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UNCERTAINITY FACTORS THAT INFLUENCINGPLANNING IN CONSTRUCTION PROJECTS

[1]SALAMAN SUBASH S, [2]Dr. A. KUMAR,M.E., Ph.D, [3]Ms. NIVETHA JOHN,M.E.,
[1,2,3]Department of civil engineering, RVS Technical campus, Coimbatore.

ABSTRACT

Research on uncertainty in construction has emphasized the importance of incorporating uncertainty factors in project-cost and time forecasts. Delays are always measured as expensive to all parties concerned in the projects and very often it will result in clash, claims, total desertion and much difficult for the feasibility and it slows the growth of construction sector. For analyzing the causes of delay, an appraisal on construction project's time performance was conducted. The main objective of this study is the identification of factors of delay and their effects on the success and completion of project. However, little attention has been paid to identification and quantification of the specific risks. The present paper focuses on an assessment of the effect of uncertainty on the outcomes of planning. The factors influencing the planning of the construction projects which then ultimately causes delay of the projects. This project mainly focuses the importance and factors that affects the planning in the execution (construction) phase. The projects also includes visiting of some construction companies and conducts the questionnaire survey, then analyze the major factors and the root cause for the top 5 factors and the percentages of delays due to delays and suggests some proactive measures for the improvement of planning in the execution phase of construction project.

INTRODUCTION

GENERAL

Planning is a bridge between the experiences of the past projects and the proposed actions that produces favorable results in the future. It can also be said that it is a precaution by which we can reduce undesirable effects or unexpected happenings and thereby eliminating confusion, waste, and loss of efficiency. Planning involves prior determination, specification of factors, forces, effects and relationships necessary to reach the desired goals. Planning should be done logically, thoroughly and honestly to have a chance to succeed. The previous experiences of projects provide basic planning logic. Then difference between previous projects and current projects shall be known to make any exceptional features in the basic planning logic. These differences can be unusual client requirement, out of the way location, potential external or internal delaying factors.

The construction delay is a universal evident reality not only in India however all the countries faced this global fact. Construction delay can be defined as execute later than intended planned, or particular period, or later than specific time that all the concerned parties agreed for construction project. Delay in project is counted as a common problem in construction projects. On large level there is no suspicion that the development of country depends upon its achievement of its advance planning with elevated construction contents. There is a French dictum "when the construction industry prospers everything prospers". Escalation of construction industry is of imperative for all regions of national and international economy, as well as everyone involved in the industry like contractors, workers, financiers, architects, engineers etc.

The project's success depends on meeting objectives within time and budget limits. Tools and techniques play important role in project management. The major factor of construction problems is project's delay. Delay means loss of income according to and for the owner or client. In case of contractor, delay to the higher costs due to longer work time, labor cost increase and higher fabrication costs. On time completion of project is an indicator of efficiency. But there are many unpredictable factors and variables resulting from various sources affecting construction projects. Delays are one of the biggest problems which construction firms face. The problem of delay in the construction industry is a global phenomenon. Keeping construction projects within estimated costs and schedules requires sound strategies, good practices, and careful judgment. However, to the dislike of owners, contractors and consultants, many projects experience extensive delays and thereby exceed initial time and cost estimates.

DEFINITION OF DELAYS IN CONSTRUCTION PROJECTS

The contract document must give a date for completion of construction works which becomes binding as the final completion date for the whole project. A construction project delay is defined as the time during which part of the construction project has been extended beyond what was originally planned due to unanticipated circumstances (Bramble and Challahan 1991) or the time overrun beyond project delivery date (Ahmed et al 2003). Kaming et al (1997) defined delayas the extension of time beyond planned completion dates traceable to the contractors.

The studies regarding the causes of construction delay identify the construction project delay as the additional portion of time that the construction project requires to finish more than originally estimated or contracted. Delay causes in construction can be defined as those events that happen during the project life and lead to either (individually or combined) the project, or any part of it, taking more time to finish than the original estimate, (Challahan, et al 1992). Based on the assumptions that are used in this research model, there are three more definitions that will be used in the model design; "direct delays", "root delay causes" and "root delay causes' indicators".

Direct delays are defined as the real or actual delays that occur and are documented in a construction project. This direct delay can be recognized and recorded by one or more parties in the construction project during the normal management process. This direct delay can be used a basis for claims from any party. Root delay causes are defined as earlier events that develop to become direct delay. These root delay causes may be due to managerial, financial or specific project related factors. Root Delay Causes' indicators are defined as the measures that are used to evaluate the root delay causes.

