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Study on Ergonomics in Improving Labor Productivity

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Abstract: *One of the uniqueness of human action is the ability to modify the environment and create new structures. Even though all social activities are agreed not in a construction environment, only a few studies deal about labour productivity based on an ergonomic approach. Construction project trends carry immense moments for the marketplace as a whole. Labour productivity is one of the essential vital parts affecting the overall production of any corporation, whether big or tiny business. The studies estimate the parts that move work productivity based on the application of ergonomics. The chapter presents a preliminary survey of some principles inspired by social ergonomics development, analyzing the function they perform in the potency process, to define a design methodology establishing the labour to create working and living area fitting the demands of inhabitants. The factors that affect labour productivity are determined from the literature study and using these factors conducting the questionnaire survey among the labours in various construction projects. The ranking of the elements will be done by Relative Important Index (RII) using the data's the main determinants creating the labour potency comprise to be understood from the effects proper scheme will be given to the firms for improving their ergonomic ways in the worksite.*

Keywords: *Ergonomics, Factors, Labour Productivity, RII*

I. INTRODUCTION

A. General

Ergonomics tries to provide the best fit between the workers and their jobs; it is derived from two Greek words "ERGON" that means "work" and "NOMOS" which mean principles or laws, therefore literally Ergonomics means the laws of work (Sanders, 2004). Ergonomics is the system you use your body to work and implementing the job or task to you to decrease your risk of harm. These musculoskeletal impairments emerge slowly over time and happen in the soft tissues of your thesis like the nerves, tendons, muscles, ligaments and limbs. These injuries are called musculoskeletal disorders or MSDs. The risk for MSD increases with these hazards: 1) Repetition- same task or muscles repeatedly used 2) High Force- high muscle power in lifting & gripping 3) Awkward Postures- joints bent out of normal position 4) Contact Stress-pressure pressed on small body area (examples: palm, knee, or forearm) 5) Hand-Arm Vibration-from power tools or equipment 6) push/pull 7) environment. Ergonomics helps to protect the body from injuries, and using it makes activities easier for the organization. Ergonomics is the craftsmanship that plans and invents jobs to fit workers. Ergonomics deals with individual characteristics, expectations and behaviours in the design of the tasks where people were doing their workday today. Essential ergonomics risk factors include strength, repetition, uncomfortable and static postures, physical and mental stresses.

B. Ergonomics Issues in Construction

Ergonomics issues are present in every field surrounding us. In any work you take like office, industrial, hotel etc. ergonomic problems are present. Ergonomics is related to workers doing the job on the construction sites. The construction workers are continuously bending, stooping, squatting twisting, which leads to musculoskeletal disorders in body of workers. Construction is a field of work that is very physically demanding. Indian construction workers are exposed to many risk factors on construction sites. Many construction workers have to control machines, move heavy objects, repair equipment, as well as monitor processes. There is a lack of studies in the construction work system, likely because of high task variability, irregular activity periods, changing work environments, and the transient nature of construction professions. Also, in highly physically demanding construction jobs, psychosocial and environmental work-related circumstances are the most important factors associated with workability. The physically demanding nature of the construction trade has made it riskier for the workers affecting.

Construction workers performing activities are challenging due to diversity, changeability and dynamic features of the building and construction industry. The complexity of the projects and extensive scope of the works in the construction industry make the workers to be exposed to injuries, illnesses, disabilities or even deaths. The construction industry is one of the seven occupations with the highest incident rate.

Work-related musculoskeletal disorders (WRMSDs) is common among various workers, and a huge amount of money is wasted due to it. The construction industry is one of the seven occupations with the highest accident rate. Musculoskeletal injuries in construction work are among the most significant risk zones for Construction workers. The Indian construction industry is developing continuously, so there is quick development. The job of worker is affected by new technologies, changing marketing and strategies of production. This leads to work-related musculoskeletal disorders (WRMSDs) among workers. For a safe future, Ergonomics helps to control musculoskeletal disorder, and so construction procedure is also improved, so ergonomics is necessary for the style of work and make the workplace safe for workers.

II. LITERATURE REVIEW

A. Literature Survey

The literature review is divided into various parts ergonomics and work-related musculoskeletal disorder, ergonomics risk assessment tool, ergonomics risk assessment

B. Ergonomics and work-related Musculoskeletal Disorder

WRMSDs are developed with time in the body due to continuous working at construction sites. Ergonomic risk factors at the workplace are workplace elements (conditions) and actions, or a combination of both, which cause physical stress to the body, thus increasing the risk of WRMSD. These include forceful exertions, awkward postures, repetitive exertions, segmental and whole-body vibration, contact stress, organizational factors, an environmental factors.

- 1) *Awkward Posture*: This is the relative orientation or position of the body segments while performing work activities. Body postures deviated from the neutral posture are. Awkward postures include bending, reaching, twisting, squatting, and kneeling.
- 2) *Repetitive work*: In this body, segments continuously performing the same activity for more times like bending, reaching squatting and kneeling. When there is more frequency of doing the same work for a longer period.
- 3) *Contact Stress*: In this activity performed with the tool, material, equipment due to contact with this thing, they are the stress there to do activities.
- 4) *Vibration*: Vibration occurs due to use of high vibrating equipment on a construction site for a more lengthy period of time.

