# WORK IMPROVEMENT TECHNIQUES IN CONSTRUCTION

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**ABSTRACT**

Advances in technology are widely regarded as major sources of improvement in the competitive position of firms and industries and major factor in the construction process for increased national economic growth and standards of living. However, the benefits from technological advances depend on the extent to which these technologies are utilized.

The construction industry has been slow in adopting and utilizing new technologies with negative consequences on productivity and innovation..

The evaluation in adopting new technology is at the heart of the innovation process. While some new technologies promise to improve construction productivity, their ability to deliver is not always realized.

In this project a study has been carried out on various techniques which are suitable for productivity improvement. The existing productivity measurement and improvement practices and their factors have been assessed using questionnaire and case study. The collected data were analyzed using the SPSS software. Improving productivity in a well-established organization is complex and needs to be well considered.

## 1. INTRODUCTION

### 1.1 GENERAL

The construction industry is one of the most significant in the total economy in most countries, since it accounts for 4-9% of the Gross National Product and 40-60% of the Gross Fixed Capital investment. Improving construction capacity and capability is important for most developing countries. Construction projects are enlarging into complicated and technologically advanced progress needing efficient management.

Productivity is a dominant issue in construction, promising efficient usage of resources and cost savings and ultimately affecting efficiency, profitability and competitiveness of construction organizations.

It is generally built not only for the present generation but also for the future. In order to meet these challenges, it is important to recognize the special features of construction activity including its broad scope and strong interactions that exist with all branches of engineering and other disciplines that determine the need of technology.

The perceived lack of technological change is a primary argument supporting the construction productivity. This belief in declining productivity, which influences workforce strategies, technology adoption, research programs, and industry perceptions, is based on a number of productivity studies using industrial and macroeconomic data.

On the other hand, construction is labor oriented activity. Labor is considered a cheap resource available in plenty and no efforts were made to improve that. The technology improvements have dramatically changed the process of construction, as well as the quality of construction output.

### 1.2 OBJECTIVES

- To study on the construction productivity improvement techniques.
- To investigate the implementation of work study on the site.
- Improving performance through increased productivity and competitiveness.
- To improve the quality of working strategy and to increases the productivity of a construction project.

### 1.3 NEED FOR IMPROVEMENT IN CONSTRUCTION TECHNOLOGY

It is not just a discovery or the advancement of a technology that ensures acceptance and adoption but rather a series of interrelated events that contribute to the success or demise of its implementation.

For example, one aspect that helps improve the impact of any new technology is an innovation that decreases the investment and maintenance costs along with a comprehensive understanding of how the technology can be most effectively utilized to improve productivity.

Recently, the National Research Council (NRC) suggested that the National Institute of Standards and Technology (NIST) should take the lead in developing a "technology readiness index" for high-risk, high-cost, high-impact construction-related innovations.

Such an index could be used to provide a common understanding of the status of a technology and its level of risk. It could also be used to help make decisions about funding for additional research and development or for deploying the technology into widespread practice.

### 1.4 CHALLENGES FACED BY THE INDUSTRY

The construction industry everywhere faces problems and challenges. However, in developing countries like India, these difficulties and challenges are present alongside a general situation of socio-economic stress, chronic resource shortages, institutional weaknesses and a general inability to deal with the key issues. There is also evidence that the problems have become greater in extent and severity in recent years. One of the charges leveled at the construction industry, as at the beginning of the 21st century, is that it has a poor record on innovation, when compared with manufacturing industries such as aerospace or electronics.

### 1.5 PROBLEM FACING AREAS

The general problems that are faced by construction industry for the execution of project,

The problems could be grouped under five major factors:

- Incompetent designers/contractors
- Poor estimation and change management
- Social and technological issues
- Site related issues
- Improper techniques.

They directly relate the various strategies that are affected due to the above factors. It represents the major findings and highlights practical applications are mentioned below

## 2. LITERATURE REVIEW

### 2.1 GENERAL

This chapter presents an overview of literatures collected from various journals. The most notes worthy of them which are relevant to the current study are being reviewed.

**Panagiotis Mitropoulos and C.B.Tatum (1999)** represents the decision-making processes managers use in the adoption of new technologies, the factors affecting these processes and the strategies managers use to deal with the uncertainty involved in such decisions. The study focused on eight cases of adoption of two commercially available information technologies: (1) Electronic data interchanges; and (2) 3D computer-aided design system.

