

USE OF INFORMATION TECHNOLOGY IN CONSTRUCTION INDUSTRY FOR SUPPLY CHAIN MANAGEMENT

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Abstract - A poor administration on development activities can prompt noteworthy negative contacts with low efficiency, cost and time overwhelm, clashes and debate bringing about cases and tedious prosecution. Past examinations called attention to that a proficient administration of the development co-ordinations process can be an approach to lift up the development profitability. Appropriate administration of supply chain would bring about bringing down costs, short conveyance time, low stock level and enhance dependability which would enhance the aggressive position of associations.

Introduction - The development business has been blamed for being, at the very least, inefficient, wasteful and ineffectual. There are a few worries that the business isn't performing to its maximum capacity. These worries chiefly center around territories with respect to the business' benefit edges, its customers' fulfillment and the discontinuity of the construction procurement process. Focused weights from inside the business, and also outer financial and different contemplations are compelling the business to reconsider and enhance its execution.

In the present construction industry, changes in client assumptions with respect to extend conveyance, time, cost, and quality have constrained the partners to scan for new operational models. In the post-retreat period, it is significantly more important to investigate more creative strategies for venture conveyance to control the expanding wastages, upgraded productivity and accomplishing better quality. Over the last three decades, most manufacturing firms have recognized Supply Chain Management (SCM) as a new way of doing business. The implementation of this new approach was a consequence of various changes in manufacturing environments, such as development of information technology (Internet), globalization, and sophisticated customers who demand increasing product variety, lower cost, better quality, and faster response. Competition is shifting from firm versus firm to supply chain (SC) versus SC.

The supply chain is the focus for more effective ways of creating value for clients; as a vehicle for innovation and continuous improvement, integration of systems and perhaps even improved, industry-wide, profitability levels. In its broadest sense, Supply chain Management (SCM) is the oversight of materials, data, and funds as they move in a procedure from provider to producer to distributor to retailer to customer. Supply chain management includes organizing and incorporating these streams both inside and among organizations. In late SCM, changes incorporate, for example, data innovation with Web interfaces, E-acquisition, lean development and inserted advances for checking and control.

Then again, the data stream between different partners of the undertaking in construction industry is more mind boggling and non-direct when contrasted with straight stream in assembling industry. In addition, the construction business is divided. This causes delay in data stream at different phases of the undertaking which constitutes the real obstruction looked in development industry. The structure is required to check the deficiencies due to the deferrals in conventional management consequently increasing the value of the entire procedure and along a long run accomplishing Supply Chain Management.

Web technology and the needs of construction management

The Internet is a perfect vehicle for incorporating and scattering data around a system of taking an interest gatherings and associations. It has turned into a financially savvy, all around acknowledged and promptly accessible conveyance framework. The Web offers unparalleled correspondence open doors for the development business, especially its office to oblige an extensive variety of media composes (content, voice, objects, and so on). It is currently feasible for development firms to develop neighborhood or potentially worldwide data systems with low access cost utilizing moderate equipment and programming. The entrance control and safety efforts accessible on the Internet can guarantee information security and trustworthiness.

Electronic development data administration frameworks can make utilization of programs, information dealing with gadgets and other Internet innovation to make a system for sharing and controlling corporate data in a way that will help development venture directors to finish chip away at time and inside spending plan.

The evolving use of the internet in construction

There have been three unmistakable phases of advancement of the utilization of data innovation in the development business. In the main stage items were specifically used to enhance the proficiency in manual procedures of data control at activity level (up to late 1970s). The second period of improvement saw the presentation of remain solitary bundles. From the mid1990s, the third period of improvement started the mix of remain solitary frameworks into key electronic stages for continuous organized information trade and to keep up store network connections i.e. data frameworks that hold, oversee and utilize information for an assortment of administration capacities. The Internet is a perfect vehicle for these.

Supply Chain & Information Technology -

Supply Chain Management (SCM) as a way to enhance operational efficiency has been perceived since the mid '90s inside the different assembling businesses. Toward the back era few effective usage and studies, today SCM is a demonstrated, surely knew hypothesis for dealing several aspects of manufacturing as well as construction industry, from fund to activities administration.

