 Nos	1600 Nos
4	Lead time required	7 Days	5 Days
5	Unit Price per Block	Basic Price – Rs 100 per Block Transport – Rs 1.10 per Block	Basic Price – Rs 99 per Block Transport – Rs 1.10 per Block
6	Time Required to Deliver at the Location	8 Days	5 Days
7	hours worked that were incurred for	8 Hrs.	8 Hrs.
8	Unloading at the premise	Unloaded at multiple locations as per its utilization	Unloaded at Ground Floor
9	The location where it is being used The location where it is being unloaded and stored	At multiple points	At 10 th Floor

10	In order to get the material from the storage facility to the location where it will be used,	0 hrs/day	6 hrs/day for 2days
11	additional manpower and further costs were spent.	00	Rs 1200/day
12	The halt caused additional time to be spent.	00 Hrs	06 Hrs



Table 3.3: Data Observation – Material Management – *Fly Ash Bags*

Sr No	Material	Project A	Project B
1	Type of Material	Fly Ash Bags	Fly Ash Bags
2	Quantity Required	1000 Nos	1500 Nos
3	Procured Quantity	500 Nos in 2 lots	500 Nos in 3 lots
4	Lead time required	3 Days	4 Days
5	Unit Price per Block	Basic Price – Rs 350 per Bag Transport – Rs 2.00 per Bag	Basic Price – Rs 350 per Bag Transport – Rs 2.00per Bag
6	Time Required to Deliver at the Location	4 Days	6 Days
7	hours worked that were incurred for	4 Hrs.	6 Hrs.
8	Unloading at the premise	Unloaded at store	Unloaded at Ground Floor (covered area)
10	The location where it is being used The location where it is being unloaded and stored	0 hrs/day	2 hrs/day for 3 lots
11	In order to get the material from the storage facility to the location where it will be used,	00	Rs 600/day = 1800/-
12	additional manpower and further costs were spent.	00 Hrs	06 Hrs

Table 3.4 : Tentative Delay Analysis of a Slab Casting at both Sites

Sr No	Delaying Factors	Project ABC	Project XYZ
1	Timeframe for completion	25 Days	21 Days
2	Actual number of days used	32 Days	35 Days
3	Delay brought on by the delivery of materials	3 days	3 days
4	Lack of skilled labour	1 day	1 day

5	Insufficient coordination and communication	2 days	2days
6	Delay brought on by moving and handling materials	1 Day	2 Days
7	plants and equipment not being available	1 day	2 days
8	Plant failure-related delay	0 days	2-3 hrs