It summarizes relevant background, describes the decisions studied, presents the major findings and high lights practical applications. The recommendations focus on the strategies that managers can use to increase the likelihood of successful adoption of new technologies.

**Albert P.C.Chan, et.al. (2004)** report that construction industry is a very competitive high-risk business. Many problems, such as little cooperation, lack of trust and ineffective communication resulting in adversarial relationships between contracting parties, are facing the construction industry. It represents a review of the development of the partnering concept in general and identifies critical success and a set of success factor of partnering projects.

It result the establishment and communication of a conflicts resolution strategy, a willingness to share resources among project participants, a clear definition of responsibilities, a commitment to a win-win attitude and regular monitoring partnering process were believed to be the significant underlying factors for partnering success. Such identification of success factor could well formulate effective strategies for minimizing construction conflicts and improving project performance.

**P.C.Chan, et.al. (2004)** report that partnering is one of the most innovative developments in delivering a project efficiently and reducing construction disputes. It presents a review of the development of the partnering concept in general and identifies critical success factors for partnering projects.

It results indicated that certain requirements must be for partnering to succeed. It particular, the establishment and communication of a conflicts resolution strategy, a clear definition of responsibilities and regular monitoring of partnering process were believed to be the significant underlying factors for partnering success. The identification of success factor could well formulate effective strategies for minimizing construction conflicts and improving project performance.

**Carlos H. Caldas, et.al. (2009)** describes a research study that aimed to identify effective management practices and technologies for lessons learned programs in the construction industry.

It results that even though more lessons learned programs are being initiated, the potential for savings and improvement has not been fully met. The study has also identified crucial characteristics of a successful program and verified that most organizations are stronger in some categories and weaker in others.

**Paul M. Goodrum, et.al. (2009)** observed that a stronger relationship exists between changes in material technology and partial factor productivity than in labor productivity.

The results that changes in the unit weight of materials had a significant relationship to labor productivity, while changes in installation and modularity had a significant relationship to partial factor productivity. The research findings will help industry practitioners to better understand how they may leverage technology to improve construction productivity, while also helping researchers understand the theoretical relationships between technology and construction productivity.

**Chien-Liang Lin, et.al. (2010)** observed that there are two different definitions of BPs: one is defined as a performance benchmark of best practice and the other as a standard reflecting a contractor's normal operating performance. It is necessary to clarify the difference between the two definitions and their corresponding BPs.

It results the capability of deriving productivities of multi-input and multi-output activities, the proposed scale of labor productivity from the level of single factor productivity to total factor productivity which will help construction researchers and managers to evaluate performances of interests in a much more effective way.

**Lee teh-chang** observed that the construction industry is expanding and going hi-tech in design and execution it is hampered due to lack of skilled craftsmen. Modern youth are not interested in getting into the construction industry as the work is hazardous, dirty and difficult at construction sites.

It results the technical trends in the construction process and demonstrates some work improvement techniques that can be adopted to overcome this trend.

**Paul M. Goodrum, et.al. (2010)** represents some new technologies promise to improve construction productivity; their ability to deliver is not always realized. The stages examine a technology's costs, feasibility, usage history, and technical impact.

It results from historical analyses to formalize how selected technologies that have improved construction productivity can be used as a predictor of how future technologies might do the same. Statistical analysis confirmed that average performance scores produced by the model were significantly different across the categories of successful inconclusive and unsuccessful in terms of the technologies' actual implementation experience**.**

## 3. METHODOLOGY

### 3.1 GENERAL STEPS

- Reviewing the relevant literature regarding work improvement techniques in construction.
- Identifying the problems arising during the execution of construction work.

- Defining the problem occurrence.
- Collection of data related to the problem definition and adaptation of remedial measures by forming suitable techniques.
- Study on those techniques for its suitability.
- Questionnaire survey.
- Selection of appropriate techniques.
- Techniques used in the company for practice.
- Suggestions for implementation of the techniques.
- Case study of that selected techniques.
- Conclusion and discussion.

## 4. STUDY ON TECHNIQUES

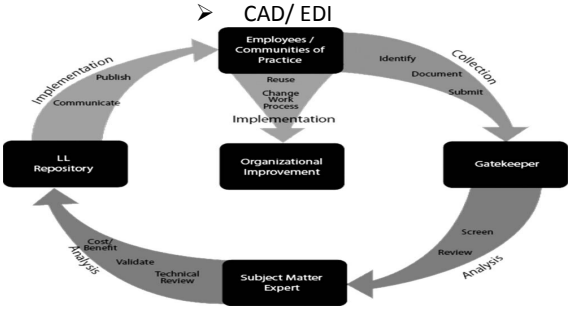
### 4.1 GENERAL

Construction cannot exist in isolation in this fast developing world of technology, management, methods and techniques that are being developed in other sectors of economy.