III. RESEARCH METHODOLOGY

A. Ergonomics Risk assessment Method

The two observation-based methods used for residential building construction are

- 1) *Checklist (questionnaire)*: For musculoskeletal disorder (injuries) for construction the 1) Nordic questionnaire Discomfort in a body part) is used for risk assessment in the construction site. 2)Ergonomics checklist for physical risk factor like awkward posture, fixed posture, repetitive work, vibration, contact stress.
- 2) *Rapid Entire Body Assessment*: This ergonomic evaluation tool uses a precise process to estimate whole-body postural MSD and risks associated with job tasks. A single-page worksheet is used to evaluate required or decided body position, powerful exertions, type of movement or action, repetition, and coupling. The REBA was designed for straightforward use externally need for an advanced level in ergonomics or high-priced equipment. You only need the worksheet and a pen. On the other idea, you probably should finish reading and studying this guide, and I suppose a clipboard would help as well. Using the REBA worksheet, the evaluator will allocate a score for each of the following body quarters: wrists, forearms, elbows, shoulders, neck, trunk, back, legs and knees. After the data for each area is managed and scored, tables on the form are then used to collect the risk factor variables, producing a single score that represents the level of MSD danger:
- 3) *QEC (quick exposure check)*: QEC assesses the exposure of the four body areas at the greatest risk to the most critical risk factors for WMSDs. QEC has been designed to determine the differences in the presentation to musculoskeletal risk portions of the back, shoulders and arms, hands and wrists, and neck for ergonomic intervention includes the practitioner (i.e. the writer) who attends the evaluation, and the operator who has the direct practice of the task indicates the change in exposure records following an invasion
- 4) *Relative Importance Index (RII)*: Relative Importance Index (RII) was calculated for each of the factors so that the important an critical factors may be identified and proper preventive and remedial measures could be taken up. Th ranking of the factors in terms of criticality by response was found by Relative Importance Index (RII)

$$RII = \sum W/A \times N \quad (0 \leq RII \leq 1)$$

where W = Weight distributed to each part by respondents

A = highest weight, N=Total no of respondent

IV. CONCLUSION

The ergonomics risk factor associated with each selected activity from the residential construction site was identified using the RII (related importance index). For different activities,

there is a different risk factor associated with it. The risk obtained were based on the type of working method (conditions) for each activity. The musculoskeletal disorder for workers at residential construction site is determined by questionnaire and by finding RII rank, we got the workers exposed to the disorders for different activities. Thus the most important musculoskeletal disorder occurring in the selected activity were determined. The ergonomics risk assessment carried out using REBA shows that most of the workers for task selected are at high and medium risk level. The result shows that 37.8% of workers are at high risk, and 44.4% of workers are at medium risk. This indicates that the necessary action should be needed soon. Similarly, the risk assessment carried out through QEC showed that selected task average risk score shows that exposure level back, shoulder/ arm, wrist/hand and neck has a high and medium risk for all the activities. Thus changes need to be taken for the procedure of work.

Comparison of REBA and QEC risk exposure level using the Wilcoxon signed-rank test in SPSS shows that there is no significant difference in exposure level for REBA and QEC. In QEC, other factors like diving, vibration, work pace and stress were also obtained. This indicates that either method can be carried out for ergonomics risk assessment at the construction site.

Recommendation or Solution for ergonomics risk for musculoskeletal disorder on residential construction site

A. General Solutions

Ergonomics risk control on residential site is much needed as seen from the analysis that workers are exposed to ergonomics risk factor on construction sites. Suggestions were taken from the workers, supervisors, site engineers. We are asking workers how can they fit in a job properly considering working conditions, site engineer, and supervisor. Ergonomics programs should be conducted at regular intervals at construction sites. It helps the workers to work in proper posture, and thus ergonomics injuries can be avoided. There should be adequate awareness of operators to ergonomics. This programs also motivate the workers to work in the proper position. The engineer/ supervisor should also be trained for proper posture analysis so they can help workers to do it. There should be an adequate connection within the workers and the supervisors. The workers should also express their views and problems with the supervisor or engineer so that necessary steps can be taken. Supervisors or instructors should be placed at the site for proper helping the workers to guide them if they are working in the wrong position. If not special supervisors then managers or engineers should also guide. Job rotation and sharing of jobs is an important factor to control musculoskeletal disorder on construction sites. Related jobs can be most likely rotated for most of the activities. This helps workers not exposed to continuously on one or two body parts (discomfort don't occur). PPE (Personal protective equipment) are used, but changes in PPE equipment's needed. PPE should be improved. PPE should be designed ergonomically so proper control to risk hazard, eg. Gloves, helmets. For small sites, if they can't afford the mechanical equipment's they should consider ergonomically designe non-motorized equipment, the tool at the site as it is better than poor handling equipment's, tools and manually doing work.

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