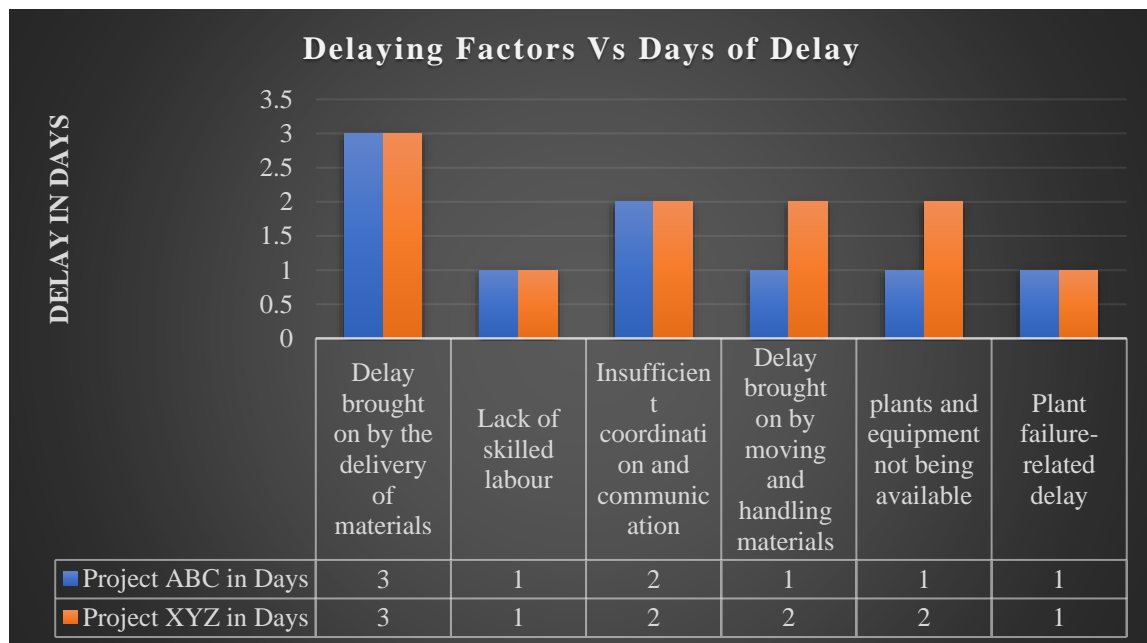


Fig 3.6: Graphical Comparison of Delays for both Projects

CHAPTER 4

RESULT AND DISCUSSION

4.1 DEVELOPING NEW MODELS FOR EFFICIENT LOGISTICS SYSTEMS

We discovered that the current procedure was ineffective in terms of logistics management during the data gathering and analysis. The procurement, shipping, and stacking of materials at the site are not tracked by any system. The main challenges were initiating purchase orders, monitoring all consequences during transportation and receiving at the site, keeping all parties informed about order progress, and streamlining information access.

As a result, we believe it is necessary to streamline and ease communication between clients, suppliers, managers, contractors, and other project participants as well as on building sites. In order to meet customer needs, we are introducing a conceptualised logistics framework that will enable supply chains to plan, execute, and regulate the effective, efficient flow and storage of goods, services, and related data from the point of origin to the point of consumption/placing.

4.1.1 Considerations for Site Layout Planning in Site Logistic Management

We discovered certain shortcomings in the current Site Layout planning during the data collection and analysis process. The following elements should be taken into account when designing a site that will maximise utilisation, reduce the amount of space required for temporary construction, and increase productivity and safety.

1. Security -Fire prevention: Fire is a major cause of damage on construction sites. Fire extinguishers are therefore essential for any construction job. Medical services: A first aid pack is essential for building projects. A well-equipped medical room with a physician and nurse is crucial for remote projects.

Construction workers are required to wear basic safety equipment such as goggles, hard helmets, gloves, and safety shoes.

2. Accessibility of the Site : Easy accessibility will keep the morale of the equipment and vehicle drivers high, minimize the chance of accidents, and save time in maneuvering to arrive at and leave the project. Large projects necessitate careful planning in order to design the roads that lead from the closest freeway. Internal roadways are essential for a smooth work flow. Additionally, parking lots are available for the owner, office staff, and craft workers; nevertheless, this facility must be designed to take advantage of available space.

3. Signs of Information: The project's specifics should be located on the site map, which should be placed at the entrance gate and shown in the office of the project manager or site supervisor.

- Traffic regulatory signs: For major projects, these signs greatly reduce the likelihood of accidents by directing traffic on the site.

Disputes between labour and management can be avoided by displaying the safety regulations and labour relations policy.

- Emergency routes and subterranean services: As the building develops, it is crucial to post the emergency escape routes on each floor. To avoid damage, the locations of subterranean services should be identified.

4. Safety- entry: A booth must give a suitable guard entry to the location. Additionally, all visitors to the project must be tracked.

Lighting: To keep the site lit, a backup generator is required.

Fencing: From a security perspective, the boundary should be fenced off.

5. Lodging: All types of project workers must have camp accommodations on large construction projects.

6. Offices; The offices ought to be in a secure location, near the site, and close to one another. Additionally, supply the offices with the necessary office supplies. There may be job offices, general contractor offices, subcontractor offices, and consultant offices on the site.

7. Sanitation and Water Supply: To accommodate the workforce, water and lavatory facilities must be placed in easily accessible areas.

8. Material Management: Material handling encompasses at least one-third of all construction activities. Direct cost and time savings will come from using the right equipment for material handling and planning ahead to minimise multiple handling.

9. Site cleanup and storage: To prevent multiple material movements, storage areas must be planned and reserved.

- ✓ Laydown areas are spaces set aside for the temporary or permanent storage of heavy equipment and commodities.
- ✓ Warehouses: These are covered storage spaces where supplies are kept until they are needed for the task.

- ✓ Material staging areas are employed when temporary materials are kept close to the work. In general, they are as close to their place of employment as they can be.
- ✓ Cleaning the workplace is essential, particularly in areas with high levels of debris production. Debris must be disposed of on a regular basis.