TYPES OF DELAYS

The type of delay can also have an impact on non-critical activities which need a more detailed analysis to determine whether additional time extension is warranted, or if the reduction of float time can be justified. Excusable delays can be further classified into excusable with compensation and excusable without compensation. Terry Williams (2003) identified that there are three basic ways to classify delays:

Excusable delay with compensation

Excusable delay without compensation

Non-excusable delay

EXCUSABLE DELAY WITH COMPENSATION

Excusable with compensation are caused by the client's actions or inactions. When contractors encounter this type of delay, they are entitled to time extension as well as monetary compensation due to the delays. An example of an excusable delay with compensation would be when an owner denies access to the site once the notice to proceed is given. This delay is because come sometime unexpected situation and it not from mistake of the contractor. The external factor is something hard to make sure because it refer to the future and event.

EXCUSABLE DELAY WITHOUT COMPENSATION

Excusable without compensation are delays where neither the client nor the contractor is deemed responsible. When this type of delay is encountered, only a time extension will be warranted since there are no grounds for damages. This delay is allow to the extends of time to finish construction without give any compensation to the contractor. The factor that include of this delay is:

1. Protest from the labour
2. Unexpected whether
3. Unexpected of late delivery equipment
4. Unexpected of late delivery material.

NON-EXCUSABLE DELAY

This delay cause by avoid the contract agreement by contractor and it was identify by construction contract. Client can claim their loss if had in the contract agreement. These delay had to identify by client because they rarely to check the schedule of the construction. The factor that contribute to the non-excusable delay:

5. The usual weather and as expected weather
6. Delay cause by subcontractor
7. The inefficiency of contractor to manage the construction site.
8. The financial of contractor.
9. The lack of labour.
10. Failure to manage their work according to the contract schedule.
11. Always make mistake or failure to fulfill of owner specification.

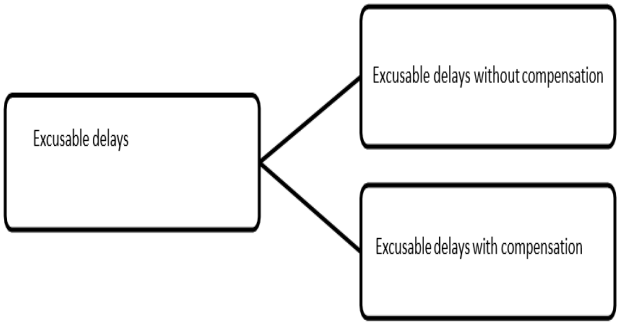

Figure 1.1 - Types of excusable delays

OBJECTIVE OF THE STUDY

The objective of the study is:

- Identify the uncertainty factor that influence the planning of the construction project and contributes to delay.
- Identify the top 5 factors that contribute to construction project delays.
- Finding root cause to the major delays factors.
- Percentage of time delays in projects and Comparing on percentage of time delays of the periods.

SCOPE OF THE STUDY

The scope of this study is:

- Planning can be done for complex construction projects easily if we know that possible factors which might influence them later.
- Effect of delays such as time overrun, cost overrun, disputes, arbitration, Litigation and total abandonment can be avoided.
- This can bridge the gaps between the planning and execution of the projects.
- The reasons for delays can be found out and their root causes for those delays can be identified.

LITERATURE STUDY

GENERAL

This chapter covers the explanations of literatures that are collected for the reference. Those literature very helpful to know, how to execute the thesis, what are all the major factors affect the planning, how to design the questionnaire, etc.

LITERATURE REVIEW

1. S.M.Renuga and Balasubramanian Malathi (2013) they have identify the critical factors influencing delay and their impact on project completion. In this study they have concentrated in Resource (Manpower, Material and Equipment) related delay in construction projects. For this research, a questionnaire survey method was adopted to find the impact of critical factors that leads to resource related delays in construction projects. The survey results in this literature they have identified top ten critical factors using Relative Importance Index (RII) in each of the categories (Manpower, Material and Equipment) and provided some recommendations to reduce the impact of the resource related delays in construction projects.

