Productivity Improvement Facilitated by PE Interventions in An Unorganised Sector - Brick Industry

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Abstract— This paper focuses on the application of participatory ergonomics (PE) intervention in an unorganized sector – Brick Industry. A participatory ergonomics model was designed for improving working conditions, quality, and productivity in a brick industry. It consists of a part that studies the literature on success factors in the process towards higher productivity and greater comfort. Evidence is found in the literature that a positive approach has benefits in terms of shareholder value and productivity, and for comfort. The PE intervention process is applied in a local brick industry. The workers participated in interview and expressed the discomfort they faced in the tasks they perform. The positive factor about PE intervention is that the workers themselves suggest the solutions when they are aware of the correct postures and the hazardous postures. This ultimately helped them to stay healthy and contribute towards a comfortable and more productive work.

Keywords: PE, Intervention, productivity

I. INTRODUCTION

With growing population India needs more shelters for people simultaneously the need for construction raw material is also increasing. The most basic building material for construction of houses is the conventional brick. Bricks are used in construction to make walls, pavement and other masonry work. The rising demand for bricks has created means of employment for many low skilled workers. During peak season the workers are under continuous pressure to meet the demands which sometimes leads to adverse effects on their health [1].

When compared at the global scale, Asia is the largest producer of brick, which comes out to be 87% of the total bricks produced. India is the second largest producer of bricks after China. Brick sector is one of the unorganized sectors in India though it has huge demand and widely spread with around 60.45% share in domestic product of the country [2]. Around 8 million workers are working in 1,50,000 brick units.

Brick industries work processes are hardly technology based and most of the work is done manually like molding, drying and firing. And most of the work is done in the dry months in extreme heat with an unorganized work culture. With adverse working conditions and relatively less skilled workers makes brick industry a zone of occupational safety and health hazards and calls for a need to initiate ergonomic interventions and above all participation of employees in the redesign of their work process may increase the chances of meeting the objectives with more assertion. Participatory ergonomics (PE) emphasizes utilization of employees' potential for conducting ergonomic improvements at work. The approaches and methods of PE differ from traditional ergonomics. PE specifies that end-users should be actively involved in planning and implementing ergonomics solutions.

II. LITERATURE REVIEW

Working with bricks leads to upper limb disorders. There are always symptoms of pain in shoulders, low back, wrists due to work. The work-related musculoskeletal disorders in a brick manufacturing industry has been studied by Mufamadi [58] with a focus on a sorting section. The project was designed using logical framework approach method due to it is simple. Twisting and bending of the trunk were identified as the major cause for most of the pain and discomfort and the need of corrective measures were suggested. The necessity of redesigning the workplace which reduces the twisting and bending of trunk and high speed of work has been addressed.

Apart from working postures there are other factors which lead to occupational health disorders like air pollution due to brick kilns. Bhanarkar et, al [3].Dust is a serious cause of pollution near brick kilns. The good housekeeping required to reduce the fugitive dust emission. Development of green belt around the brick kilns may be an effective mitigation mechanism for fugitive emissions.

The brick industry is the most unorganized sector in India where the workers encounter morbidities due to indecent work and the living environment is not hygienic due to which most of their income is spent in health care [4] out of which most of them are infections and injuries. Almost 57 % of them reported a loss of household income in their treatment. Among those, only 10% of the brick workers covered by healthcare schemes, rest of the 90% did not possess health insurance. The workers do not avail a proper treatment because of unaffordability as well as the inaccessibility of healthcare facilities. Hence avoiding work related health hazards through ergonomic interventions which are participative in nature can be one of the positive step towards betterment of brick industry workers.

Every industry either organized or unorganized strive to improve the productivity. Brick industry is an industry where most of the work is still done manually leading to unsafe working posture and fatigue [5] consequently causing orthopedic and ophthalmological diseases which hinder the productivity due to absentia of the workers.

Designing an appropriate questionnaire which addresses all the corners of the issues present in an unorganized sector like brick industry and a statistical analysis of the resulting data [6] will give important and scientific insights into the problems which of course will help in finding the optimum solutions. The demographic

details of the workers are very important part of the work analysis. Long-term brick kiln workers, who adopt a specific posture for prolonged periods, have severe musculoskeletal pain that interferes with activities of daily living and reduces job satisfaction. Health education on frequent postural change, implementation and monitoring of laws among unorganized industries are recommended to bring down morbidity due to musculoskeletal disorders (MSD). Prolonged years at service and overwork also have significant impact on the prevalence of MSD. This study recommends detailed research, health education to the workers, implementation and monitoring of laws in unorganized sectors to tackle morbidity related to MSDs.

There is sequence of steps in making of the bricks. Every step has its own way of lifting, bending postures along with varying weights. The weight of the material being lifted has an important impact on which part of the body comes under stress [7]. Composite Lifting Indices (CLI) for different tasks needs to be calculated and the lifting tasks must not exceed recommended weight limit (RWL).On the basis of CLI and RWL, the tasks needed to be redesigned from an ergonomics perspective to avoid the risk factors.

