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Cost Reduction Using Supply Chain Management of Flyover Construction

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ABSTRACT: Supply Chain Management is a proven concept in the manufacturing industry and has to come along way in the construction industry. In the Indian construction industry, which is still considered sector, Supply chain management can be implemented with considerable improvements in the material flow and overall cost of project. In construction, procurement and procurement related activities occur during all phases of a construction project. Because of inevitable complexity and fragmentations of the construction process, suppliers of resources like equipment, labour, material and other services may not be always available on time, in right amounts and in the desired quality and price. An overall management process like supply chain management is essential to monitor and control all such logistic activities. The aim of this dissertation is to reduce the cost of project by using SCM model. To study the feasibility of this model, a case study has taken from Pune city to achieve this aim. The case study is construction of flyover at Akurdi, Bhakti Shakti, Pune. In this dissertation, a qualitative analysis has done by direct observation on site and interview with the technical staff of both consultant as well as contractor. The case study assesses the supply chain of the project in detailed, finding the problems in supply chain, highlighting the effect of these problems on supply chain. Finally a proposed supply chain is suggested to the contractor, so that he can save the cost of materials as well as lead time giving benefits and limitations of reduction of suppliers. Recommendations to use these proposed supply chain were presented including evaluation of material cost should be conducted between purchasing from supplier and purchasing directly from the material producer. These evaluations should be carried out with respect to the time, transportation cost, credit allowance and payment method etc.

KEYWORDS: CSCM, Construction Supply chain management, JIT (Just in time), profitability, under-budget.

I. INTRODUCTION

Supply chain management was born in the manufacturing industry in the 1988 at Shingo with the Just in Time (JIT) delivery system implemented in Toyota (Vrijhoef and Koskela, 1999), with the main aim of reducing inventories and regulating suppliers' interaction with the production lines. The main implementation of SCM was to standardize the supplies to the Toyota car manufacturers. The outcome of this implementation in Toyota car manufacturers was significant in the context of time and money. It enhances the supplier's communication with production line. With the successful implementation of SCM by Toyota, Japanese industry absorbs SCM as a tool in a short duration, with this adoption SCM become important topic for the researcher too and researchers try to find the possibility of SCM as a tool in different industry domains (Chevin and Cook, 2000) in parallel to SCM different new approaches also emerged for example value chain and extended enterprise. These concepts also affect the understanding of SCM in the industry.



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II. OBJECTIVES OF THE STUDY

Following on the objective of the study

i.To study the conventional SCM in a flyover construction project.

ii. This study is to identify shortcomings in traditional SCM used in a flyover construction.

iii. To investigate the reasons which are responsible for the existence of the shortcomings faced by the supply chain.

iv.Identifying the ways and means of making the current supply chain more effective and efficient.

v.Designing models for explaining and connecting new knowledge to existing, related ideas in order to show opportunities and benefits of supply chain management and logistics in the field of construction.

III. SCOPE OF THE STUDY

The scope and extent of this study is a detailed study of the concept of Supply Chain Management and its application in flyover construction highlighting the key benefits of Supply Chain Management demonstrating the advantages of Supply Chain Management by illustrating a live case study and to develop a plan which would help companies implement an effective Supply Chain Management in their organization.

Supply chain management is a relatively new concept in construction industry. A few companies have implemented Supply Chain Management in India. Our aim is to develop a template which would help an organization to successfully implement Supply Chain Management.

IV. RESEARCH METHODOLOGY

- 1. The Flyover construction industry has many special characteristics. It is often argued that the construction industry is unique in the way that it establishes projects to deliver one-off products, there are three types of flyover construction supply chain methods :
- a) The primary supply chain which delivers the materials that are incorporated into the final construction product,
- b) The support chain which provides equipment, expertise and materials that facilitate construction, and
- c) The human resource supply chain which involves the supply of labour.

