

# AUTOMATION IN CONSTRUCTION INDUSTRY IT' S APPLICATION AND BARRIERS TO IMPLIMENTATION ON CONSTRUCTION SITE

Smit Rangani<sup>1</sup>, Jayraj solanki<sup>2</sup>

M.Tech Student, Department of Civil Engineering, Ganpat University, Gujarat, India  
PG Head & Assistant Professor, Ganpat University, Gujarat, India

\*\*\*

**Abstract** - Construction industry is one the oldest and most contributing in nations economy. Construction industry is labor concentrated and work is directed in hazardous environments; in this way, the significance of construction robotics has developed quickly. For good quality work, for example, absence of talented specialists, inadequately introduced equipment, poor plants, and so forth among this in an expansion in the genuine expense of construction and work. The significance of construction automation has developed quickly in evolved nations. In nations like India, the construction firms need automation, for example, new equipment, electronic gadgets and so on. The venture requires good quality of work, great nature of work, builds efficiency and so on. Considering late application and tasks for utilizing robots and automation in the construction business. The subjective examination has been completed. From this subjective examination a current use of automation, barriers to implementation on site, how these barriers are minimized are discussed in this paper.

**Key Words:** Automation, Robotics, Construction industry, safety, onsite construction etc...

## 1. INTRODUCTION

Construction industry is one of the most undeveloped fields in terms of automation. Despite that, construction is most oldest and it have great contribution to the country's economy. The significance of construction automation has developed quickly in developed nations. Developed nation have great revolution in terms of automation in every sector like automobile industry, food industry, etc. but in construction, it is low compares to other industrial sectors. The objections of construction quality is serious issue in the Indian construction industry. For fruitful quality work, for example, unavailability of skilled workers, poor working techniques, bad condition of equipment's, old working methods and so forth it will require more time, cost will increased, bad work quality. The infrastructure venture requires more numbers of skilled workers, updated equipment, soft wares, which will save time and increases productivity. Construction automation technologies describes the field of innovative work concentrated on construction automation forms. Automated construction

work process prompts leads to a continually working throughout year without any barriers. For fast development with less hazard and great quality in the construction business.

Automation technologies can give decreased labor dependability higher output and high productivity, diminished human mistakes, more working efficiency, flexibility etc. Bringing every one of the undertaking execution pointer (PPI, for example, cost, plan, quality, safety, work, profitability, material utilization or waste, and so on to an ideal values.

### 1.1 OBJECTIVE

To study the how much amount of Automation is utilized in current construction industry and its future trends, and study which barriers are highly affect to apply in construction and how it can be minimized.

Intelligent and integrated control over all construction processes to optimize resource value.

To improve and achieve ideal optimum value of construction quality, safety, profitability, productivity.

### 1.2 NEED FOR STUDY

The reason for this study is To identify Benefits of automation, and future trends of automation in construction. To Analyze, which are the main obstacles to implementation on site and how it can be minimized.

### 1.3 SCOPE OF WORK

This study was done on the different organizations of Ahmedabad and Kutch region. Attempts to evaluate overall uses and development of automation technologies in construction industry with reviewing organizations' inclination for the what amount of automation used and If not then what are the issues they are confronting? in which zone they use automation technologies..

## 1.4 RESEARCH METHODOLOGY

### 1.4.1 Literature Review

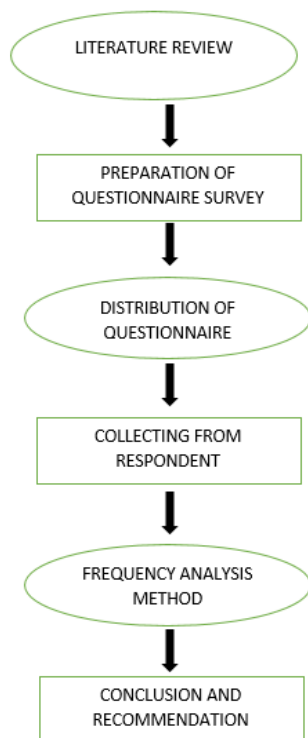
Literature review has been done from previously published research papers on this topic from various international journals as well as relevant books and researched thesis to understand previous work done on this kind of project.