2. Ali S. Alnuaimi and Mohammed A. Al Mohsin (2013) a field study was conducted on a number of construction projects in muscat area to identify problems resulting from delays in completion of construction projects. The data collected was classified into two groups of the project, the first group includes the project constructed during the period 2007-2008 and the second group comprised projects constructed during the period 2009-2010.Percentage of delays have been calculated for each project constructed in this periods and both the period where compared. It was founded that 40 percent projects in both groups have experienced delay in completion.

3. Hitendra R. Gavhale (2013) they have evaluated specific schedule impact scenario on a single project Mumbai Metro Rail Project (MMRP) is taken ascase study. The source of delay cost of delay and methods to mitigate delays were studied. The questionnaire survey covering delays and disputes was developed and presented to construction professionals. Questionnaire covers various factors influencing delays attributed to client, contractor, consultant, material related, labour related, equipment and other external factors. The responses to questionnaire were analyzed by Rank Index(I).The survey results implies the effect of delays in time overrun, cost overrun, disputes, arbitration, Litigation and total abandonment and have recommended some suggestions for minimizing the effect of delays in projects.

4. Towhid Pourrostam and Amiruddin Ismail (2012) they have identified the causes and effect of delays in Iranian construction projects. Projects investigated in this study include residential, office and administration buildings and roads. A questionnaire survey was conducted to solicit the causes and effect of delay from consultant and contractors viewpoint. This survey has identified 10 most important cause of delay from a list of 28 different cause of delay and 6 different effect of delay. This survey have identified some of the factors are delay in progress paymentby client, change orders by client during construction, poor site management
,slowness in decision making process by client, financial difficulties by contractors, late in reviewing and approving the design documents by client, problem with subcontractors, ineffective planning and scheduling of project by contractor, Mistakes during construction and weather condition the survey also implies the effect of

delays in time overrun, cost overrun, disputes, arbitration, Litigation and total abandonment. Relative Importance Index (RII) has been used for ranking the causes and spearman rank correlation coefficient is used for studying the strength of relationship between two sets of ranking. This literature has highlighted factors and the need to reduce delays by client, consultant and contractors.

5. Megha Desai (2013) they have worked on identification and ranking of causes of delay in residential construction projects in Indian context. Totally 59 causes were identified under 9 major group. A questionnaire survey was conducted and the causes of delays are ranked by two different techniques Relative importance index and important index based on degree of severity and degree of frequency. Results shows us that out of top 10 factors totally 5 factors are common in ranking by both methods. The result shows some of the factors are original contract duration is too short, shortage of labours, delay in material delivery, low productivity level of labours, delay in progress payments by owner. Labour related factors were the ranked first and external factors are ranked last.

6. Enas Fathi Taher and R.K.Pandey (2013) they have identified andranked delay causes in the planning and design phases. A structured questionnaire was sent to engineers at the A/E companies for public construction projects in India.This study has identified the delay causes and analyzed the importance and the frequency of delays using the relative importance index. Analytical results reveal that changes in client's requirement are the main cause of delays in both planning and design phases. The factors that were affecting have been categorized intocontractor related delay, client related delays and material related delays and labour related delays. This literature has suggested good management and management of these causes can minimize the delays of the projects.

7. Kasimu A.M (2013) this study focuses on specific causes of delay like insufficient coordination and inefficient communication between involved parties in construction projects. Questionnaire survey has been used as a tool to carry out this study. The results of factors are analyzed based on mean value criterion and standard deviation (SD). Some of the factors are improper planning, lack of effective communication, design errors, shortage of supply like steel, concrete etc, slow decision making, financial issues, shortage of materials, cash-flow problems during construction, site accidents, quality assurance and control and political influence and economic condition. This study implies in adequate planning, coordination and proper monitoring of the construction projects by an experienced and qualify professional will reduce the impact of delays.

