



# A Study on Construction Labour Upskilling for Effective Project Management and Improved Construction Quality

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## ABSTRACT

On of the major employment-generating sector in India is Construction Industry and it plays a significant role in the country's infrastructure and economic development. Rapid growth of infrastructure projects, urbanization and the demand for modern construction techniques have created a constant need for skilled professionals as construction labour. However, despite the rapid growth of the industry, major part of the construction workforce in India is still unskilled or semiskilled. This affects the quality of construction, site safety, productivity and the overall project delivery. Lack of technical knowledge often leads to material wastage, continuous rework and defects, project delays and finally leading to increased project overall costs.

This study focuses on how construction labour upskilling is important for improving construction quality and achieving effective project management. The research examines India's existing labour conditions, the current skill gap in the sector, and the increasing demand of skilled Indian labour globally. The study also analyzes various skill development initiatives taken by the government and some private sectors such as PMKVY, MSSDS, and company-based training models implemented by some companies.

The research further include some case studies to understand the importance of skilled labour over unskilled labour and a market survey analysis conducted through Google Forms to understand industry professionals perspectives about labour conditions, upskilling awareness and suggestions as per current requirement. Based on the findings, the study proposes a labour upskilling framework based on practical training, safety practices, technical information and continuous skill development on construction sites. The research concludes that labour upskilling is essential for improving construction quality, reducing project inefficiencies, increase productivity and even support the future growth of the construction industry at national levels and global levels.

## Keywords :

Construction Industry, Skilled Labour, Labour Upskilling, Workforce Development, Construction Productivity, Construction Quality, Skill Gap, Construction Safety, Labour Training, Modern Construction Technology, Construction Management, Infrastructure Development, Workforce Efficiency, Skill Development Programs, Project Performance.



## CHAPTER 1 - INTRODUCTION

### 1.1 Background of the Study

The construction industry is one of the most important sectors contributing to infrastructure development, urbanization, industrial growth, and economic progress. The sector supports the development of residential buildings, transportation systems, bridges, industrial facilities, commercial complexes, airports, smart cities, and public infrastructure projects. Along with economic contribution, the construction industry also creates employment opportunities for millions of skilled, semi-skilled, and unskilled workers.

Construction activities are highly labour-intensive and depend greatly on workforce productivity, technical knowledge, workmanship quality, and proper project coordination. Activities such as masonry, reinforcement work, shuttering, plumbing, electrical installation, finishing work, and machinery operation require technical understanding and practical skills to maintain construction quality and ensure efficient project execution.

In recent years, the construction industry has undergone major transformation due to rapid urbanization, technological advancement, and modernization. Advanced technologies such as Building Information Modelling (BIM), modular construction, mechanized equipment, and digital project management systems are increasingly being adopted. These modern techniques require technically trained workers capable of handling advanced construction systems and maintaining execution accuracy.

Despite rapid growth, the industry continues to face significant labour-related challenges. A large percentage of the construction workforce lacks formal technical training and vocational education. This shortage of skilled labour negatively affects construction quality, labour productivity, project timelines, and safety standards.

Therefore, labour upskilling and workforce development have become essential for improving construction quality, increasing productivity, reducing project delays, and supporting sustainable growth within the construction sector.

### 1.2 Aim of the Study

- To study the importance of labour upskilling in improving construction quality, productivity, and effective project delivery.
- To examine the growing demand for skilled construction workers and the need for workforce development in the Indian construction industry.

### 1.3 Objectives

- To study the current labour conditions and skill gaps in the Indian construction industry.
- To understand the importance of skilled labour in improving construction quality, productivity, and project execution.
- To examine the growing demand for skilled construction workers and propose recommendations for workforce development.
- To analyze the impact of labour upskilling and skill development programs on construction project performance.

### 1.4 Scope of the Study

The study focuses on labour upskilling within the Indian construction industry and its impact on productivity, quality, safety, and project management. It includes labour conditions, workforce demand, case studies, survey analysis, and labour skill development programs.



### 1.5 Limitations

- The study is mainly limited to the Indian construction industry.
- Survey responses are based on limited participants.
- Financial analysis of training programs is not covered in detail.
- The proposed framework is conceptual and based on available industry observations.

