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Review

Implementating construction projects on schedule - challenge in a developing economy

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Engineers all over the world have been trying to find out workable solutions to keep project time over-run under good control. The activity networking technique initiated in the USA in the late fifties gained large popularity. This was followed by the introduction of the computer and a large number of management software aiming at effective project control. The techniques are in use globally including in the developing world. Needless to say these techniques have proved very useful, but the real problem of effectively controlling the slippage on construction projects, particularly in the developing countries, still remains largely unsolved. The author has done substantial work in India and other developing countries trying to find workable solutions to this burning issue and have achieved some success. Keeping in view this experience, the author has been actively pursuing further studies, research and detailed work in this area and his broad findings are outlined in this paper.

Key words: Activity network, concurrent delays, developing countries, project slippage, project implementation profile, work breakdown structure, remedial measures.

INTRODUCTION

Projects, particularly those relating to engineering construction do suffer delays or in other word, slippage initially and / or in various intermediate stages during implementation. Many of these slippages can be effectively arrested by proper planning and through continuous and sustained effort. Slippages left unmanaged get compounded and eventually go out of control. Over the last few decades construction engineers in the developing world have been using PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method) with the application of computers and modern Project Management (PM) Software for planning, scheduling, monitoring and controlling the projects. While these state-of-the-art techniques are certainly helpful in managing the project, in the developing countries like India Civil Engineering construction projects are still found to slip and at times, go beyond control. Managing complex, multi-disciplinary projects in a developing country presents some special problems which vary from one project to another. Hence, the problem and its solution are project specific. Although no sure solution is possible, the author has suggested workable solutions in the light of his experience on handling diversified projects (Kar, 2007) in the construction sector in India and other developing countries.

ENGINEERING AND MANAGEMENT ASPECTS

Industrial projects in general and particularly those relating to development of infrastructure, form a highlight area in the national economy of most developing countries. A large number of these projects do not give the desired end result and eventually end up with large project slippage. The reasons for such failure are quite complex and it is not wise to pinpoint specific reasons to ensure project success. However, it is felt the main reasons for project failure in developing countries are lack of advance planning, a holistic approach, lack of comprehensive engineering and management strategy, inconsistency in monitoring and follow-up, coordination and communication lapses and above all, absence of a methodical approach (kar, 2007).

In the infrastructure sector a major area under focus is water resource that may include surface water, sea water, ground water and water from other sources. Lack of clean water is the single largest cause of human illness and death and increased spending on water resources

development is suggested vis-à-vis demand for other infrastructure facilities. While the total water available in the world is adequate only one percent is available as fresh water, the rest lies in the salty oceans and in glaciers in the polar region and as ice caps on mountains.

Regarding the ground water, the danger of excessive withdrawal by pumping is alarming as it is disturbing the natural equilibrium. Any planning for ground water development must take into account the concept of safe yield, sustained yield and optimum yield. Also, the possibility of saline water and arsenic intrusion and large scale land subsidence due to over extraction must be considered carefully. The impact of global climate change must also be considered in planning of all water resources project.

Most developing countries have adopted a policy of rapid industrialization in tandem with infrastructure development in order to upgrade their national economy. These industries include mines and collieries, iron and steel, non-ferrous metals, petroleum and petrochemicals, cement, fertilizer, textiles, jute, rolling stock, automobiles, two-wheelers, nuclear / thermal / hydroelectric power plants, computer and information technology, telecommunication, paper and pulp, leather, housing, hospitals, hotels and tourism, printing, television, mass communication, movies and entertainment etc (kar, 2007).

MANAGEMENT AND CONTROL OF CONSTRUCTION DELAY

Study reveals that there are about five stumbling blocks on the road to effective management growth (melanson, 1993), these are:

1.) Lapses in effective communication.
2.) Shortcomings in understanding chain of command.
3.) Lapses in establishing priorities.
4.) Lapses in follow-up actions.
5.) Inability to emphasize.

Meetings are inevitable in the engineering construction business as well as in all management efforts(Parker, 1985). However, in reality most meetings are found to be a great time waster. To make meetings more productive and meaningful the following possibilities are considered:

1.) Reducing the number of meetings by eliminating and / or combining meetings.
2.) It should be ensured that meetings achieve the desired result. It is suggested that we start with an agenda and have a number of follow-up meetings.
3.) Shortening each meeting by having a time schedule for implementation of the points agreed and adhering to it.
4.) Reducing the number of participants in each meeting. Inviting only those who really matter and can make a worthwhile contribution.
5.) Implementing a rigorous and effective set of follow-up actions.

Detailed survey and analysis indicate that there are about twelve fundamental reasons for failure of most engineering projects (Giola, 1996). Many of these causes are interwoven and inter-dependant.