8. Atul R. Kolhe et.al (2013) this paper describes an advanced scheduling methodology that is part of a research program devoted to the topic of Location Based Repetitive Scheduling Method for housing projects in India. Now a day there is a cut throat competition in all fields of Engineering and construction in India. Most often project manager has to plan location based repetitive projects (LBRP). LBRP are the projects where certain activities are continuously repeating at each locations of the project. Such as commercial housing projects, multistoried sky scrapers, the linear segmented works like roads, long-bridges, airfields, tunnels,pipe network. The LBRP are characterized by the repeating activities, which in most instants arise from the sub division of a generalized activity into specific activities associated with particular locations. For e.g. painting activity for high-rise building may broken into painting for first storey, painting for second storey and so on, where each storey is a significant location of that high-rise building. Activities that repeat from one location to other location creates a very important need for a construction schedule that facilitate the uninterrupted work flow including work crews from one location to next, because it is often this requirement that establishes activity starting times and determines the overall project duration. Hence uninterrupted work flow becomes an extremely important issue for the planning and scheduling of high-rise building, hence high rise building construction planners need to carefully design a process that ensures a continuous and reliable flow of resources through different locations in a project. The conventional Critical Path Method and its resource oriented extension such as time cost trader off, limited resources allocations and resource leveling does not consider the waste time during the transformation of work flow from one location to the other. Location Based Repetitive Scheduling Method **(**LBRSM) explicitly take care those entire requirements for repetitive nature projects like high rise buildings. The application of such work flow continuity during LBRSM leads to maximizing the use of a learning curve and minimizing idle time of each crew. This paper suggests modified flow-line schedule, here called as 'LBRSM' based on real life case study, which can be implemented at micro-level for high-rise building construction project.

9. Remon Fayek Aziz (2013) this research works attempts to identify, investigate and rank factors

perceived to affect delays in the construction projects with respect to their relative importance so as to proffer possible ways to coping with this phenomenon. Totally, ninety nine (99) factors were short-listed to be part of the questionnaire survey and were identified and categorized into nine (9) major categories and they were consultant related factors, contractor related factors, design related factors, equipment related factors, external related factors, labour related factors, material related factors, owner related factors and project related factors. The data were analyzed using Relative Importance Index (RII),ranking and simple percentages.

10. Hamzah Abdul-Rahman et.al (2011) this paper addresses the issues of financial-related delays in construction projects. Aiming to determine the major causes of financial-related problems leading to construction delay and to identify possible solutions in mitigating financial-related construction delays, data was collected though a questionnaire survey and a follow-up interview survey. Responses were obtained from a combination of clients, contractors, consultants and bankers in the questionnaire survey. Contractors' unstable financial background, client's poor financial and business management, difficulties in getting loan from financiers, and inflation were identified as the most significant causes. Findings indicate clients play the most important role in reducing the impact of financial problems towards project delay. Recommendations in mitigating financial-related delays are provided accordingly.

11. Ehab Mohammed Soliman (2005) this study has proposed Delay Hierarchy Propagation Model (DHPM) is the first attempt to model delays in the construction project. This model is an innovative predictive approach to anticipate the future encountered delays before they become real. The model assumes that the direct delay is generated from earlier events or aspects that are found before the direct delay occurs; these events are called the root delay causes. These root delay causes need to be analyzed, measured and managed in order to prevent or mitigate the effect of a later direct delay in the project life. The direct delays were analyzed by a cause- effect technique to extract a set of root delay causes. The model assumes that the root delay causes will influence the project resources supply rate. The resource shortage then leads to activity delay and, hence possible delay to the wholeproject.

12. Alwi and Keith (2003) identified the important causes of delays in building Construction projects in Indonesia. A questionnaire survey was carried out targeting 89 respondents from large contractors and 23 respondents from small contractors. The respondents were asked to assess the level of effect the 31 potential delay causes on their projects. The delay factors were grouped into six major groups. The results showed that the large and small contractors generally agree on the importance ranking of the individual delay variables. In relation to the groups ofthe delay variable, however, the result showed that there is no agreement between the two groups of contractors. The professional management group was ranked the highest and the external groups were ranked the lowest by large contractors. Whereas, small contractors ranked the design and documentation group as the highest and the execution group as the lowest.

PROJECT METHODOLOGY

GENERAL

From the literature survey it had been learnt concluded there are many issues about quality in construction industry. Due to time constraint for the project, the descriptive survey method is to be adopted, whereas other methods may take long duration. Several methods for collecting information from the industry were evaluated from various literatures.