### 4.2 TECHNIQUES SUITABLE FOR IMPROVEMENT PROCESS

The development of technology in those areas influences various techniques in construction industry. It includes:

- Predictive Model Framework
- Simulation Model
- Data Envelopment Analysis
- Lesson Learned Programs
- Information Technology
- Artificial Intelligence Techniques
- Automated Data Acquisition
- Automated Equipment
- Construction Automation
- Project Partnering
- CAD/ EDI




### 4.2.6 COMPUTER AIDED DESIGN (CAD) / ELECTRONIC DATA INTERCHANGE (EDI)

- Five cases involved for the adaption of CAD,
  - ✓ 3D CAD Adoption by Mechanical Contractor
  - ✓ CAD Adoption by Design-Build Mechanical Contractor
  - ✓ 3D CAD Adoption by Piping Contractor
  - ✓ 3D CAD Adoption by Heavy/Civil Contractor
  - ✓ 3D CAD Adoption by Heavy/Civil Contractor
  - ✓ Use of CAD by Heavy/Civil Contractor
- Three cases for adoption of EDI,
  - ✓ Adoption of EDI/EDMS by Heavy/Civil Contractor
  - ✓ Adoption by EDI/EDMS by General Contractor
  - ✓ Adoption of EDIS by Heavy/Civil Contractor

## 5. CASE STUDY

### 5.1 CONSTRUCTION PROJECT PARTNERING

**ABSTRACT**

The case study of project partnering are described, a design and construct project procured by conventional lump-sum competitive tender which was demonstrating signs of claimsmanship, time and cost overruns and threats of disputation. This project involved the contractor and government department client. The results indicate that quite different outcomes can occur when using different project procurement methods, using the partnering processes and procedures. The general conditions of contract may need to be in concert with the aims and objectives of partnering.

**SUMMARY**

Partnering success was achieved due to increased pride and commitment to a quality end product, and direct ownership of decisions taken. All of the project objectives on this project were met, with the objective to complete the facility within the agreed programme being exceeded.

The project was, by all accounts a very successful partnering venture. The project was completed six weeks ahead of programme, on budget, with no head contract variations or contractual disputes.

Even though partnering tries to promote a win-win situation there are sometimes disputes, generally over money, that are win-lose by. It is when these disputes arise that a partnering relationship may be strained. Some reasons for failure of partnering include:

- Failure of most parties to understand the concept;
- The project or the culture of the parties involved is not suited to partnering;
- Implementation without support from senior management; and
- Parties using the partnering approach on a project and hoping to learn from their mistakes.

While every construction project is a challenge, the construction industry now has a project management tool to overcome the traditional obstacles that can adversely affect a successful construction project. "I am occasionally asked if partnering works. My answer is, even if there were to be no financial or performance advantages, it is clearly the ethical way of doing business."

Partnering will not solve all of the problems encountered in the construction industry on its own, but it does create a framework for conflict resolution, improved communications, reduced litigation and cost containment on potential overruns. It is a management tool that requires commitment, dedication, and a change of culture to make it successful.

### 5.2 PUBLIC PRIVATE PARTNERSHIP

#### 5.2.1.1 Introduction

The application of Public – Private Partnership (PPP) principles has grown over recent years and they were adopted in some project which was not involved in chosen appropriate techniques. As the advantages of blending private sector resources and skills with the public ones has become evident. It has also become clear the PPP architectures are complex and such projects require a detailed understanding of their design and implementation features. PPPs have become

accepted as a complementary implementation tool. The industry has undertaken many efforts recently to assist in the definition of PPP and to guide their application in the respect of the provisions of the Treaties.

But it does not advocate the use of any particular implementation method, the substantial need for investment in infrastructure in the Union does require the harnessing of all viable investment methods. In this context the industry has undertaken an information and awareness raising effort on the values and risks of the PPP approach.

**Conclusion**

In order to facilitate a common analysis of cases, 6 criteria were selected, including value of investment, contract duration, transfer of responsibility, demand risk, availability risk and contract type. A qualitative cross-sectoral analysis demonstrates a number of variances between the PPP models adopted. The following conclusions are made, based on the 6 criteria:

***Value of Investment:*** The water and transport sectors represented the largest capital investments.

***Contract Duration:*** Again the water and transport sectors represented the longest project / contract durations often over 20 years.

