



# Ergonomics Application in Civil Engineering

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**Abstract :** This study has been undertaken to study ergonomics in the construction industry. Productivity is an important issue in the construction industry. It is directly related to the construction cost and duration of the work. Construction productivity is influenced by many factors such as material equipment and labour. Labour is the most important factor, since labour determines how the work is done. Labour productivity is influenced by the work methods, physical fatigue, work environment, capability and complexity of the world to improve labour productivity due to the work method, application of the principle of ergonomics is important to consider. This review also provides a systematic overview of the comparison of ergonomic assessment techniques the broad categories are comparison of applied sector, trend analysis, ergonomics assessment techniques been compared, comparative studies between ergonomic assessment techniques, frequently compared techniques levels of action categories used.

## I. INTRODUCTION

### I.1 GENERAL

Productivity is an important issue in the construction industry. Productivity significantly affect the completion schedule of the project, as well as the effect on the budget. In current industrial work scenario, the problem of work related musculoskeletal disorders (WMSDs) is very common. musculoskeletal disorders (MSDs) are one of the major causes of illness under second most cause of disability worldwide measured by years lived with disability (YLDs). Low productivity let the project completed behind the schedule, the cost increase and the budget overrun. This situation leads the construction company loss the profit and reduce the competitiveness in the construction industry.

Materials, equipment and labour are three aspects of construction projects that affect productivity. labour intensiveness is the most important factor that should be getting attention for improving productivity. labour account for up to 40% of the direct capital cost of large construction projects, and there is a need to maximize the productivity of labour resources.

There are numerous factors affect labour productivity such as location, site restriction, weather condition, project size, height, the complexity of the work, experiencing management and supervision and skill of craft labour. The most frequent condition is the low back pain. WMSDs commonly include disorders of muscles, tendons, peripheral nerves, joints, bones, ligaments etc.

In a different side, factors affect labour productivity such as capability, physical fatigue, mental fatigue, stress fatigue, boredom and environmental aspects of on site construction. The main cause of occurrence of MSDs is accumulation of repeating stress over time. musculoskeletal conditions affect billions of people around the world especially in construction industry. Individual capabilities different from people to people, therefore the employers have to implement standardized test to qualify applicants on the basis of strength, lifting ability, agility, or similar characteristics. on the job, the employers have to pay careful attention to work assignment to avoid excessive 14 over taxing an individual's physical capabilities. physical fatigue largely result from an overuse of energy. The three aspects i.e. Position of the body, any moment of observation of labour In workplace and work device support.

The techniques used the combination of exposure risk factors for its assessment. Few techniques such as rapid entire body assessment (REBA), Rapid Upper Limb Assessment (RULA), and Ovako Working posture Assessment System (OWAS) Follow standardized tables in which combination of heads, arms and legs position identifies or poster school and suggest level of risk involved in the task, especially in construction industry.

### I.2 ERGONOMICS IN CONSTRUCTION INDUSTRY

Ergonomics are human factors sciences. It plays an important role in the success of a design or task. They can work interdependent to enhance each other, improving safety and productivity and reducing employer costs. Ergonomic disorders are the fastest rising category of work-related illness. It deals with designing and classifies things so that people can use them with no trouble and safely. Adapting the job to fit the personnel can help to reduce ergonomic stress and eliminate many potential ergonomic disorder tunnels.

### I.3 IMPORTANCE OF ERGONOMICS

Ergonomics is important because when doing a job and body is stressed by a stiff posture, extreme temperature, or repeated movement, musculoskeletal system is affected. The body may begin to have symptoms such as fatigue, discomfort, and pain, which can be the first signs of a musculoskeletal disorder. In workplaces, various kinds of research and practices are handled ergonomically: Optimization of work design, design of protected tools/machines and measures against excessive workloads, design of safe and healthy work environments and workstations, measures against heat, noise, vibration and hazardous substances, appropriate setting of working and resting time and shift work schedule and establishment of organizational culture, safety culture and leadership. They are five of the proven benefits of a strong workplace ergonomics process are ergonomics reduce costs, ergonomics enhance productivity, ergonomics improves quality, ergonomics improves employee engagement, ergonomics creates a

better safety culture. All ergonomic task force members should take advanced training in job analysis and control measures, problem area identification, and should improve skills in team building and problem solving. In adding together to organization and the work force, contribution should be insured from: safety personnel, health-care providers, human resource personnel, maintenance, and purchasing. Ergonomic specialists.