Some of the major causes are:

1.) Planning - Many construction projects are inadequately defined in the beginning.
2.) Change - Projects on engineering construction change in the course of implementation upsetting the time schedule.
3.) Project Manager - Poor management by the project manager is frequently a cause of failure on construction projects.
4.) Scheduling - Poor project schedule leads to delay or slippage.
5.) Management Support - Lack of top management involvement and support is a major cause of failure.
6.) Funding - The fund flow should be smooth conforming to project requirement.
7.) Cost Containment - Failure to contain the cost leads to project slippage.
8.) Resources - Optimum resources must be allocated and deployed for project success.
9.) Information Management - Lack of quality feedback in time and poor coordination are causes of project failure in the construction sector.
10.) Incentives - Human resources management and motivation of the workmen are major aspects for project success.
11.) Risk Analysis - Failure to assess the risk is a potential cause for construction project failure.
12.) Total involvement - Involvement of the Government and the Community in general are very significant factors for success in an engineering construction project.

APPLICATION OF MANAGEMENT TECHNIQUES

Since the development of CPM schedule by EI DUPONT Co. USA in 1957 followed by US NAVY who developed PERT in 1958 there has been rapid growth on project control system. Also, projects have become more complex technically and organizationally. In view of the increased complexity some researchers have advocated new tools to project managers such as The Project Implementation Profile (PIP) for better monitoring and control. However, so far PIP has not gained much popularity amongst the users.

Work Breakdown Structure (WBS) focuses on the work to be accomplished to complete the project. Because of its simplicity it is recommended for better planning and overall project control. WBS forces all project participants to be specific and accountable for their own task and enables better tracking of performance. Monitoring and to

be specific and accountable for their own task and enables better tracking of performance. Monitoring and evaluation also becomes more meaningful with a well developed WBS. WBS makes it possible to detect slippage in a task and evaluate its impact on the subsequent task.

When things go wrong in a project causing delays they do not come one after another, but all at a time. This syndrome of concurrent delay is a common phenomenon in construction projects. Such delays have to be tackled all at a time, taking into account the dominant cause for possible project failure (Kar, 2005).

Some project authorities wish to deploy the most recent and more sophisticated software to ensure project success. It must be understood that success is not really software dependent. Higher the sophistication more is the cost of the software and the learning period. The selected software should be the one that best meets the specific requirements of the project, inexpensive and easy to learn and apply (Kar, 2007).

MAJOR CAUSES OF PROJECT DEAY

The causes leading to project slippage may be numerous and in most cases multiple causes occur simultaneously. The reasons could be either or both of the following (Kar, 2007):

1.) Lapses in Engineering aspects
2.) Lapses in Management aspects

Engineering construction activities to be considered include:

1.) Site Selection.
2.) Site Survey and Technical Investigation.
3.) Process Selection based on alternative studies.
4.) Testing Project Goals and Scope.
5.) Fixing Overall Project Criteria.
6.) Possible Design Strategy.
7.) Preliminary Plan with Cost and Schedule.
8.) Detailed Design and Engineering.
9.) Quality Assurance and Quality Control.
10.) Preparing Bid Documents and Placement of Order.
11.) Project Implementation – Supervision and Control.
12.) Finishing and Handing Over.
13.) Settlement of Disputes and Claims.
14.) Contract Closure.

Management Activities to be considered include:

Setting-up Project Organization, Communication within and outside the Project Organization.

1.) Planning the Mobilization and Utilization of major Resources.
2.) Project Cash Flow.
3.) Implementation Pan and Strategy Formulation.
4.) Monitoring and Evaluation of the project.
5.) Feed Back, Updating, Follow-up and Reporting.
6.) Overall Coordination and Control.
7.) Motivating and Leading.
8.) Identifying, Analyzing and Solving Problems.
9.) Analyzing and Controlling Delays and Slippages.
9.) Overall Project Evaluation and Review.
10.) Final Project Completion Report for record and reference for future projects.

The factors causing project delay or slippage could be broadly identified as:

1.) Internal factors, that is, factors which are within the control of the project authorities.
2.) External factors, that is, factors which are somewhat beyond the control of the project authorities.

The Internal factors include:

1.) Access to the site or acquisition of Right of Way.
2.) Clearance from Local Authorities as required.
3.) Project funding or mobilization of Fund.
4.) Contractor's Mobilization - manpower and/or material/ equipment.
5.) Lack of Drawings-GA and/or detailed working drawings.
6.) Shortage of Construction Materials and Equipment.
7.) Shortage of Construction Workforce-Skilled /Unskilled.
8.) Non-delivery of Essential Supplies such as, construction materials, equipment, bought out items etc.
9.) Identification of Problem Areas in design, engineering and construction.
10.) Decision on Remedial Measures / Corrective Action.
11.) Implementation of Corrective Action.
12.) Measuring Project Response to Corrective Action applied.
13.) Decision on Revised Corrective Action and its application.