FLYOVER CONSTRUCTION SUPPLY CHAINS MATERIALS SUPPLY CHAINS END CUSTOMER CONSTRUCTION RAW MATERIALS / COMPONENT SUPPLIERS MATERIALS SUPPLIERS **OR CIVIL** ENGINEERING FIRM LABOUR SUPPLY CHAINS SUBCONTRACTOR LABOUR LABOUR MARKET PROFESSIONAL EQUIPMENT SUPPLY CHAINS SERVICES FIRMS EQUIPMENT EQUIPMENT PROVIDERS MANUFACTURERS



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V. CONCEPTS OF SCM

Supply Chain Management (SCM) is a concept originating from the supply system by which Toyota was seen to coordinate its supplies and manages its suppliers. The basic concept of the SCM includes tools like Just-In-Time (JIT) and logistics management. The current concept of the SCM is somewhat broader but still largely dominated by logistics (Vrijhoef and Koskela, 1999).

SCM deals with the management of materials and information resources across a network of organizations that are involved in the design and the production process. It recognizes the inter-connection between materials and information resources within and across the organization boundaries and seeks systematic improvement in the way these resources are structured and controlled (Trucker and Mohammed, 2001). The objective of supply chain management is to be able to have the right products in the right quantities at the right place at the right moment at minimal cost.

The focus and attention in this study are given to the materials since it forms a large portion of the total cost of a construction project. In addition, materials are essential for the daily progress of a construction project. The absence of materials when needed is one of the main causes of loss of productivity in a job site. Therefore, contractors have to manage their materials efficiently to lower cost in order to remain in business. They should select reputable suppliers, tracking the materials to identify when materials need to be ordered based on the actual usage of materials on site and progress of the work, dealing on site with materials handling, storage, misplacement and handling of materials surplus.

VI. CASE STUDY

CASE STUDY ON FLYOVER AT AKURDI

- Company Name- M/s B.G.shirke contruction technology Pvt.Ltd.
- Project Name Construction of railway over bridge(ROB) 45m.wide road bhakti shakti to mukai chowk near Nisarg darshan society from Ch 2/850 to Ch. 3/740
- Client- Pimpri chinchwad Municipal corporation, pimpri.
- Name of consultant-STUD consultants Pvt. Limited.
- Contract value-Rs. 60,32,88,315/-(lump sum)
- Rs.17,15,52,676/-(utility)
- Total- Rs.77,48,40,991/-
- Date of completion 22.08.2018
- Completion period- 30months

Table 6.1 Increasing in duration of project by scheduling activity improper SCM

Sr. No.	Activities	Duration (days)	Date of start	Date of finish	Increasing Duration (days)	Date of start	Date of finish
1	Completion programme	781	23/02/2016	21/08/2018	901	04/03/2016	21/12/2018
2	Submission of design and Drawing	78	17/03/2016	15/06/2016	78	17/03/2016	15/06/2016
3	Approval on design and drawing	86	26/03/2016	04/07/2016	86	26/03/2016	04/07/2016
4	Relocation of utilities	245	23/02/2016	05/12/2016	245	23/02/2016	05/12/2016
5	Construction of slip road	108	16/04/2016	19/08/2016	108	16/04/2016	19/08/2016