### 1.4.2 Data Collection

Data collection has been carried out by questionnaire survey from various executives who have worked in similar kind of projects and within similar region.

### 1.4.3 Data Analysis

Data analysis has been done from collected data by qualitative analysis and quantitative analysis as well as frequency analysis so that proper importance index to factor can be achieved.



Flow-Chart Research Methodology

## 2. DATA COLLECTION

### 2.1 General

This chapter describes the background of the quantitative data collection exercise, and presents the main steps taken for the collection of data required for the study whereas the methodology chapter describes the steps taken in designing

the questionnaire, this section provides in account of the execution of the methodology.

### 2.2 Questionnaire Design

The questionnaire is made by seeing the relative literatures in the area of Automation in Construction Company. The questionnaire was validated with experts for clarity, ease of usage, and value of the facts that could be gathered.

### 2.3 Data Measurement

For measuring the process, Scale is used to rank the each factors. This range from 1 to 5.

Table: 1 – Rating Scale

SCALE	DESCRIPTON
1	Very low
2	Low
3	Moderate
4	High
5	Very high

### 2.4 Sample Size

A total of 75 questionnaires, of 75 questionnaires in Construction Company, is given to owner of construction firms. Selected sample size for the all construction companies, specifically work in small company, specialist owner and project manager, sr. Engineer.

Table: 2 – Percentage Of Valid Respondent

TOTAL NO. OF QUESTIONNAI RES SENT	TOTAL NO. OF QUESTIONNAI RES RECEIVED	NUMBER OF VALID RESPONDERS	RESPON SE RATE
75	43	43	58 %

### 2.5 Area Of Usage

Areas Most used by companies in automation are Design, costing and Sheduling, planning, project management, Tendring, On site work.

**Table: 3 – Area Of Usage**

SR NO.	AREA OF USAGE
1	Design
2	Costing & Scheduling
3	Planning
4	Project Management
5	Tendering

### 2.6 Areas Of Usages For On-Site Work

**TABLE: 4 – Area Of Usage Of On-Site Work**

SR NO.	ON SITE WORK
1	Earth Work
2	Steel Work
3	Concrete Work
4	Painting Work
5	Building Assembly And Lifting Work
6	Flooring Work

### 2.7 Barriers To Implementation Of Automation In On-Site Construction

**Table: 5 – Barriers Statement With Code**

CODE	STATEMENT
A1	High Cost
A2	Technology Are Expensive To Update And Maintain
A3	Low Technology Literacy
A4	Locally Unavailability Of Automation Technologies
A5	Technology Difficult To Use

A6	Project Magnitude I.E. Size, Location, Project Period
A7	Size Of The Firm

A total 7 statement related to barriers to implementation was provided and requested to respondent to give there opinion on each statement from very low to very high.

### 2.8 How To Minimized Barriers In Implementation Of Automation In Construction Work

**Table: 6 – Overcome Statement With Code**

CODE	OVERCOME STATMENT
B1	Reducing The Cost Of Technology And Robots
B2	Making Technology To Cheaper To Maintain And Updating
B3	Developing Of Technologies That Are Easier To Use And Understood
B4	Automation System Will Be More Easily Locally Available
B5	Training Program For Workers And Employees
B6	Developing Technologies That Are User Friendly

A total 6 statement related to minimized of barriers to implementation was provided and requested to respondent to give there opinion on each statement from very low to very high.

### 2.9 Benefits Of Automation Technology To Implementation On Project Performance

**Table: 7 – Benefit Statement With Code**

CODE	STATEMENT
C1	Finance Saving
C2	Less Human Labor
C3	Less Human Error

C4	High Productivity
C5	Safety Improvement
C6	Less Material Wastage
C7	Work Quality Increased
C8	Time Saving
C9	Improving Working Condition

A total 9 statement related to Benefits of Automation Technology to Implementation on Project Performance was provided and requested to respondent to give there opinion on each statement from very low to very high.