The following steps are carried out in the project. These are

- After title conformation relevant literatures were collected. From the literature the problem and issues were identified
- Framing the questionnaires based on the analysis from the various people of construction industry, literature review
- Group the companies based on the methodology
- Conduct the questionnaire survey in pre-defined companies
- Analyzing the data collected from survey
- Continuation of survey from phase I
- Identification of top 5 delay factors
- Root cause analysis for the top delay factors
- Implementation of the possible solution
- Conclusion

WORKING METHODOLOGY

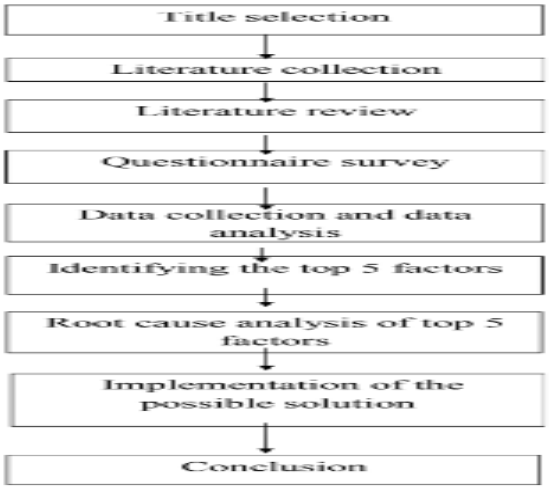

Figure 3.1 - Working methodology

COMPANY IDENTIFICATION

Companies for questionnaire survey are mainly classified in to 2 types according to their cost. They are high level, middle level companies.

- High level companies their project cost is more than 100 crores
- Middle level companies project cost ranges from 5 to 100 crores

RELATIVE IMPORTANCE INDEX (RII) ANALYSIS

Relative Importance Index (RII) analysis was employed to measure the Likert (ordinal) importance scale. In this study, five scale rating was used and the weight was give as below:

5 – Very High;
2 – Negligible; 4 – High;
1 – Not Much; 3 – Moderate;
The RII was calculated by using the formula as below RII $=\sum w/A * N$ Where, - Equation (3.1)

w = weight of scale; A = highest weight ('5' in this case);

N = total number of respondent

LIKERT SCALE

In the Likert scale, the matter of choosing opposite adjectives is avoided. Rather, it makes a statement or poses one description (or adjective) for whatever is being evaluated (David and Ronald, 1987). The Likert scale is a technique for measuring attitudes, beliefs, perceptions, and to a great extent, knowledge and consensus (Kaluzny and Veney, 1991). Respondent are asked to check one category from among several categories of answers that best represents their feeling about or beliefs in a statement. In general each statement has five response categories, which may be labeled as strongly disagree, disagree, undecided, agree, and strongly agree. This can be reduced to three categories, for example simply disagree; undecided and agree, or seven categories providing a finer differentiation along the continuum from strongly disagree to strongly agree. One apparent advantage of the Likert scale is that the respondent needs to consider only one adjective (description) for each item, and the problem of finding an exactly opposite adjective is not required(David and Ronald, 1987). The Likert scale has the advantage over many other attitude or perception measurement techniques of being fairly simple, straightforward, and for the most part, easy for people to answer (Kaluzny and Veney, 1991). The judgment of samplings that use Likert scale is based on the meanvalues and the standard deviation. Analysis of the results that come from averaging of Likert scales are criticized as the values that came from averaging Likert scale are not meaningful as the mean value will be a fraction while the Likert scale points are not fraction. The statistical that is more efficient to be used to judge the analysis of Likert scale is using mode or median more than the average values. Most of researches work that was conducted in psychological and management studies used the average values to judge the results of a questionnaire. Many the research works that used to determine and rank the causes of delays in construction industry used sort of mean values of Likert scale. These studies used certain types of Likert scale mean values to rank delay causes; Sullivan and Harries (1986), Assaf et al (1995), Dlakwa and Culpin (1995), Kumaraswamy and Chan (1998), Ogunlana et al (1996),Al-Khalil and AIGhafly (1999) and Frimpong et al (2003). There are many studies in another aspects used the mean values to judge a questionnaire results. Bushait et al (1999) used a questionnaire of 70 statements asking for quality practices in the design organizations. The respondents were asked to choose the relevant answer for each one of these statements from five ranks "always, mostly, sometimes, rarely andnever". The answers were quantified by Likert scale by giving 100% for always, 75% for mostly, 50% for sometimes, 25% for rarely and 0% for never. The average prevalence of quality practice statement was determined by the following equations which is the averaging of the used Likert scale:

Based on these averages the statements were ranked. Kaming et al (1997) used questionnaire to identify variables that can influence projects to be overrun. The respondents are asked to identify each one of the variables from four points scale form very important and to not important. The authors analyzed respondents' answers of this Likert scale by converting respondents answers to values of 4 for very important and I for no important. They ranked variables based on the average of Likert scale values. Odeh and Battaineh (2002) used a questionnaire to identify the causes of delays in Jordon construction industry. The respondents were asked to identify these causes in a 5 Likert scales. As the answers gained from respondents from the subjective type of data, the Likert scale will be used to represent these data. All the questions used in the questionnaire ask the participant to define a level from very high, high, average, low, very low and no effect. A numerical Likert scale of 5 points, 5 for very high, 4 for high, 3 for 99 averages, 2 for low and I for very low is used to convert these subjective answers to numerical values.

ROOT CAUSE ANALYSIS FOR THE TOP 5 FACTORS

INTRODUCTION

Root cause analysis of the top most uncertainty factors is determined and gives suggestions and recommendations in construction industry. This method will be helpful to minimizing the project delays and reduce problems in construction industry. This approach will be mostly useful for project and overcome the uncertainty factors that affecting planning of the construction projects. The follow section outlines the top five causes contributed by each top 5 uncertainty factor.

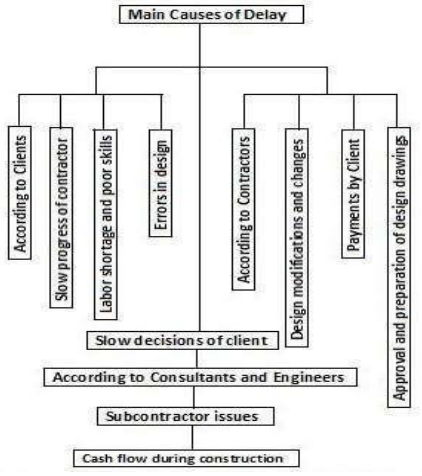

Figure 6.1 - The causes of delays in large construction projects

KEY CAUSES FROM CLIENT

The causes of uncertainty delay originally from the client could be more important than from the consultant and the contractor because decisions made by the client significantly affect others. The project owner has a great influence on the project's time performance. The owner related direct delays that were found in previous studies are:

- Decision making by client and change of decision by client
- Delay in contractors progress payments
- Owner financial problems
- Design changes by owner
- Deficiencies in owner's organization
- Interference by the owner in the construction operations
- Slow decision making by the owner
- Excessive bureaucracy in the owner's administration

KEY CAUSES FROM ACTIVITY PATH/CRITICAL PATH METHOD

The causes of uncertainty delay from the activity path/critical path method can play a significantly role in delaying a project.

- Main focus on activities and their logical connections
- Minor attention on resources (assumes unlimited resources available)
- Gantt Charts - Difficult to manage and monitor resource usage
- Discontinuous resource usage – interrupted production flow

KEY CAUSES FROM DESIGN RELATED/ DEVIATION IN DRAWING

The causes of uncertainty delay from Design related/ Deviation in drawing The can play a significantly role in delaying a project. Design related direct delays found in previous studies

- Design changes and modifications by the consultant
- Ambiguities, mistakes and inconsistencies in design specifications and Drawings
- Design complexity
- Delay in taking actions regarding material, shop drawings approval or delays in providing design information.

KEY CAUSES FROM FINANCIAL ISSUE & CASH FLOW

The causes of uncertainty delay from financial issues and cash flow can be of a major delaying factor in a project. There are

Owner's management deficiencies: owner management has to analyze and study and take action in the proper time. In case of insufficient professionals, inexperience and non support to finish the project a delay of taking action will be resulted.

Owner's financial problems: The owner has to fund the project. The delay in revision of bills before approval to fund and the availability of funds will affect the decision regarding funding.

Poor cash flow management: Poor cash flow management can result in a number of different problems. Of those problems, these are a few examples –

- **Too much stock** – A business owner receives high demand for a product and orders high volume of materials to fill orders. If the demand suddenly changes, the business owner is left with too much stock and, potentially, debts from ordering materials. There's also the potential risk that the stock you have will become obsolete!
- **Long payment terms** – Lengthy payment terms often mean long stretches of time go by without money coming in. Any unseen issues, which cover anything from a fire at the office to the need to replace a laptop, can be problematic due to a shortage of cash. There's also the possibility of bad debt this is when customers or clients never pay you at all.
- **Overspending** – It's very tempting to splash out on orthopedic chairs and huge monitors for your office, especially after winning a new client. Still, remember that you haven't actually got that money until they've paid you; if you need any cash in the mean time; it's likely to be very difficult to convert fixed assets back into cash! Not to mention the fact that spending money youdon't actually have is never a good idea.
- **Overtrading** – In a similar vein to buying in too much stock, it's tempting to employ more staff, expand to different locations etc when you're doing well. However, offsetting fixed prices like rents and salaries against profits, which may vary from month to month, can be a risky move and can put a lot of pressure on short term finances.