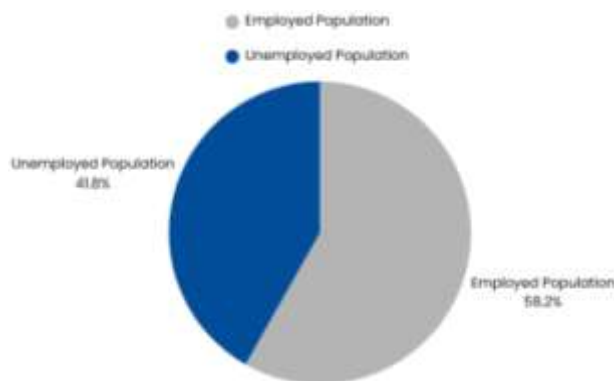
## CHAPTER 2 - LITERATURE REVIEW

### 2.1 Construction Industry and Economic Growth :

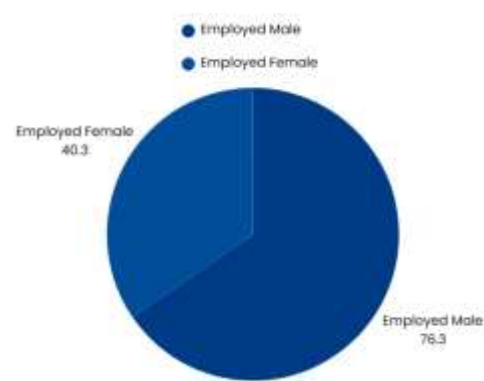
The construction industry contributes significantly towards India’s Gross Domestic Product (GDP) and supports multiple allied sectors such as cement, steel, transportation, electrical manufacturing, and equipment production. Rapid urbanization and infrastructure expansion have increased the demand for housing, roads, metro systems, industrial projects, airports, and smart cities.

The construction sector currently contributes nearly 8% to India’s GDP and employs millions of workers across different skill categories. Due to increasing infrastructure investment and industrial growth, the sector continues to expand rapidly.

### 2.2 Employment and Labour Scenario in India :



WPR for employed and unemployed



WPR for employed male and female

India possesses one of the world’s largest labour populations. However, a significant portion of the workforce remains unskilled or semi-skilled. Reports indicate that only a small percentage of workers receive formal vocational or technical training.

The construction industry alone employs nearly 71 million workers. However, only around 19% of construction workers are considered technically skilled. The remaining workforce mainly depends on informal learning and practical exposure rather than structured technical training. This imbalance between workforce demand and technical competency has created a major skill gap within the industry.



### 2.3 Skilled Labour vs Unskilled Labour :

**Table - *Distribution of Workforce by Skill Level in India***

LABOUR CATEGORY	PERCENTAGE OF TOTAL WORKFORCE
Skilled labour (formal vocational / technical training)	≈ 4.1%
Semi-skilled labour (informal training / on-the-job learning)	≈ 30.6%
Unskilled labour (no formal training)	≈ 65.3%
Total	100%

Skilled labour refers to workers possessing technical knowledge, vocational training, or practical expertise in specialized construction activities. Skilled workers include masons, electricians, carpenters, welders, bar benders, machinery operators, and plumbers.

Unskilled labour generally performs support-based or manual activities without formal technical knowledge. While unskilled labour remains important within construction projects, lack of technical understanding often leads to poor workmanship, reduced productivity, material wastage, and increased project delays.

#### Importance of Skilled Labour

- Improves labour productivity
- Enhances construction quality
- Reduces material wastage
- Minimizes rework and delays
- Improves construction safety
- Supports modern construction technologies

#### 2.4 Impact of Skill gap on Construction Quality :

The shortage of skilled labour directly affects project quality, productivity, safety, and overall project performance.

#### Major Impacts of Skill Gap:

- Poor workmanship quality
- Increased material wastage
- Frequent rework
- Delays in project completion
- Unsafe construction practices
- Higher project costs
- Reduced productivity



Lack of technical training also limits the adoption of modern technologies such as BIM, precast systems, mechanized construction, and modular construction techniques.

## 2.5 Global Demand for Skilled Indian Worker :

Many developed countries such as Germany, Japan, Israel, Australia, and Gulf nations are facing severe labour shortages due to ageing populations and increasing infrastructure demands.

Indian workers are globally preferred due to their adaptability, practical skills, and cost efficiency. International labour agreements and workforce mobility partnerships have increased overseas employment opportunities for skilled Indian workers. This growing global demand highlights the importance of labour upskilling and technical workforce development in India.

**Table - *Future Global and National Workforce Requirement***

Country / Region	Estimated Additional Requirement	Sector / Reason
Germany & Europe	300,000 – 500,000	Ageing workforce and industrial labour shortage
Japan	50,000 – 100,000	Skilled worker recruitment under SSW Program
Israel	20,000 – 50,000	Construction labour shortage
Saudi Arabia	500,000 – 700,000	NEOM and mega infrastructure projects
United Arab Emirates	150,000 – 250,000	Infrastructure and real estate growth
Qatar	50,000 – 100,000	Infrastructure maintenance and expansion
Kuwait & Oman	80,000 – 120,000	Oil, industrial, and urban projects
Australia	150,000 – 250,000	Infrastructure and Olympic development projects
United Kingdom	Around 240,000	Construction workforce shortage

**Table - *Estimated Skilled Workforce Requirement in India by 2030***

Category	Data
Total Construction Workforce in India	71 Million Workers
Skilled Workers Available	19%
Unskilled Workforce	81%
Expected Workforce by 2030	100 Million Workers
Estimated Skilled Workers Required	40 Million Workers



Category	Data
Currently Available Skilled Workers	≈ 13.5 Million
Additional Skilled Workers Needed by 2030	≈ 26.5 Million
Additional Green-Skilled Workers Required	3.2 Million



Figure - *Future Demand for skilled Indian Workers*

## CHAPTER 3 - METHODOLOGY

### 3.1 Research Approach :

The study adopts a mixed-method research approach combining both qualitative and quantitative analysis.