### 3. DATA ANALYSIS

#### 3.1 General

This Analysis gives detailed quantitative, ordinal and qualitative analysis of the data collection for the research, which are the questionnaire survey. Data analysis is a carefully planned step in the research process that should take into careful consideration the purpose of the analysis, which in this case to give info about questions which asked in survey.

After information is gathered, the pre-systematic procedure is led, where information is to check for lucidity, no-mistake, and completeness of the information which are gathered. Some abnormal reactions found during the information cleaning process are then cross-checked with the poll got, and amended by doling out the suitable incentive on account of information passage botch, or missing an incentive on account of an wrong reaction.

#### 3.2 Area Of Usage

Over all highest percentage of automation is used in project management with 80% of use and lowest use of automation is in tendering area.

To provide clarity to the distribution of usage of automation in construction, the statical analysis is used.

**Table: 8** - Area Of Usages Statical Analysis

AREA OF USAGE	SAMPLE NO.	MEAN	MEAN RANK
Design	43	4.00	2
Costing &	43	3.81	4

Scheduling			
Planning	43	3.97	3
Project Management	43	4.18	1
Tendering	43	3.79	5

The analysis result shown that , the automation are used most in project management area with mean value of (4.18). It can be confirmed that automation is least used in tendering area with mean value of (2.04).

#### 3.3 Areas Of Usages For On-Site Work

Over all highest percentage of automation in on-site construction is used in earth work and lowest use of automation is in paint work. To give clarity to the distribution of usage of automation in on-site construction , the statical analysis is used.

**Table: 9** - On-Site Work Area Usages Statical Analysis

ON-SITE WORK	SAMPLE NO	MEAN	MEAN RANK
Earth Work	43	3.93	1
Steel Work	43	2.32	4
Concrete Work	43	3.44	2
Building Assembly And Lifting Work	43	3.30	3
Painting Work	43	1.67	6
Flooring Work	43	1.88	5

The analysis result shown that , the highest automation are used in on-site construction work is earth work area with mean value of (3.93) and on-site automation is least used in painting work area with mean value of (1.67).

#### 3.4 Barriers To Implementation Of Automation In On-Site Work

**Table: 10** – Barrier Statement Statics Analysis

STATEMENT	N	MEAN	RANK
A1- High Cost	43	4.20	1

A2- Technology Are Expensive To Update And Maintain	43	4.11	3
A3- Low Technology Literacy	43	3.30	6
A4- Locally Unavailability Of Automation Technologies	43	3.65	5
A5- Technology Difficult To Use	43	3.13	7
A6- Project Magnitude I.E. Size, Location, Project Period	43	3.90	4
A7- Size Of The Firm	43	4.13	2

From frequency distribution and bar chart that, high percentage of respondent rated barrier A1-high cost with mean value 4.20 , And second high rated is statement A7-size of the firm with mean value 4.13. and least rated statement is A5- Technology is difficult to use with mean value 3.13.

### 3.5 How To Minimized Barriers In Implementation Of Automation In Construction

**Table: 11** – Overcome Statement Statics Analysis

Statement	N	Mean	Rank
B1-Reducing The Cost Of Technology And Robots	43	3.62	6
B2-Making Technology To Cheaper To Maintain And Updating	43	3.69	5
B3-Developing Of Technologies That Are Easier To Use And Understood	43	3.90	1
B4-Automation System Will Be More Easily Locally Available	43	3.79	4
B5-Training Program For Workers And Employees	43	3.88	2
B6-Developing Technologies That Are User Friendly	43	3.81	3

From frequency distribution and bar chart seen that, high percentage of respondent rated Statement B3 – (Developing Of Technologies That Are Easier To Use And Understood) with mean value 3.90 , And second high rated is statement B5 – (Training Program For Workers And Employees) with mean value 3.88 . and least rated statement is B1- (Reducing The Cost Of Technology And Robots) with mean value 3.62 .