10. Handmade Change-Houses: During waiting times, craft workers can change and store clothing, wash, and relax in covered spaces called craft change-houses.

11. Fabrication shops and batch plants: On projects where producing concrete on-site is more cost-effective than purchasing a ready mix, batch facilities are supplied. An on-site batch facility will be accompanied by admixture tanks, cement silos, and aggregate storage piles. Shops are utilised for on-site fabrication of equipment and materials. Paint, carpentry, mechanical and electrical shops fall under this category. Additionally, the project's workers and testing equipment were housed in testing shops.

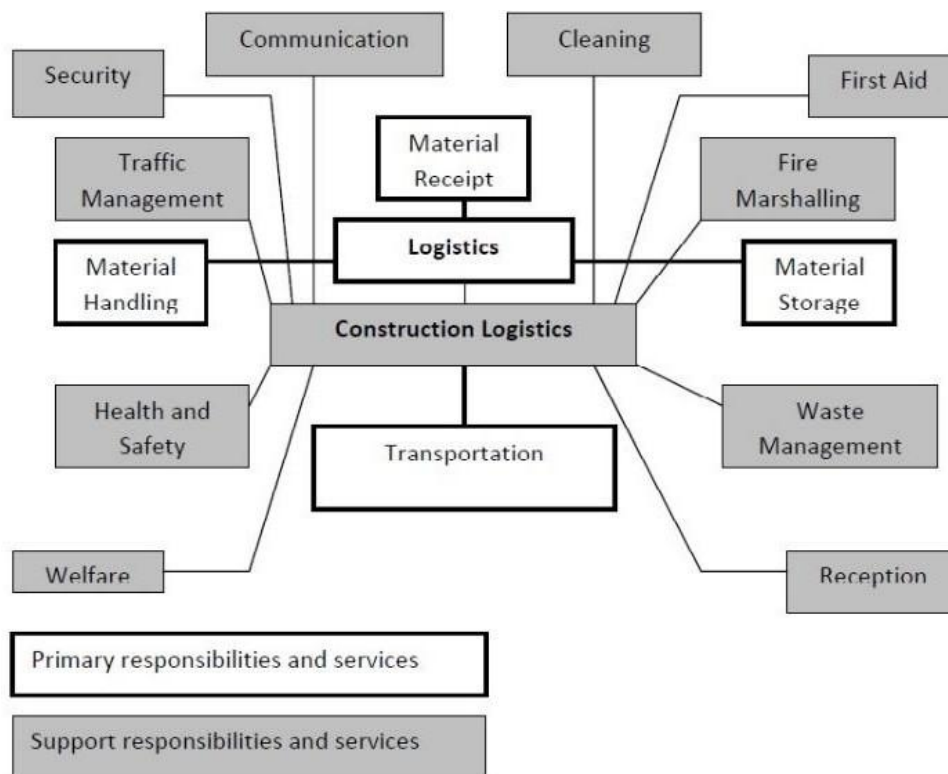


Figure 4.1: Initial Functions and Logistics Functions and Services

4.1.2 Planning for Site Layout

The location of off-loading, storage spaces, material protection, and the transportation of materials to building sites are all determined by site layout, which is an integral part of materials management. This phase's goal is to choose the best route for material routing by carefully examining the space, facilities, and safety of the construction site. The significance of site architecture in boosting productivity, reducing commute time, and optimising space utilisation has been highlighted by numerous researchers.

Site initialisation, site modelling, and site optimisation are the three phases that make up this phase. The process of organising site facilities (vehicles, building elements, temporary facilities, etc.) on the site is known as site initialisation. CAD data was used to create the first site layout. The site layout's geometry is developed using a CAD program.