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6	Construction of box culverts Towards bhakti shakti side	129	23/02/2016	22/07/2016	139	04/03/2016	3/08/2016
7	Toward ravet side	104	23/02/2016	23/062016	119	04/03/2016	08/07/2016
8	Construction of flyover /ROB work	616	23/02/2016	10/02/2018	627	04/03/2016	20/02/2018
9	Viaduct portion- ravet to ROB(box girder)	607	23/02/2016	31/01/18	617	04/03/2016	01/03/18
10	Foundation work	290	19/04/2016	22/03/2017	300	30/04/2016	02/04/2017
11	Substructure	305	04/06/2016	25/05/2017	320	20/06/2016	10/06/2017
12	Superstructure	500	28/06/2016	31/05/2018	515	13/07/2016	15/03/2018
13	ROB portion (steel girder)	598	23/02/2016	20/01/2018	598	23/02/2016	20/01/2018
14	Foundation work	70	28/07/2016	17/10/2018	70	28/07/2016	17/10/2018
15	Substructure	105	12/10/2016	10/02/2017	105	12/10/2016	10/02/2017
16	Superstructure	455	09/08/2016	20/01/2018	455	09/08/2016	20/01/2018
17	ROB to bhakti shakti chowk (I girder)	616	23/02/2016	10/02/2018	631	04/03/2016	26/02/2018
18	Foundation work	107	21/09/2016	23/01/2017	107	21/09/2016	23/01/2017
19	Substructure	120	26/01/2017	14/06/2017	120	26/01/2017	14/06/2017
20	Superstructure	466	17/08/2016	10/02/2018	466	17/08/2016	10/02/2018
21	Approaches with RE Wall	570	23/02/2016	18/12/2017	590	23/02/2016	06/01/2018
22	Construction of RE Wall	570	23/02/2016	18/12/2017	570	23/02/2016	18/12/2017
23	Bhakti shakti side	569	23/02/2016	18/12/2017	569	23/02/2016	18/12/2017
24	Ravet side	502	23/02/2016	29/09/2017	512	23/02/2016	10/10/2017
25	Painting work	150	23/01/2018	16/07/2018	150	23/01/2018	16/07/2018
26	Completion of project	0	21/08/2018	21/01/2018	0	21/12/2018	21/12/2018



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Planning the activity:

Discussion with the technical staff it was found that the some activity delay due to improper supply chain management of material. In the following tables scheduling **the most delayed activity** with SCM.

Most delayed activity:

Table 6.2 Activity no.1

Sr.no.	Activity	Material req	uired					
1	Construction of	cement				Sand	Aggregate	Steel
	box culverts	Required	Delay in Duration (days)	Purchase	procurement			
	Towards bhakti shakti side	yes	10	12/2/2016	21/02/16	-	-	-

Sr.no	parameter	Duration (days)
1	planned days	129
2	actual days	139



Graph no.6.1 Most delay activity no.1

Table 6.3 Activity no.2

S	r.no.	Activity	Material requ	uired					
1		Construction	cement				Sand	Aggregate	Steel
		of box culverts	Required	Delay in	Purchase	procurement			
		Toward ravet		Duration					
		side		(days)					
			yes	15	12/02/2016	22/02/2016	-	-	-

Sr.no	parameter	Duration (days)
1	planned days	104
2	actual days	119



Table 6.4 Activity no.3

Graph no.6.2 Most delay activity no.2



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Sr.no.	Activity	Material req	uired					
1	Construction of	cement				Sand	Aggregate	Steel
	flyover /ROB work	Required	Delay in Duration (days)	Purchase	procurement			
		yes	15	12/02/2016	22/02/2016	-	-	-

Sr.no	parameter	Duration (days)
1	planned days	616
2	actual days	627



Graph no.6.3 Most delay activity no.3

Table 6.4 Activity no.4

Sr.no.	Activity	Material req	uired					
4	Viaduct	cement				Sand	Aggregate	Steel
	portion-ravet	Required	Delay in	Purchase	procurement			
	to ROB(box		Duration					
	girder)		(days)					
		yes	15	12/02/2016	22/02/2016	-	-	-

Sr.no	parameter	Duration (days)
1	planned days	607
2	actual days	617





Graph no.6.4 Most delay activity no.4



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Sr.no.	Activity	Material req	Material required					
5	Foundation	steel				Sand	Aggregate	cement
	work	Required	Delay in	Purchase	procurement			
			Duration					
			(days)					
		yes	10	09/04/02/2016	17/04/2016	-	-	-