### 3.6 Benefits Of Automation Technology To Implementation On Project Performance

**Table: 12** – Benefit Statement Statics Analysis

Statement	N	Mean	Mean Rank
C1-Finance Saving	43	3.67	7
C2-Less Human Labor	43	3.62	8
C3-Less Human Error	43	3.95	6
C4-High Productivity	43	4.00	5
C5-Safety Improvement	43	4.02	3
C6-Less Material Wastage	43	3.32	9
C7-Work Quality Increased	43	4.44	1
C8-Time Saving	43	4.04	2
C9-Improving Working Condition	43	4.02	3

From frequency distribution and bar chart it is seen that, high percentage of respondent rated Statement C7 – (Work Quality Increased) with mean value 4.44 , And second high rated is statement C8 – (Time Saving) with mean value 4.04 . And least rated statement is C6- (Less Material Wastage) with mean value 3.32 .

### 4. CONCLUSION

The main aim of this research is to find current use of automation in construction and on-site construction work. And main barriers to the implementation of automation technologies in construction.

Factor related to the barriers are finds through literature review, case studies, Then further make questionnaires for survey work and then data is analyzed with frequency analysis method.

From Frequency analysis method it can be concluded that the barriers like high cost, size of firm , technology are hard-expensive to maintain and update are high rated barriers in implementation of automation in construction. And barriers like low technology knowledge to workers, technology are difficult to use are least rated in survey.

The level of site automation was found to have solid relationship with cost of automation technology (purchase cost, maintenance cost, and updation costs), size of the firm, project magnitude, and staff limit.

From this research it can be summarized that barriers will be minimized by developing technologies that are easier to use and understood and training program for workers and employees that is highest rated in survey and making technology cheaper to maintain and updating statement is least rated in survey.

By using automation technologies in construction had a major influence on project performance with greater influence on improved work quality, time saving, improving working condition, safety improvement, and high productivity in work.

Because of the high complexity, nature of the development procedure and the development technological improvement a drawn out arrangement is important to receive it to cutting edge development techniques. Modelers, specialists and every other member of the development procedure must be coordinated in this adjustment procedure. The short- and long term improvement of Automation will happen step by step and will be situated to the particular application.

The benefits of executing automation technologies is the need of the present infrastructure project and development firms to increase the productivity great, increase the safety for workers, and good quality of work. Small and medium size firm are the need of automation advances to implementation in various areas.

## REFERENCES

- [1] Maalek, R, Janaka R, & Kamal R 2014, Evaluation of the state-of-the-art automated construction progress monitoring and control systems, Construction Research Congress 2014, ASCE 2014, viewed on 15th March 2015 <http://sipb.sggw.pl/CRC2014/data/papers/9780784413517.105.pdf>
- [2] Mahbub, R 2008, An investigation into the barriers to the implementation of automation and robotics technologies in the construction industry, unpublished PhD Thesis, School of Urban Development, Faculty of Built Environment and Engineering Queensland University of Technology.
- [3] Balaguer, C. and Abderrahim, M. 2008, „Trends in Robotics and Automation in Construction. Robotics and Automation in Construction’, Published by In-Tech, Croatia.
- [4] Akash S. Tambi, A. R. Kolhe & Upendra Saharkar, “Remedies over the obstacles in implementing automation in Indian infrastructure projects”, International Journal of Research in Engineering and Technology (IJRET)
- [5] Gwaya, A, O, Masu, S, M & Wanyona, G 2014, „A critical analysis of the causes of project management failures in Kenya’, International journal of soft computing (IJSCE), ISSN: 2331-2307, Volume 4, issue 1 pp.64-69
- [6] Ahuja, V., Yang, J. & Shankar, R 2009, Benefits of collaborative ICT adoption for building project

management Construction Innovation: Information, Process, Management, Vol.9 (3), pp. 323–340.