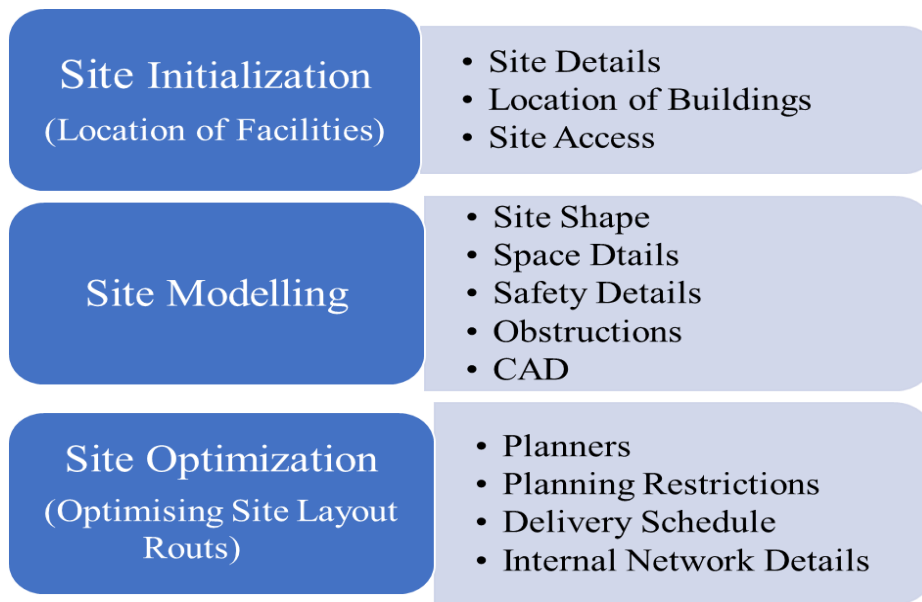


Figure 4.2: Site Layout Factors for Planning

Due to the fact that Project B does not have any planned logistics, the site layout was designed for Project B. Taking into consideration the space limits of the basement floor, this layout is created in two stages: first, before the execution of the basement floor, and then after the basement floor.

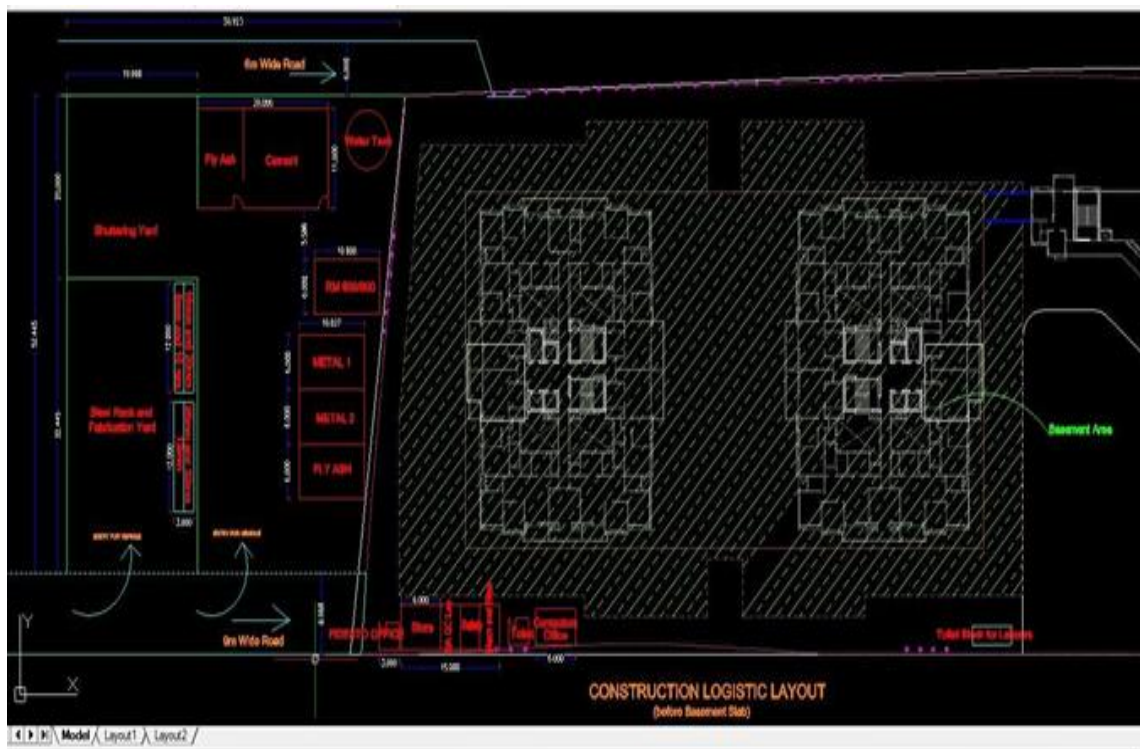


Figure 4.3: Autocad Drawing Site Layout Planned for Project B – Stage 1

The Site Layout map that is proposed for Project B for stage 1 is depicted in Figure 4.3. This map is the same one that will be followed up until the execution of the basement floor. Elements that make up this Layout:

- ✓ In order to ensure that the operations of the construction project are not disrupted in any way, all of the materials and equipment that have been set up are stored in one of the construction areas.
- ✓ Steel and other materials are each furnished with their own private entry gate for the purpose of material logistics.
- ✓ In the vicinity of the cement storage room, there is a separate area that has been designated for the installation of the batching plant.
- ✓ It is required that all aggregates and metals be stored and preserved in a grading order.
- ✓ Separate area that is designated for the establishment of offices belonging to various agencies, such as store and lab setups, client and contractor offices, engineering offices, and so on.



Figure 4.4: Autocad Drawing for Site Layout Planned for Project B – Stage 2

The Site Layout map that is proposed for Project B for stage 2 is depicted in Figure 4.4. This map displays the same layout that will be followed following the execution of the basement floor, which is when the actual building construction will take place above plinth level.

Elements that make up this Layout:

- ✓ In order to ensure that the operations of the construction site are not disrupted in any way, all of the materials and equipment that have been set up are stored in the central core of the construction area.
- ✓ Steel and other materials are each furnished with their own private entry gate for the purpose of material logistics.
- ✓ In the vicinity of the cement storage room, there is a separate area that has been designated for the installation of the batching plant.
- ✓ Separate area that is designated for the establishment of offices belonging to various agencies, such as store and lab setups, client and contractor offices, engineering offices, and so on.
- ✓ The possibility of installing a tower crane with a height of sixty meters in the center core between two buildings, so that both of the buildings can be covered by a single crane.



Figure 4.6: Implementation Of Site Layout As Per Planning

4.1.3 Construction Site Resource Planning

In point of fact, a significant number of construction projects are typically plagued by a variety of delays, including but not limited to adverse weather conditions, inappropriate ground conditions, client modification orders, and so on. The execution period of the project will ultimately be lengthened as a result of these uncertainties. Putting out the idea that the material management system should be incorporated into the planning and scheduling of the project.

In order to achieve the goal of having an integrated dynamic logistics system to combat site requirements, the objective of this phase is to integrate the requirements of the detailed Work Plan, which are based on the Last Planner Methodology, with the external logistics and site layout system respectively.