KEY CAUSES FROM APPROVAL

Delay in approvals led to projects being held back and interest costs shooting up, which resulted in higher cost for homebuyers, making the product unaffordable. With the new mechanism, approvals would happen faster, time and cost factors will come down for both developers as well as homebuyers. The causes of uncertainty delay from approval can be

- Owner's failure to co-ordinate with government authorities and documentations
- Delay of shop drawing approval

SUGGESTIONS AND DICUSSTION

INTRODUCTION

This chapter deals the possible solution and suggestion for the top 5 root causes that has identified that affects planning of a construction projects. Furthermore some of these solutions have been implemented in various projects andsome of them are yet to be tried out in any projects.

SUGGESTION FOR CLIENT RELATED UNCERTAINTY FACTORS

A turnkey or a turnkey project (also spelled turn-key) is a type of project that is constructed so that it could be sold to any buyer as a completed product. This is contrasted with build to order, where the constructor builds an item to the buyer's exact specifications, or when an incomplete product is sold with the assumption that the buyer would complete it. In real estate, turnkey is defined as delivering alocation that is ready for occupation. The turnkey process includes all of the steps involved to open a location including the site selection, negotiations, space planning, and construction coordination and complete installation. Turnkey real estate also refers to a type of investment. This process includes the purchase, construction or rehab (of an existing site), the leasing out to tenants, and then the sale of the property to a buyer. The buyer is purchasing an investment property which is producing a stream of income.

The research point out that owner is the main source of variations in building construction projects. Even though the research showed that the owner get involved during the design phase of the project, this is not enough for

minimizing problems associated with variations and project delays due to variations. As per general point view also, the owner usually lack the ability to read design documents prepared by the engineer. Many professionals suggested that owners, in many case, get surprised that what is being constructed is not what they have anticipated or imagined. Owners of building projects are usually businessmen who have a good level of education and with extra effort and visual aids they should be able to imagine the design. As the research showed that most variations are client and design related, thus this extra effort in understanding the design would minimize variations made by the owner. Also it will directly effect to project success without any delays due to variations.

SUGGESTIONS FOR ACTIVITY PATH AND CRITICAL PATH METHOD RELATED UNCERTAINTY FACTORS

Linear Scheduling Method (LSM) or Location based repetitive scheduling method is a graphical scheduling method focusing on continuous resource utilization in repetitive activities. It is believed that it originally adopted the idea of Line-Of- Balance method. LSM is used mainly in the construction industry to schedule resources in repetitive activities commonly found in highway, pipeline, high-rise building and rail construction projects. These projects are called repetitive or linear projects.

The main advantages of LSM over Critical Path Method (CPM) is its underlying idea of keeping resources continuously at work. In other words, it schedules activities in such a way that:

1. Resource utilization is maximized;
2. Interruption in on-going process is minimized, including hiring-and-firing; and
3. The effect of the learning curve phenomenon is minimized.

SUGGESTION FOR FINANCIAL AND CASH FLOW RELATED UNCERTAINTY FACTORS

Financial management refers to the efficient and effective management of money (funds) in such a manner as to accomplish the objectives of the organization. It is the specialized function directly associated with the top management. The significance of this function is not seen in the 'Line' but also in the capacity of 'Staff' in overall of a company. It has been defined differently by different experts in the field. It includes how to raise the capital, how to allocate it i.e. capital budgeting. Not only about long term budgeting but also how to allocate the short term resources like current liabilities.

Today's businesses compete in markets that are increasingly global, highly competitive, and rapidly changing. At the same time, finance organizations face mounting pressure to spend less time managing transactions and more time supporting strategic decision-making. Existing on-premise software simply cannot address these challenges. Workday started from a clean sheet of paper and re- invented a modern financial management solution that combines in-memory accounting and analytics with a modern user experience to support the needs of businesses today and into the future. Workday Financial Management is built on an adaptive, global foundation that is seamlessly unified with the Workday suite of enterprise cloud applications. It gives finance organizations visibility, control, and consistency throughout global operations.