Organizations are presently transparently adjusting their business forms and embracing innovation based SCM instruments to lessen wastefulness and improve perceivability into their activities, better deal with their assembling arranging and booking, and better associate and incorporate with their providers. Advantages from effective reception of SCM strategies and Information technology(IT) arrangements incorporate diminished wasteful aspects, decreased work-in-progress(WIP), expanded throughput, and expanded efficiency, all of which prompt lessened main concern working expenses, and expanded topline income and related benefits. The cost saving & performance improvement in assembling have not gone unnoticed in construction industry. There have been expanding calls by scholastic's and experts to apply SCM standards to construction practices.

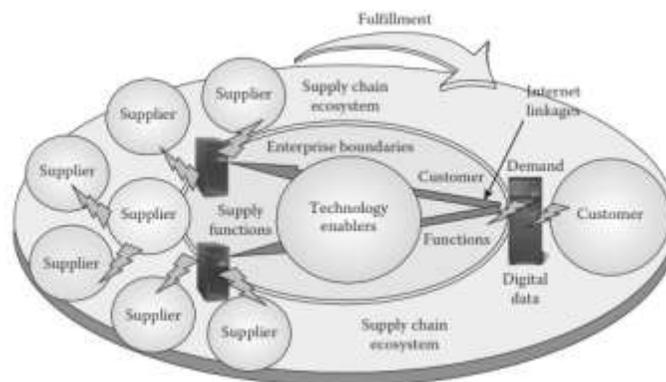


Fig. 1.1 Technology-Enabled Supply Chain

Redefining Supply Chain Management

The developing key capacities of SCM and its combination with the present integrative data innovations require an update of existing meanings of SCM. The objective is to show how innovation devices are changing SCM from an operational methodology for the streamlining of inside co-ordinations capacities to an associated system of related business accomplices centered around the shared objective of special case client fulfillment.

A New SCM Definition

In view of these elements, SCM can be reclassified as a vital channel administration reasoning made out of the persistent recovery of systems of organizations incorporated together through data advances and enabled to execute superlative, client

winning an incentive at the most reduced cost through the computerized, constant synchronization of items and administrations, essential commercial center data, and co-ordinations conveyance abilities with request needs.

Aim & Objectives -

1. To get an understanding of the methods/practices used in the construction project for supply chain management.
2. To get an understanding about the use of information technology in the ongoing construction project.
3. To know about the problems faced during the complete project in managing the supply chain network.

Methodology – A real ongoing construction project is chosen to understand & study the use of information technology in the construction project.

Case Study – A XYZ company (name not disclosed as per requested) has been awarded a contract for the construction of Metro Corridor where DMRC is the customer and General Consultants are providing the consultation for the project.

XYZ company is in a joint venture with a foreign company which has specialization in the underground works, which integrates design, construction, research and manufacture into a single entity and is among the top 500 world organization.

Project Scope -

The construction part of the project includes:

- 6662.92 meters of construction of Tunnel by Shield TBM
- Construction of 4 metro stations as Station A, B, C & D
- Construction of Ramp by Cut & Over method

Deliverables of the Project: Following Includes the Deliverables of the project:

1. **Stations (4 Nos.)** – The total length of the stations to be constructed is 927.12 meters instead of 1040.413 Meters due to non-availability of land. The station length and completion date is having the following breakup:

a. Station A	Length	: 266.22 meters
b. Station B	Length	: 243.33 meters
c. Station C	Length	: 151.7 meters
d. Station D	Length	: 265.87 meters
2. **Tunnel**
The Tunnel of length 6662.92 meters have to be constructed which has been divided into 3 drives:
 - a. **Drive 1:** 1665 + 1681 = 3346 meters between station C & station D
 - b. **Drive 2:** 806 + 813 = 2619 meters between station A & station B
 - c. **Drive 3:** 975 + 982 = 1957 meters between Station B & C.
3. **Cut & Cover**
A total Cut & Cover of 879.78 meters has to be constructed having following breakup:
 - a. Station A: 201.04 meters
 - b. Station D (1): 193.05 meters
 - c. Station D (2): 485.69 meters
4. **Ramp:** A ramp of 240.03 meters has to be constructed at Station D.