Sr.no	parameter	Duration (days)
1	planned days	290
2	actual days	300



Table6.6 Activity no.6

Sr.no.	Activity	Material req	Material required						
6	substructure	steel				Sand	Aggregate	cement	
		Required	Delay in	Purchase	procurement				
			Duration						
			(days)						
		ves	15	25/05//2016	02/06/2016	-	-	-	

Sr.no	parameter	Duration (days)
1	planned days	305
2	actual days	320



Graph no.6.6 Most delay activity no.6

Table 6.7 Activity no.7

Sr.no.	Activity	Material re	equired						
7	superstructure	steel					Sand	Aggregate	cement
		Required	Delay	in	Purchase	procurement			
			Duration						
			(days)						
		yes	15		25/05/02/2016	02/06/2016	-	-	-



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Sr.no	parameter	Duration (days)
1	planned days	500
2	actual days	515



Table 6.8 Activity no.8

Sr.no. Activity Material required 8 ROB to bhakti Aggregate and sand cemrnt Aggregate steel shakti chowk (I Required Delay in Purchase procurement girder Duration (days) 12/02/02/2016 22/02/2016 yes 15 yes _



Graph no.6.8 Most delay activity no.8

Table 6.9 Activity no.9

Sr.no.	Activity	Material rea	quired					
9	Approaches with	Cement an	d steel			cemrnt	Aggregate	sand
	RE Wall	Required	Delay in	Purchase	procurement			
			Duration					
			(days)					
		yes	20	12/02/02/2016	22/02/2016	Yes	-	No



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Sr.no	parameter	Duration (days)
1	planned days	570
2	actual days	590



Graph no 6.9 Most delay activity no.9

Table 6.10 Activity no.10

Sr.no.	Activity		Material rea	quired					
10	Construc	ction of	Cement				steel	Aggregate	sand
	wall	Ravet	Required	Delay in	Purchase	procurement			
	side			Duration					
				(days)					
			yes	10	12/02/02/2016	22/02/2016	-	-	-

Sr.no	parameter	Duration (days)
1	planned days	502
2	actual days	512





Cost benefit ratio: .

For 120 days-

% increase in cost of project due to delay=(25725000/770000000)*100=3.0%

% change in duration due to delay= 100*(901-781)/781= 15.36%

For 365 days-

% change in duration due to delay= 100*(1146-781)/781= 46.73%

% increase in cost of project due to delay= (77558250/770000000)*100= 10.07%



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V. RESULTS

Case study-Akurdi

Following are the results of case study :

Table no.7.1. Comparision of cost and duration:

Sr.no	parameter	Duration (days)	Cost(Rs.)
1	Actual project cost and duration	750	382058863
2	Due to delay in project due to improper SCM	870	407783463
		(increased by 16%)	(increased by 6.7%)
3	Due to delay because land and substation problem	1115	459617113
		(increased by 49%)	(increased by 20.30%)



Graph no.7.1 comparison of duration in project



VI. CONCLUSION AND RECOMMENDATIONS

This study demonstrates how systematic application of Supply Chain Management can improve material chain of project and their by reducing the cost and time of the project. This study is applicable to contractor and giving valuable information of saving the cost of materials. Thought the whole work, attempts have been made of reducing the time and cost of project by compressing the unnecessary nodes in the chain. This study is conducted when the project was it in under construction. Since this study is an individualistic academic effort in restricted time, natural shortcomings will creep in. Still this work has been possible with constant, appreciating guidance of experts manufacturing field and construction field with considerable experience.



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From the detailed case study, it was found that the improper supply chain management is increasing the cost and time of the construction. From the qualitative analysis of the case study, following two results were obtained.

Case study1-Akurdi

For 120 days-

% increase in cost of project due to delay=(25725000/38,20,58,863)*100=6.7%

% change in duration due to delay= 100*(870-750)/750= 16.36%

For 365 days-

% change in duration due to delay= 100*(1115-750)/750= 49.73%

% increase in cost of project due to delay= (77558250/382058863)*100= 20.07%

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