#### I.4 MATERIAL'S AND METHODS

The objectives this research is to study how the implementation of ergonomics and motion economics principles can improve construction labour productivity, Brick masonry and plaster worker, wall painter, and ceramic installation worker in building construction could be chosen as samples, since the productivity of these tasks are dominantly based on labour capability, Brick masonry work could be choose by consideration that almost housing , in build of brick masonry. Painting and ceramic installation were chosen since the tasks must be done by people work that can not be replaced by machine.

The systematic review follows the preferred reporting items for systematic reviews and meta analysis ( PRISMA ) methodology ( Ales-sandro,2009), ((Moher et al., 2009)). PRISMA is a well accepted methodology for conducting and reporting systematic reviews in any engineering domain.

#### I.5 OBJECTIVES OF STUDY

1. Identification of Ergonomics.
2. Study of types of Ergonomics techniques.
3. Study of commonly used observational techniques by the ergonomists.
4. Study of environment and surrounding on construction site.
5. Study of observations which would be taken on construction site.

#### Equations

$$\frac{WH2}{WH1} = \frac{P2}{P1} \times \frac{T1}{T2}$$

Where,

**W** –Weight of the worker

**H1** – Height Climbed for task 1

**H2** – Height Climbed for task 2

**P1** –Pulse rise

**P2** – Pulse rate rise

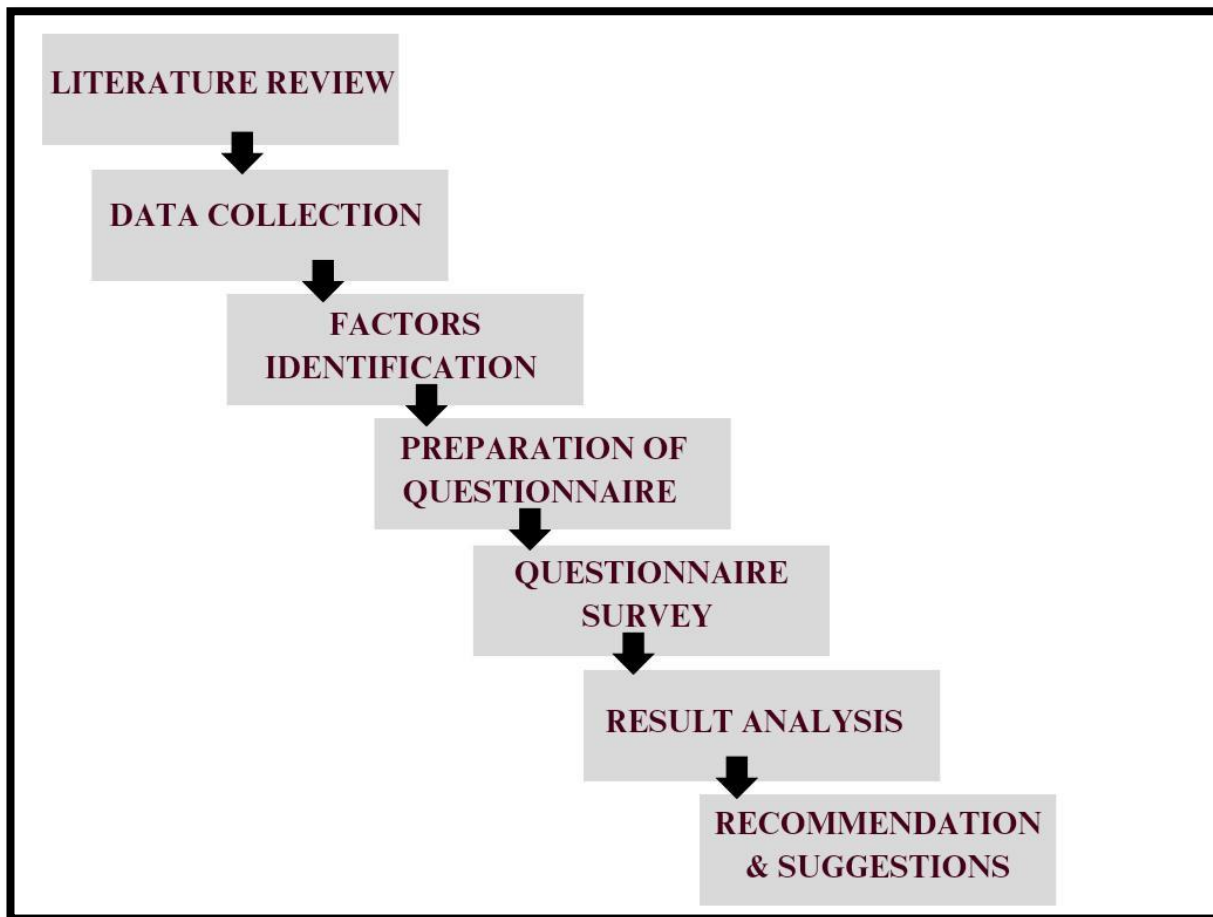
**T1**– Time required for task 1

**T2** - Time required for task 2

**WH2 & WH1**–Work done

## II. METHODOLOGY

In construction industry, planning is important to achieve its goals. The plan can be achieved by sequencing the flow of work into a typical methodology fig. represents the methodology adopted for successful completion of the project. During the execution of any civil structure from foundation to the finishing and various scheduled activities are performed on sites. So all these activities causes