Value of the Project: The total value of the project is 1010 crores.

USE OF INFORMATION TECHNOLOGY

FARVISION SOFTWARE of Gamut Infosystems Limited is a Product Development Company from India. It has specialized in building products for various verticals since 1990. FAR VISION - the flagship product of Gamut, is a web-based ERP for Construction companies - both real estate and infrastructure companies. This product now has been implemented in several hundred companies all over the country. It is used by the company for managing the project. Farvision is an ERP developed

with the potential to organize, maintain and carry all the needed activities of a construction project. It provides various services like real-estate, property management, facility management, manufacturing, Hrms.

Features of Farvision:

Accounting Management; CRM; Distribution Management; Enterprise Asset Management; Inventory Management Project Management; Purchasing; Sales Management; Financial Management; Supply Chain Management; HR Management; Warehouse Management

Farvision during project management:

Farvision – Pre-Construction

The underlying procedures of a venture are canvassed in Land Bank, Liaison and Legal modules.

- Land Bank include arrive securing and venture possibility
- Legal involves treatment of court cases and development
- Liaison includes different methods in gaining land and getting endorsement for development

Farvision – Construction Management

- Project Estimation utilizing BOQ and checking Actual Cost as executed by Sub Contractors.
- Project Planner instruments like PERT, CPM to plan and oversee complex ventures
- Contractor Running Bill generation is straightforwardly identified with their Measurement Book and installment that discredits agony of overseeing extensive tasks making every day charging fast and simple.
- Key Cost and Progress Indicators are accessible regarding per Square Foot/Meter Cost on a normal premise from the Online System of Activity-wise Cost.

Farvision – Material Management

- Material Requirement Planning - Generation of Indents from Material Requirement Planning, Preparation of Purchase Order, Evaluation Charts for Procurement, Maintenance of Supplier Directory can be facilitated through Farvision. Cautions and Escalations are incorporate with Farvision ERP to accelerate acquirement forms and follow up done till the material is conveyed.
- Availability of Stocks at all Sites - Stock can be quickly investigated through Farvision and redeployed starting with one site then onto the next for productive stock and cost management.

Farvision Financials:

- Online, Real time Integration between Financials, Materials, Construction and Marketing to guarantee programmed compromise between Materials Procured, used, Work Progress and Contractor Billing.
- Graphical Visualization of Financial Data like Projected Inflows/Actual Inflows/Outflows/Break Even Point helps in knowing assets and money position.
- Consolidation of Accounts crosswise over Projects and Companies - Farvision offers an effective device for showing solidified Receivables, Payables, Profit and Loss Statement, Balance Sheet, Trial Balance, and so forth initially.

Material Management practice

The research work has researched momentum materials administration rehearses in the construction industry. The research considered the whole scope of exercises important for securing the required material, beginning with the assessing procedure and consummation with site conveyance, dissemination and storage logistics. Research results included recording the issue bottlenecks in the supply chain network and also distinguishing and arranging the different criteria that impact the choice procedure for acquiring material. A conceptual framework for the material supply chain process was created in view of different exchanges and meetings with office and site staff from the development site at Station D.

From the information acquired from these interviews, five distinct phases that comprise the process were identified:

1. Bidding Phase
2. Sourcing Phase
3. Materials Procurement
4. Construction Phase
5. Post-Construction Phase

Problems Encountered in different phases: Bidding Phase

This phase includes bid estimate, preparation, submission and winning.

Problems Encountered

Encountered Problems	Possible Solutions
Lack of communication between the parties	Contractors Should <ul style="list-style-type: none"> - Establish internet-based communication system to integrate the involved parties in the estimation process and enabling them to have an access to project data and to share project information. - Using special forms for data sharing and communication. - Build good relationship with the owners, suppliers and subcontractors based on trust and exchange of information.
Ambiguities between plans and specifications and Incomplete drawings and missing details	Consultants Should <ul style="list-style-type: none"> - Give more focus and attention when preparing the tender documents in order to be clear and understandable. Contractors Should <ul style="list-style-type: none"> - Study the tender documents carefully - Request more information and clarifications from the client in case there are ambiguities between plans and specifications. - Solve ambiguities in advance as they arise otherwise it will interrupt the works during the construction phase.