#### Qualitative Research Includes:

- Literature review
- Case study analysis
- Site observations
- Labour condition assessment
- Study of skill development programs

#### Quantitative Research Includes:

- Survey analysis
- Labour statistics
- Comparative analysis
- Percentage-based evaluation



### 3.2 Data Collection Methods :

The following methods were used for data collection:

- Literature review from journals, reports, and government publications
- Online and live case studies
- Google Form questionnaire survey
- Industry observations
- Comparative project analysis

### 3.3 Research Design :

The study was conducted in the following stages:

1. Background study of construction industry and labour conditions
2. Literature review and workforce analysis
3. Identification of skill gaps
4. Case study analysis
5. Survey data collection
6. Comparative analysis
7. Proposal development and recommendations

## CHAPTER 4 - CASE STUDY ANALYSIS

### 4.1 Online Case Study :

#### 4.1.1 Skilled Labour based Construction Project - Chhatrapati Shivaji Maharaj International Airport Terminal 2, Mumbai

The airport terminal project represents an example of successful skilled labour-based construction.

The project involved advanced structural systems, mechanical services, architectural detailing, electrical systems, and finishing activities requiring highly trained workers.

#### Benefits Observed:

- Better workmanship quality
- Faster execution
- Reduced material wastage
- Better safety compliance
- Minimal rework
- Improved coordination
- Timely project completion



The project demonstrated the importance of skilled labour in maintaining quality and achieving effective project management.

#### **4.1.2 Unskilled Labour and Construction Failure - Vivekananda Flyover Project, Kolkata**

The Vivekananda Flyover collapse highlighted the consequences of poor workmanship, weak supervision, and inadequate technical execution.

##### **Problems Identified:**

- Improper reinforcement placement
- Poor shuttering practices
- Weak concrete workmanship
- Inadequate supervision
- Unsafe construction practices

##### **Impacts Observed:**

- Structural failure
- Safety risks
- Delays and financial losses
- Increased rework
- Poor project quality

The case study demonstrated the severe risks associated with lack of technical skills and poor workforce competency.

#### **4.2 Live Case Study :**

A live comparative case study was conducted to compare projects executed using unskilled labour and upskilled labour.

##### **PROJECT A - Unskilled Labour**

Problems observed:

- High material wastage
- Frequent rework
- Irregular masonry quality
- Poor reinforcement accuracy
- Low productivity



## **Project B – Upskilled Labour**

After introducing practical training and trade-wise workforce organization, the following improvements were observed:

- Better reinforcement accuracy
- Improved finishing quality
- Faster execution
- Reduced wastage
- Improved productivity
- Better workmanship

The study proved that even small-scale practical training can significantly improve construction performance.

## **CHAPTER 5 - CASE STUDY : LABOUR SKILL DEVELOPMENT PROGRAMS**

### **5.1 Pradhan Mantri Kaushal Vikas Yojana (PMKVY):**

PMKVY is one of India's largest skill development initiatives launched to improve employability and workforce competency.

#### **Objectives:**

- Provide skill training
- Improve employability
- Offer vocational certification
- Support workforce development

The program includes training in construction trades such as masonry, plumbing, electrical work, bar bending, and carpentry.

### **5.2 Maharashtra State Skill Development Society (MSSDS):**

MSSDS focuses on skill development and vocational training within Maharashtra.

#### **Key Features:**

- Industry-oriented training
- Practical learning
- Placement support
- Workforce certification



### 5.3 Larsen & Toubro Construction Skills Training Institutes (CSTIs):

L&T established CSTIs to provide practical training for construction workers.

#### Training Areas:

- Masonry
- Carpentry
- Bar bending
- Welding
- Machinery operation
- Electrical work

The institutes emphasize practical learning and on-site technical competency.

### 5.4 Company-Based Training Models :

Companies such as Rohan Builders and Tata Projects have introduced workforce development initiatives through:

- Supervisor-led training
- On-site demonstrations
- Trade-wise labour grouping
- Continuous monitoring

These programs have shown positive impact on labour productivity and project quality.