Figure 4.7: Modify Model for Information Sharing to Construction Supply Chain

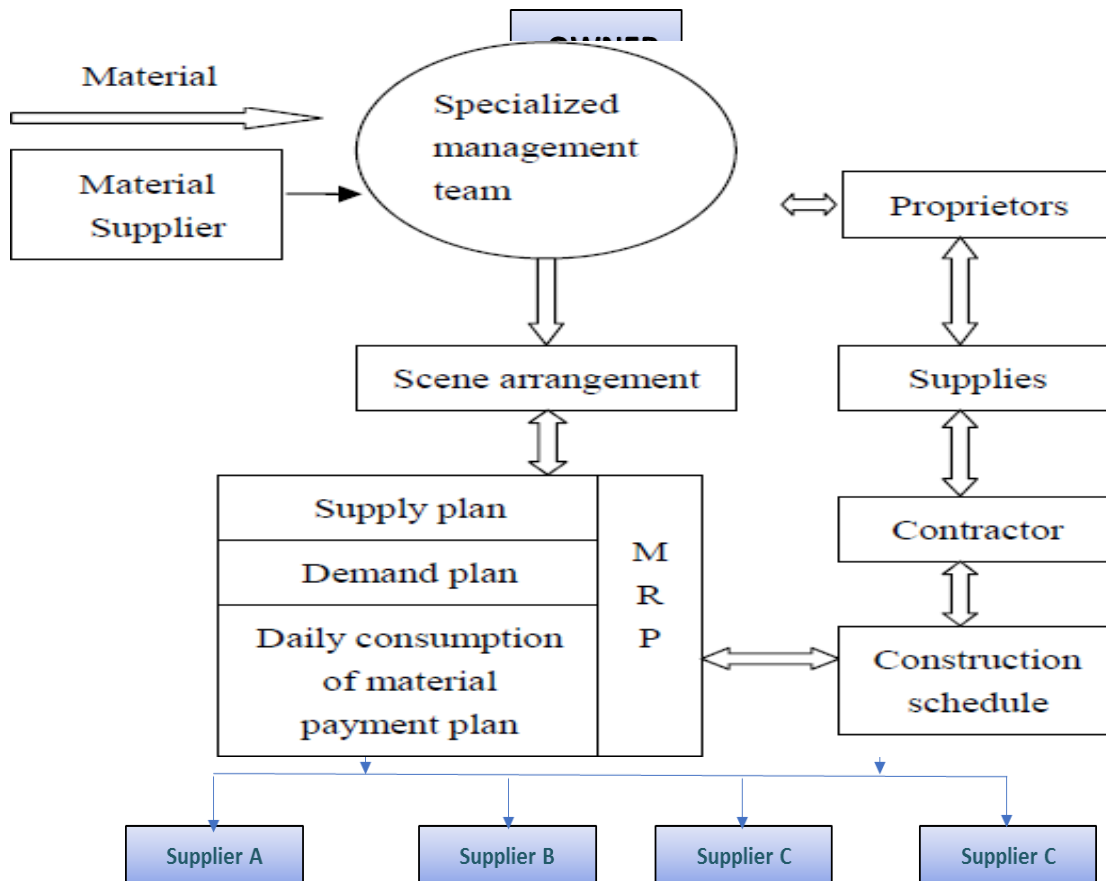


Figure 4.8 : Framework for Logistics Management Model to Construction Project

The created model framework for the efficient utilisation of construction site logistics management is depicted in Figure 4.8. This framework can be applied to any construction site. There is no specific construction project that cannot benefit from the implementation of this flow chart in order to create more efficiency in construction site logistics and obtain better results.

4.2 ANALYSIS AFTER IMPLEMENTATION OF FINDINGS AT ACTUAL SITE

Following the implementation of the "Proposed model" on both of the sites (i.e. Project A and Project B), the findings and results from the discussions and outcomes described above were applied. The alterations that were made to the process of the material supply chain have been adopted, as shown in figures 4.7 and 4.8 above. Additionally, the site layout that was planned for Project B is currently being implemented there in accordance with figures 4.3 and 4.4.

For additional information, following the implementation of the suggested developed model at both of the construction sites, a delay analysis for slab castings was carried out at both of the projects, and the results were then compared with the study that had been performed earlier. Also computed below is the same:

Table 4.1: Delay Analysis of a Slab Casting at both projects after implementing proposed model

Sr No	Delaying Factors	Project A	Project B
1	Target completion period	26 Days	22 Days
2	Actual Days consumed	33 Days	35 Days
3	Delay brought on by the delivery of materials	0 days	1 day
4	Lack of skilled labour	0 day	0 day
5	Insufficient coordination and communication	1 days	0 days
6	Delay brought on by moving and handling materials	0 Day	0 Days
7	plants and equipment not being available	0.5 day	1 days
8	Plant failure-related delay	0 days	0 days