***Transfer of Responsibility*:** The solid waste cases demonstrate the highest degree of transfer of responsibility onto the private party.

***Demand Risk*:** As with the previous criteria, the solid waste sector generally has the highest degree of transfer of risk onto the private party.

***Availability Risk*:** The general pattern suggests that risks under this category are distributed in relation to the characteristics of the project and the parties.

***Contract Type:*** Concessions and joint ventures are the most common forms of structures encountered.

## 6. RESULTS AND DISCUSSION

### 6.1 GENERAL

The analysis shows that most of the Indian construction firms didn't follow up any productivity improvement methods or techniques. Only the top level companies have proper skilled professionals to manage their productivity development.

### 6.2 ANALYSIS

Once the data have been collected they were turns to the task on the analyzing those things using SPSS. The analysis of data requires a number of closely related operations such as establishment of categories to raw data through coding, tabulation and then drawing statistical inference.

### 6.3 TOOLS USED FOR ANALYSIS

SPSS (Statistical Package for the Social Sciences).

Table 6.1 age (years)?

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 20-29 | 6 | 60.0 | 60.0 | 60.0 |
| | 30-39 | 4 | 40.0 | 40.0 | 100.0 |
| | Total | 10 | 100.0 | 100.0 | |

Table 6.2 Company experiences in building and construction business?

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Less than 5 years | 1 | 10.0 | 10.0 | 10.0 |
| | 5 years to 10 years | 6 | 60.0 | 60.0 | 70.0 |
| | 15 years and above | 3 | 30.0 | 30.0 | 100.0 |
| | Total | 10 | 100.0 | 100.0 | |

Table 6.3 Type of the project under taken by the company?

| Valid | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Housing | 5 | 50.0 | 50.0 | 50.0 |
| Industrial | 2 | 20.0 | 20.0 | 70.0 |
| Commercial | 3 | 30.0 | 30.0 | 100.0 |
| Total | 10 | 100.0 | 100.0 | |

Table 6.4 In your opinion Productivity is:

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Productivity = Sales/ Employees | 2 | 20.0 | 20.0 | 20.0 |
| | Productivity = Jobs Completed/ Jobs Schedule | 6 | 60.0 | 60.0 | 80.0 |
| | Productivity = Jobs Completed/ Jobs Schedule | 1 | 10.0 | 10.0 | 90.0 |
| | Productivity = Output/ Work Hours | 1 | 10.0 | 10.0 | 100.0 |
| | Total | 10 | 100.0 | 100.0 | |

Table 6.5 Your Experience in construction fields?

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 2years to 5 years | 5 | 50.0 | 50.0 | 50.0 |
| | 5years to 10 years | 5 | 50.0 | 50.0 | 100.0 |
| | Total | 10 | 100.0 | 100.0 | |

### 6.4INFERENCES

The major findings from the analysis results:

Many companies stated that activity sampling technique is

The majority of the companies indicated that the factor which affects the work progress is due to delay it their material delivers to the site.

The quality of supervision is an important aspect they consider for their task based productivity improvement.

In most of the companies they didn't give up proper training and education to their respective job position.

The financial incentives, employee promotion and recognition are agreed by most of the companies as their demotivating factors affecting construction productivity.

Proper control in their management, work progress and work design that possess better coordination, inspiring leadership quality, improve scheduling and budgeting will leads to productivity development in the construction projects.

**6.5 QUESTIONARY SHEET**

**SECTION-1(GENERAL INFORMATION)**

Name of the company:
Status of the company:
Address of the company:
Size of the company(no. of company):
Annual turnover:
Age of the company:
Name of the company:
Position of respondent in the company:
Contact no:

## 7. CONCLUSION

The usage of work improvement techniques, which proved to be very useful during the execution stage, which avoids many problems, has arisen in the construction project.

Construction productivity improvement is a key issue for businesses and nations to increase profitability, reduce costs, create and sustain competitive advantage.

Construction projects are often deployed in an open execution environment, during the execution phase of construction projects, the usage of various techniques suitable for its improvement, always has to be adapted to the reality state due to dynamic and incomplete process which was analyzed through questionnaire survey.

It is visualized that successful implementation of these techniques will enable a greater influence in the construction technology for the development of construction project and increases productivity.

An attempt has been made for sharing the various techniques suitable for the project, which has been utilized and the case study of those techniques were collected.

By this concept, the project will be defined at the early stages with improved techniques in the construction progress.

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