## CHAPTER 6 - DATA COLLECTION ANALYSIS

### 6.1 Questionnaire Survey

A questionnaire survey was conducted using Google Forms to collect responses from construction professionals including engineers, contractors, architects, and supervisors.

### 6.2 Objectives of the Survey

- Understand current labour conditions
- Identify skill gaps
- Evaluate awareness regarding upskilling
- Study impact of skilled labour on project performance

### 6.3 Key Findings

- **Labour Conditions**

Most respondents agreed that shortage of skilled labour is one of the major challenges affecting construction projects.

- **Construction Quality**

Participants indicated that skilled workers significantly improve workmanship quality and reduce execution errors.



- **Productivity**

Responses highlighted that trained workers complete tasks faster and with better coordination.

- **Safety Performance**

Most professionals agreed that safety awareness and technical training help reduce workplace accidents.

- **Need for Upskilling**

Survey participants strongly supported practical training programs, trade-wise workforce organization, and on-site labour development initiatives.

## **CHAPTER 7 - FINDINGS AND DISCUSSIONS**

### **7.1 Major Findings**

The research identified several important findings related to labour upskilling and construction performance.

#### **Key Observations:**

1. Skilled labour directly improves construction quality.
2. Labour upskilling increases productivity and efficiency.
3. Practical training reduces rework and material wastage.
4. Skilled workers contribute towards better safety compliance.
5. Workforce development improves project coordination and execution speed.
6. Modern construction technologies require technically trained manpower.
7. India faces a significant shortage of skilled construction workers.
8. Global demand for skilled Indian workers is continuously increasing.

### **7.2 Importance of Practical Training**

The study found that practical on-site learning is more effective than theoretical training alone.

#### **Effective Training Methods:**

- Supervisor-led demonstrations
- Trade-wise workforce grouping
- On-site practical learning
- Continuous monitoring
- Safety-oriented activities



### 7.3 Challenges in Workforce Development

Despite growing awareness regarding labour upskilling, several challenges continue to affect workforce development.

#### Major Challenges:

- Lack of awareness
- Poor participation from workers
- Shortage of training centres
- Migration of skilled labour
- Limited industry involvement
- Financial constraints
- Poor working conditions

## CHAPTER 8 - PROPOSED LABOUR UPSKILLING PROGRAM

### 8.1 Objectives of the Framework

The proposed framework aims to improve construction quality, labour productivity, safety performance, and project efficiency through practical workforce development.

### 8.2 Key Components of the Framework

#### 1. On-Site Practical Training

Workers should receive practical demonstrations directly on construction sites.

#### 2. Trade-Wise Workforce Organization

Workers should be grouped according to trades such as:

- Masonry
- Reinforcement
- Shuttering
- Finishing
- Plumbing
- Electrical work

#### 3. Supervisor-Led Guidance

Experienced supervisors should continuously guide and monitor labour activities.

#### 4. Safety Training

Regular safety awareness programs should be conducted.



## 5. Continuous Skill Development

Workers should receive periodic technical updates regarding modern construction methods.

### 8.3 Expected Outcomes

Implementation of the proposed framework may result in:

- Improved workmanship quality
- Increased productivity
- Reduced rework
- Better safety performance
- Faster project execution
- Reduced material wastage
- Improved project management

## CHAPTER 9 - CONCLUSION

The construction industry plays a major role in infrastructure development, economic growth, and employment generation. However, shortage of skilled labour continues to remain one of the most critical challenges affecting project quality, productivity, safety, and efficient project management.

The research clearly demonstrates that labour upskilling significantly improves construction performance. Skilled workers are capable of performing activities more accurately, efficiently, and safely compared to unskilled labour. Proper technical training helps reduce rework, delays, construction errors, and material wastage while improving workmanship quality and productivity.

The study also highlights the growing national and global demand for technically skilled Indian workers. Modern construction technologies, mechanized systems, sustainable construction practices, and rapid infrastructure growth have further increased the need for trained manpower.

Government initiatives and company-based training models have shown positive results in workforce development. However, stronger implementation, practical training systems, industry participation, and continuous workforce learning are still required.

Therefore, labour upskilling should be considered an essential part of construction management and infrastructure development. Investment in workforce development will not only improve project quality and productivity but also strengthen India's economic growth and global workforce competitiveness.

## CHAPTER 10 - RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proposed:

1. Increase practical and on-site labour training programs.
2. Strengthen industry participation in workforce development.
3. Improve awareness regarding vocational education.
4. Establish more construction skill development centres.



5. Encourage trade-wise workforce specialization.
6. Conduct regular safety awareness programs.
7. Promote use of modern construction technologies.
8. Improve labour welfare and working conditions.
9. Introduce continuous skill certification systems.
10. Strengthen collaboration between government and private sector organizations.

Implementation of these measures can help reduce the skill gap and support sustainable growth within the construction industry.

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