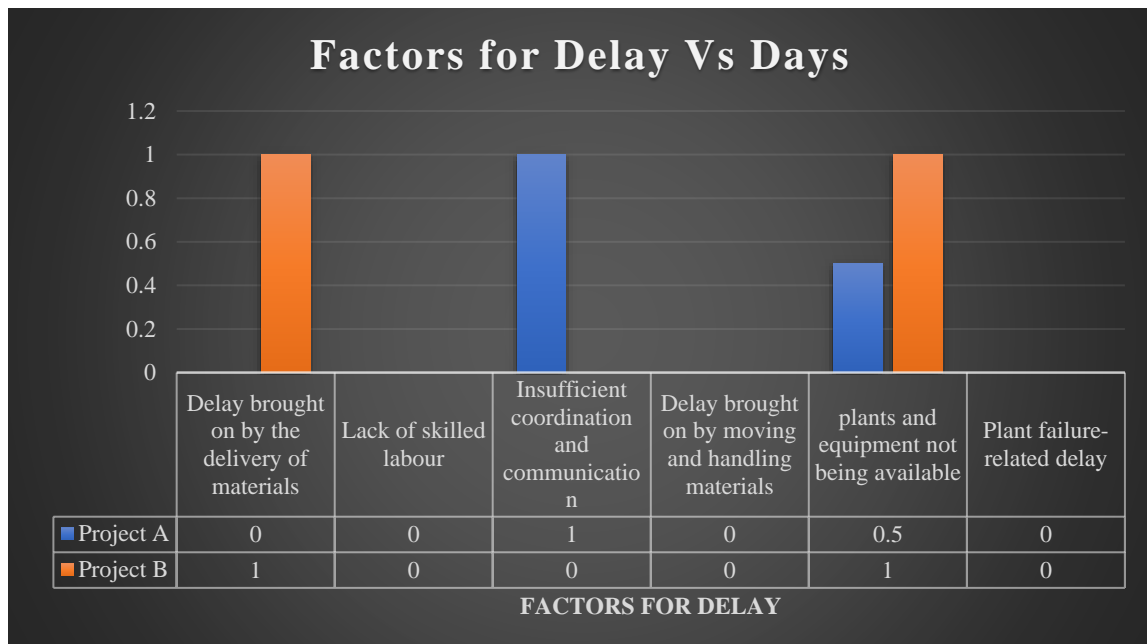


Figure 4.9 : Delay Analysis After Implementing The Model

Table 4.2: Delay Analysis Before and after implementing proposed model

Sr No	Delaying Factors	Project ABC Delay Before Model Implementation	Project ABC Delay After Model Implementation	Project XYZ Delay Before Model Implementation	Project YZ Delay After Model Implementation
1	Target completion period	25 Days	25 Days	22 Days	22 Days
2	Actual Days consumed	32 Days	32 Days	35 Days	35 Days
3	Delay brought on by the delivery of materials	3 days	0 days	3 days	1 day
4	Lack of skilled labour	1 day	0 day	1 day	0 day
5	Insufficient coordination and communication	2 days	1 days	2days	0 days
6	Delay brought on by moving and handling materials	1 Day	0 Day	2 Days	0 Days
7	plants and equipment not being available	1 day	0.5 day	2 days	1 days
8	Plant failure-related delay	0 days	0 days	2-3 hrs	0 days

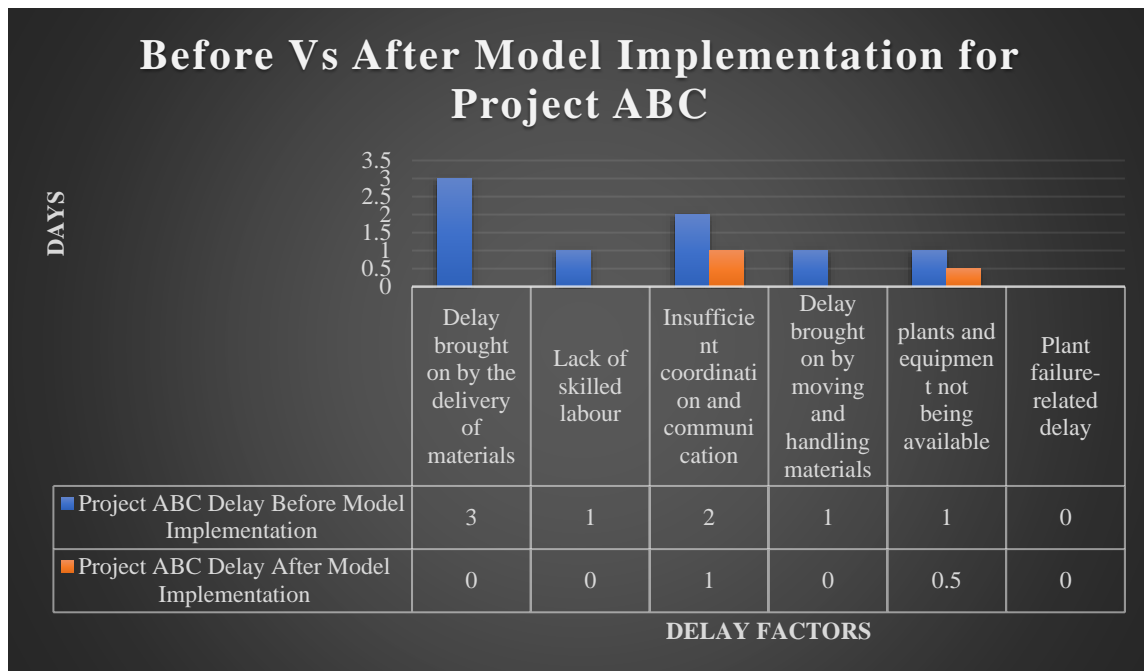


Figure 4.9: Before Vs After Implementing The Model Comparison Of Delay – Project ABC