Sourcing Phase: Process

Encountered Problems	Possible Solutions
Incomplete proposals (Suppliers did not include all the documents with the proposal)	Contractors Should <ul style="list-style-type: none"> - Improve their communication with the suppliers via using special forms - Use website information system for transferring the information - Stipulate that suppliers have to attach with their offers brochures and / or technical data for the materials that they are going to deliver and anyone who does not adhere to this condition, his offer will be rejected.

Procurement Phase

Encountered Problems	Possible Solutions
<p>Poor communication between the parties involved</p>	<p>Contractors should</p> <ul style="list-style-type: none"> - Have an access to contract data, project scheduling as well as means to communicate delivery instruction to the personnel on site in order to perform tasks. - Develop internet-based communication system to place orders - follow up the status of the ordered materials in order to make sure that the materials arrive to the job site in the quantities and date specified.
<p>Unavailability of required material</p>	<p>Contractors should</p> <ul style="list-style-type: none"> - Not rely only on lowest price to award the contract during the sourcing phase but should also consider other factors such as availability of the materials. - Use buffer time for ordering the materials to safeguard against uncertainties during the construction phase.
<p>Incorrect submittals by the suppliers</p>	<p>Contractors should</p> <ul style="list-style-type: none"> - Pre-qualify the suppliers - Obtain quotations from reputable suppliers and whom they worked with on previous projects - Send a letter of a complaint to the defaulted suppliers. Such an official letter will be a good document to such problem and puts the contractor in a better bargaining position if there will be a need for dispute resolution at later stage.
<p>Late approvals by the supervisors</p>	<p>Contractors should</p> <ul style="list-style-type: none"> - Specify with the owner the approval period for submittal if there are no related clauses in the project general conditions. - Follow up the status of material submittal approval during the construction phase. - Send a letter of a complaint to the owner in case there is a late approval by the Engineer. - Take into account in the material delivery schedule the possibility of such late approval. Hence, the material samples should be submitted for approval earlier than what is planned for.

Construction Phase

Encountered Problems	Possible Solutions
<p>Late deliveries (Materials do not arrive as scheduled) and the delivered materials do not comply with the required specifications</p>	<p>Contractors should</p> <p>In the Sourcing Phase</p> <ul style="list-style-type: none"> -Pre-qualify the suppliers -Make sure that they are capable of delivering the right material in the right quantities and in the time specified. - Consider the suppliers with higher prices but who provide better services and not to select the suppliers based on the lowest prices. <p>In the Procurement Phase</p> <ul style="list-style-type: none"> - Set out agreement with the suppliers showing the duties and

	<p>responsibilities of each party.</p> <ul style="list-style-type: none"> - Impose penalty charges in case the supplier makes late deliveries or deliver materials that do not meet the required specifications. <p>In the construction phase</p> <ul style="list-style-type: none"> - Keep buffer stocks on site enough for an operation for certain days to safeguard against the uncertainties inherent in the construction industry.
Poor communication between the parties involved	<p>Contractors should</p> <ul style="list-style-type: none"> - Establish a system for exchanging information and sharing data among the project participants.

Conclusion

From the above studies it is vivid that unlike manufacturing industry, the construction industry possess two types of information flow or sharing viz. at Firm Level and at Project Level. The effective flow of information for enhanced supply chain management is required in both the levels of sharing of information. The solution lies in the integration of these two levels or business processes. Moreover, the construction industry is a sector where project-based organizational forms are considered. Complexity in construction has been claimed to originate from two sources: uncertainty and interdependence. Uncertainty is caused by the uniqueness of construction projects, where local resources and environment are unpredictable, and there is a lack of complete specification for activities, which causes non-linearity in information flow. On the other hand, operational interdependence causes complexity through two factors: the interdependence among multiple technologies and the rigidity of sequence between various operations (Gidado 1996), which causes information (drawings) flow to rely on multiple tools (ERP, BIM) rather than on one unified platform.

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