- Revenue Management Contracts Billing
- Revenue Recognition
- Accounting and Finance Core Financials Banking and Cash Business Assets
- Audit and Internal Control
- Contract and customer management
- Amendment control and audibility
- CRM integration including Sales force
- Automated billing
- Credit card and debit payments
- Project time and expense billing
- Configurable billing rates rules
- Reporting including aging, DSO, and payment history
- Revenue and deferred revenue reporting and forecasting
- Revenue recognition schedules and accounting
- Recognition by milestone, schedule or percentage Project
- Project scenario planning
- Project staffing (with HCM)
- Project work schedules and budgets
- Project costing

- Project time and expense billing
- Workday Expenses
- Workday Procurement
- Supplier contract
- Supplier portal
- Global tax engine (VAT, GST, Sales & Use Tax, Withholding). Multi-GAAP/multi-book
- Multi-chart of accounts.GL, AP and AR
- Accruals and allocations
- Real-time global consolidation and reconciliation
- Intercompany transactions
- Period close checklists for soft and hard close
- Budget control and commitment accounting
- Support for transaction, functional, and translation currencies
- Bank account management and reconciliation
- Single, unified settlement engine
- Real-time forecasting and visibility into cash balances
- Direct debits, customer credit cards, paper checks, electronic transactions, and positive pay
- Tangible and intangible assets
- Assets multi-book accounting and depreciation
- Asset disposals and transfers
- Composite and pooled assets
- Rights management on assets
- Centralized business-process configuration
- Support for global process adjustments
- Configurable security-access policies
- Secured data access
- Global payment formats and bank statements
- Local tax asset depreciation
- Global consolidations
- Workday Expenses
- Workday Procurement
- Workday Grants Management
- Workday Integration Cloud
- Separation of duties
- Complete audit trail on all transactions
- Configurable exception reports and alerts
- Single and consolidated financial statements
- Real-time consolidation, elimination, and currency translation
- Embedded analytics into business processes
- Multi-dimensional reporting (Work tags)
- Role-based dashboards
- Operational reporting and profitability analysis
- Financial scorecards
- Predictive and prescriptive analytics Financial Reporting and Analysis

Figure 7.1 - Financial management software overview

SUGGESTIONS FOR APPROVAL RELATED UNCERTAINTY FACTORS

The suggestion for approval related delays which can minimize the impact of delays which affecting the construction projects. They are

- Time limit should be prescribed for each approval and approving authorities should strictly maintain it. If due to some reasons, approval cannot be given within prescribed time limit, it should be intimated to the applicant within first 10-15 days of submission of application with reasons. Also, documentation required at each stage of approval should be clearly laiddown and adhered to.

Developers on their part should submit proper documents as required by the authorities to make the process less cumbersome.

- Building Plan could be passed and sanctioned by certified architects, monitoring of the project could be done by the municipality.
- Airport Authority of India in consultation with the local planners and approving authorities should identify the no-flying zones, air funnel and flight paths and demarcate them in the city master plan so that projects could be planned accordingly. This should also be put online for reference of all concerned.

CONCLUSION

The uncertainty factors which affect the planning of the construction projects which ultimate causes delay of construction projects were identified with help of literature and field expert's opinion. The questionnaire has been prepared to find out the top five factors causing delay in construction projects. The top 5 uncertainty factors according to the questionnaire results are Client related, Activity path/ CPM, Deviations in drawing/ Design related, financial issues & Cash flow, Approval. To overcome these uncertainty factors some possible solution has been recommended for the project managers and the management for minimizing the effect of delays. This recommended solution will be implemented in the companies for their future projects.

- Owner who is highly concerned about delay in construction projects is required to develop abilities of studying their projects in all stages.
- Developing countries have to develop a new strategy of management in construction projects taking into account the considerations of size, nature, cost and importance of the project leading to minimize the delay.
- There is a need to continue this research work by:

a. Studying the cost of delay and consequences.

b. Studying practical remedies which have been suggested here to eliminate or reduce the delay and its consequences.

c. Studying the best project delivery plan which reflects the effect of owner's contribution in project management.

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