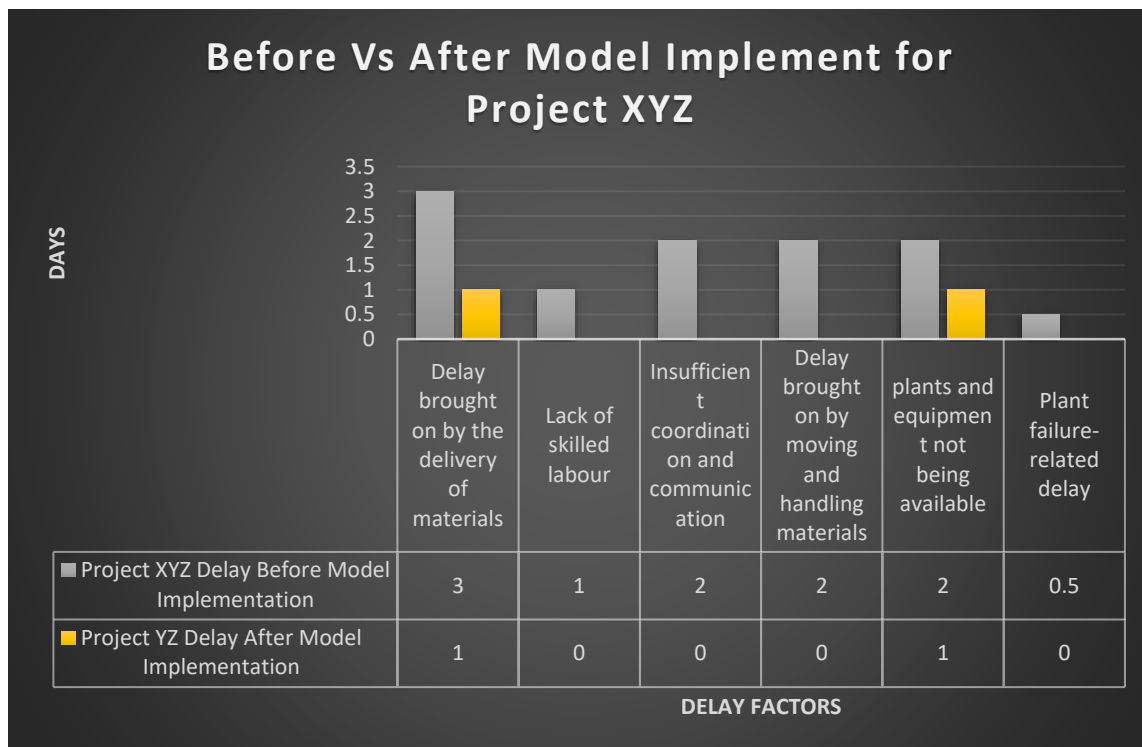


Figure 4.10: Before Vs After Implementing The Model Comparison Of Delay – Project XYZ

CHAPTER 5

CONCLUSION

The objective of this study is to investigate the existing state of construction logistic processes in the Pune area and to determine the characteristics that are necessary to make these processes more efficient. During the course of the research, we came to the realisation that construction businesses tend to underestimate the importance of construction logistics. This can have a significant influence on a variety of aspects of the project, such as the overall cost and time consumption, the amount of material that is wasted, the environment production, the production time, and so on.

In conclusion, the purpose of this study was to provide a description of the fundamental concept of integrated dynamic logistics as well as the development of a conceptual logistics framework for the purpose of managing the movement of materials from the manufacturer to the building site. When it comes to construction projects, the issue of advance planning and design is typically lacking.

Therefore, we came to the conclusion that the construction industry needs a logistics system that is both well-defined and efficient, as well as interconnected. This system will assist logistics planners in enhancing the operational efficiency and environmental friendliness of the building processes. Loading and unloading times that are effectively planned will result in lower indirect costs, will contribute to a reduction in site congestion, and will have a tendency to increase the utilisation of site area. It is projected that an integrated logistics system will increase delivery efficiency and dependability, as well as minimise costs associated with fuel and transportation, and reduce inventory levels through the use of just-in-time deliveries.

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