damage or deteriorates the health of the workers while working on a particular activity. Awkward postures, bending, forceful exertions, lifting, noise, pushing, pulling, reaching, repetitive motions, temperature extremes .All above mentioned problems we see on construction sites and they cause injuries to site workers and musculoskeletal morbidity among construction workers. To save workers from these problems we can apply ergonomics. Ergonomics methodologies encompasses physical, psychophysical, social and psychological methods. They also include specific methodologies relating to ergonomics audits and the use of computer software for ergonomics modelling. Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. After that for knowing Ergonomics Application in Civil Engineering better we searched research and review papers, consulted with professors about our project title and then to identify what kind of problems in which amount hurts on site workers, we have done one site visit in Fetri on construction site.



### III. DATA AND SOURCES OF DATA

The review of literature was focused only on pre reviewed journal papers. The research paper were searched and included. The various combinations of keywords will use to generate maximum articles from the various sources including journal publications, book publications, study reports of national societies, conference proceedings etc. The combinations used in the searched were Comparison, ergonomic assessment, REBA, RULA, QEC, OCRA, SI, OWAS.

### IV. WORK DONE

## Task-1:Concrete Mixing

H=10

T=16 sec

W=63kg

P1=120

P2=145

T1=360 sec

Work Done WH1=63 × 9.81 × 3.04 =1883.75NM

$$\frac{WH2}{WH1} = \frac{P2}{P1} \times \frac{T1}{T2} = \frac{145}{120} \times \frac{16}{360} \times 1883.75$$

WH2=101.16Nm

## Task-2 Brick Laying

W=63 kg

H=10

T1=16sec

P1=120

P2=140

T2=360sec

Work Done WH1=63 × 9.81 × 3.04 =1883.75NM

$$\frac{WH2}{WH1} = \frac{P2}{P1} \times \frac{T1}{T2} = \frac{140}{120} \times \frac{16}{300} \times 1883.75$$