The External factors include:

1.) Act of God.
2.) Heavy earthquake, landslide, Tsunami.
3.) Heavy rain, flood, Cyclone, Tornado, Hurricane.
4.) Power failure.
5.) Water supply stoppage.
6.) Revision of Government Act and/or introduction of new Act.
7.) Labour unrest, strike, lock-out, work to rule.
8.) Epidemic, famine.
9.) Local festival causing large absenteeism.

POSSIBLE REMEDIAL MEASURES

The purpose of the remedial measures is to arrest the

delay/slippage and bring the project back on schedule. are many possible corrective actions. The action to be applied has to be selected on a case-to-case basis for a specific project situation in order to derive the best result (Kar, 2005).

Some of the common remedial measures adopted are:

1.) Changing the logical sequence of activities and taking up more activities in parallel.
2.) Curtailing the activity duration by deploying additional resources.
3.) Measuring project response to the remedial measures adopted and evaluating it with respect to the plan.
4.) In case of inadequate response, deciding and applying revised corrective action.

Some of the basic steps in arresting project slippage are (kar, 2007):

1.) Organizing an effective and efficient project team.
2.) Ensuring good top management support.
3.) Ensuring that the organization is flexible enough to meet a changed project situation.
4.) Adopting a streamlined system of identifying and recording project delays on an ongoing basis.
5.) Adopting a system of problem analysis and delay analysis all through the project life.

PROPOSED TECHNIQUES FOR CONTROLLING PROJECT DELAY

The author is of the view that there is no shortage of tools, techniques and methodologies available for efficiently managing the projects in developing countries aiming at arresting slippage. The shortcoming is not in these areas. But a large gap exists between the theory and its effective application to obtain the optimum benefit (Kar, 2007). Since the PERT and CPM techniques are in use worldwide over the last half a century, it establishes the fact that the techniques are good and have come to stay. Many researchers have proposed more recent techniques which have not really gained popularity amongst the engineers/planners. These so called recent techniques are in fact improvisations on the basic activity networking techniques and are found to have limited applications on real life construction projects.

For projects in developing countries the engineering aspects must be taken up right at the outset. These include collection of raw data, site selection, feasibility study, study of alternative processes and selection of the optimum one, techno-economic evaluation, working out cost benefit ratio, funding pattern, cash flow requirement, basic work plan, conceptual design etc.

The author recommends identifying the project life cycle phases using WBS for listing of activities and work packages, assigning responsibilities on specific groups and persons within and outside the project organization. It is recommended that the activity network be developed by proper interfacing of the activities in the WBS. On the aspect of Arresting Slippage it is recommended to take up the following steps.

1.) Delay Identification
2.) Delay Quantification
3.) Problem Analysis
4.) Delay Analysis
5.) Corrective Action

On applications of corrective action the project response to the action applied has to be measure and if necessary, action has to be revised till the desired result namely, minimizing / eliminating the delay is achieved. Projects have a natural tendency of getting delayed. Arresting slippage along one chain of activities may result in slippage occurring on another chain. The syndrome of concurrent delay also needs to be carefully tackled. Tackling one delay at a time may not yield the desired result. Arresting slippage on projects is a complex affair and no sure fire solution is available. It calls for perseverance and continuous sustained effort all through the project life cycle.

CONCLUDING REMARKS

Arresting construction project slippage calls for identifying, evaluating and managing project delays and this should form an integral part of the overall project management system. At the outset a computerized database must be established. Also, the basic engi-neering has to be taken up right in the beginning - feasibility report, evaluation of alternative processes, site selection, land acquisition, survey, sub-soil investigation, site preparation etc. This will be followed by arranging the construction facilities like Construction water, Construction power, Construction storages, Construction housing etc. Detailed design and engineering will follow. The system of management should be activity networks developed through detailed planning using WBS. Project monitoring, evaluation and control should be through application of computers using state of the art PM Software. A well-defined systematic methodology of delay management must be adopted and implemented right through the life of the project. Also, a system of problem analysis and delay analysis must be integrated into the overall project and construction management system. The management must take full advantage of the recent ongoing advancements in Information Technology and Digital Communication system to facilitate communication of information, data transmittal and reporting at all levels. But the most important issues are a dedicated, competent, totally committed team; a holistic approach, total participation, cooperation and understanding amongst all concerned.

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