WH2=117.21Nm

## Task-3:Plaster

W=63 kg

H=10

T1=16sec

P1=120

P2=140

T2=480sec

Work Done WH1=63 × 9.81 × 3.04 =1883.75NM

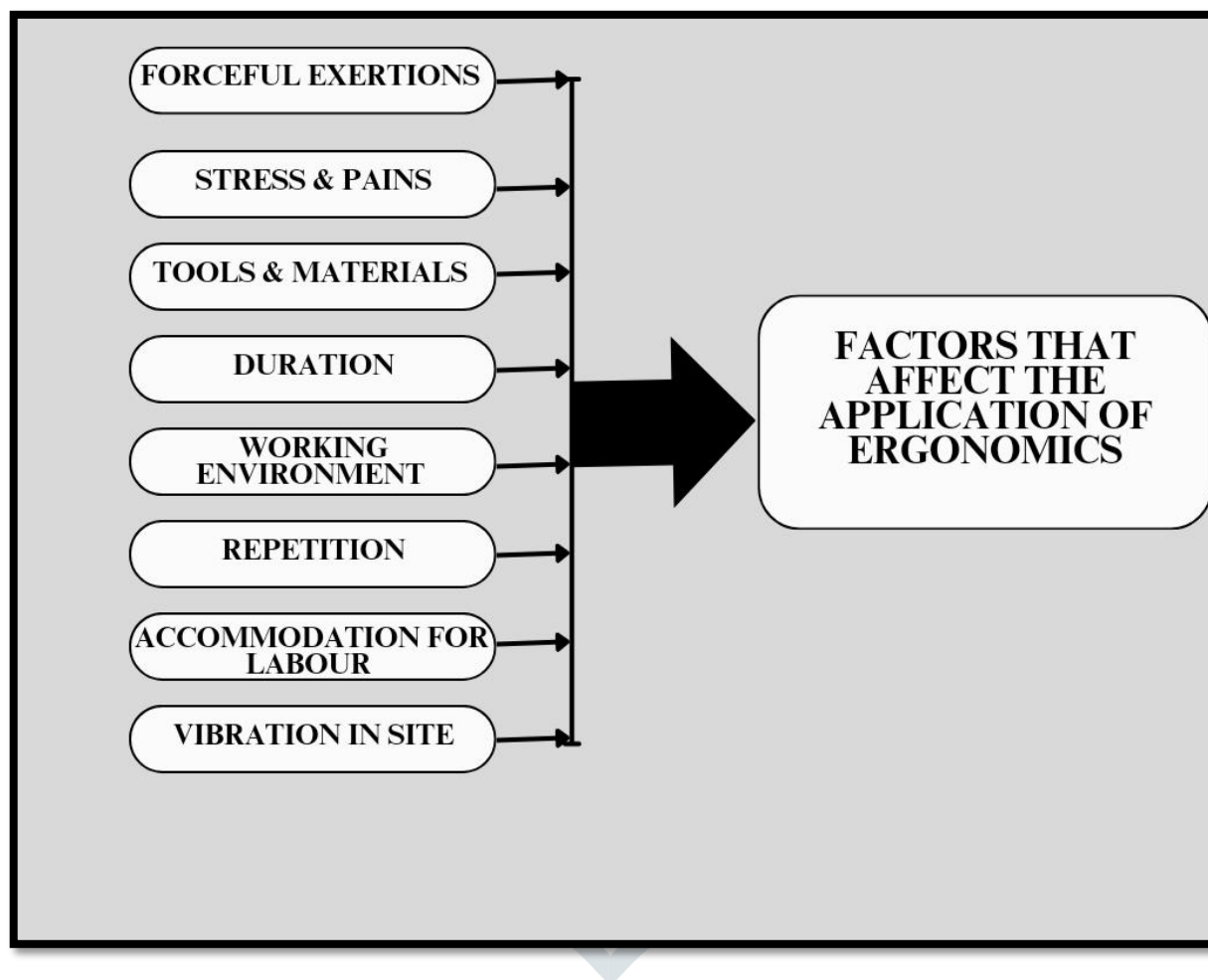
$$\frac{WH2}{WH1} = \frac{P2}{P1} \times \frac{T1}{T2} = \frac{140}{120} \times \frac{16}{480} \times 1883.75$$

WH2=73.256Nm



#### IV. RESULTS AND ANALYSIS

This section deals with the collection of data and the tool for analyzing the data. As per the review study conducted, 30 observational methods are available for ergonomic risk assessment. In addition to those 30 observational techniques, NERPA, ALLA, SWEA, PERA, WERA etc. Author's have compared some techniques of ergonomics assessment and tested existence of correlation between them with the other techniques. Labour work in different position of the body, depend on the height of the work area to be done. There are four body positions of the labour at work : squat, bent, stand up, and sit down. Each of these positions consume different energy and causes musculoskeletal fatigue in different levels. Regarding to ergonomic principle, squat position and bend position are bad positions, because these positions consume much energy and causes severe musculoskeletal fatigue. The modification of work method to alleviate squat position is done by arrange labour worked by sitting on low bench And placed material on the table to avoid bent position. placing material on the table eliminate unnecessary movement as well.



**Fig. Factors that affecting application of ergonomics**

#### A. IDENTIFICATION FACTOR

The input data are gathered through literature study. Data collection is a systematic approach for gathering information from a variety of sources to get a complete and clear perspective on the labour productivity.

The goal for data collection is to capture quality evidence that then convert to reach that analysis and allows the building of a compelling and credible answer to questions that have been posed the factors. shown in the figure can be identified from the data collection. the important factors which affect the labour productivity are determined. Depending upon the factors the questionnaire will be framed.

#### B.FACTOR ANALYSIS

Factor analysis was used to establish the underlying interrelations existing among the

manufacturers identified above. This makes it possible to reduce the factors to a more meaningful framework to increase the labour productivity in construction project. Based on The literature there are some key factors considered for the question or design. each of these consists of several sub factors.

## V. ACKNOWLEDGMENT

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## VI. CONCLUSION

Even though all human activities are carried out in a built environment, only a few studies seem to be available about a labour productivity based on at ergonomic approach. the human centered labour productivity methodology presented here yield inspiration From the holistic approach of ergonomics. I know workstation the labour productivity gets affected due to discomfort and several other factors such as force full exertions, repetition, duration, vibration in site, working environment, tools and materials, stress and pains, accommodation for labours. The videos in construction productivity are identified from literature review. Based on literature study or detail inside we was conducted from labour's from a site visit.

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