Though brick industry seem to be a simple unorganized sector but there is a huge variation in terms of age of workers, type of work involved and the impact differs on female workers and male workers and which part of the body is under stress. Ergonomic interventions like training the workers, using protective equipment and modification of the some of the working styles and equipments are needed to meet the safety objectives [8].

When it comes to the discussion on ergonomics most of the literature describes about the musculoskeletal disorders but apart from MSD there are many more issues and health hazards which are chronic and need immediate attention in case of brick industry workers[9].

The machines must be designed in such a way as to promote good postures and most importantly the work distribution must be done by considering the personal characteristics and ability of each employee, as per their weight, height, age, sex and level of health[10]. Also short and repeated pauses will help the muscles to regain.

North Karnataka is a region where the temperature is high during most of the months of the year. Working in brick industry with open kilns will expose the worker to further higher temperature along with manual lifting and load handling for longer hours. RULA and REBA based analysis indicates that different parts of the body are exposed to MSD and need ergonomic intervention [11].

III. METHODS

A. Subjects

Since it was a small enterprise hence all the workers were involved in the PE intervention process. The participants were motivated to participate. The objectives and aims of the study were made very clear to all the participants before the start of the process.

B. Work Related Interviews

Since the workers in the brick industry are not very educated, a semi pictorial questionnaire was prepared and a one to one interview was conducted. Since the literacy level was very poor it took more time for the workers to realize the importance of such programs and every question was elaborated to them and then their answer was recorded and it was done during working hours in session wise. The following important information was extracted during the interview.

1) Weight, height, age, gender, no of members in family.
2) Pain or uneasiness in different part of the body through revised Nordic Questionnaire.
3) Their part of job, working hours, their years of working in the current firm.
4) Their migration history.
5) About health history and diseases.

C. Workplace Analysis

Each and every step in the process of making brick was observed carefully. Photos were captured for every process. Every posture was then analyzed including material handling. Each task was given a detailed description on how it is performed. This process was done to recognize the demands of each and every work and to list out the risk factors to which the workers are posed.

1) Physical features of the Workers

Parameter	Mean(SD)
Age	27.5(± 8.9)
Height	150.6(± 10.5)
Weight	42.6(± 8.6)
Years of Experience	3.9(± 7.5)
Duration of Work per day	9.3(± 2.1)
Body Mass Index	22.6 (± 3.6)

2) Work Related Risk Factors

1) Weight and size of the Load ----- 4KgWhen Wet 2.5KgWhen Dry, Size (9x4x4)
2) Frequency and Duration of the task

2000 bricks molded by 4 labors from early morning 4 AM to 1PM with an hour rest. Hence on an average 500 bricks are molded in 8 hours by each labour around 70 bricks in one hour.

3) Horizontal and Vertical locations of the load relative to the worker
4) Climatic conditions in which the work is being done
5) Appropriate lighting as per the work demand: Poor lighting arrangement for the early morning session work.
6) Body parts exposed to extreme weather conditions.
7) Clothing used during the work
8) Method of payment: Salary is paid on the number of pieces calculation.
9) Staying conditions after work. - Shed house in the near area. No greenery and no plantation to overcome the effect of pollution due to kilns.

D. Proposed PE Process

The planned PE process is implemented under the following structure.

1) Permanence – Its planned to implement a temporary PE process and evaluate the results
2) Involvement – Workers which are a part of every process of brick making are considered for the participation which we consider as direct participation.
3) Level of Influence – Entire firm
4) Decision making-individual Consultation
5) Mix of Participants – The very structure of an unorganized industry is that it is not structured and power delegation is not hierarchical, the owner of the firm is the only decision maker. So mixing of participants is not an option but all of them are attended at once.
6) Requirement – Its ideal and appropriate to involve compulsorily everyone but once they are convinced with the objective of the project they will obviously come voluntarily.
7) Focus – The main focus of the process is to bring awareness about the occupational safety and health, how ergonomics can facilitate in making their work comfortable for them and ultimately the importance of their participation in redefining their work with this perspective.
8) Remit – Work place Analysis – Identify the Ergonomic issues-Involve workers – Find the solution – Implement – Evaluate
9) Role of Ergonomics specialist –Motivate the workers for participation-Be one among them – Train the participants by combining ergonomic solutions obtained for the inputs provided by the workers, be available for consultation.

IV. PHASES OF IMPLEMENTATION

During phase-1 of the PE process the owner of the firm is taken into confidence about the objectives of the project and importance and need of such interventions and low-cost improvements. Ultimately the oral permission is taken from the owner of the firm for starting the process.

Workplace Analysis- Productivity and comfort are end results of a process. So, a part of its success is determined by the way in which the process is organized. The goal of the process is to achieve a more comfortable and productive working environment. Surveying ergonomics problems at their workplaces together with the people involved. This phase included a holistic analysis of the current situation in the case and control factories, familiarization with their routine activities and measurement of selected indices and variable. Assessment of some selected organizational indices such as the amount of waste of raw material (the Productivity Index), Measurement of environmental factors such as lighting. Assessment of personal indices such as the quality of working life score, using a standard questionnaire based on Walton's (1973) quality of work life model, and pain score, using a body map.

The phase-2 of the project talks more about the participation of the workers and implementation.

In this phase meetings are planned with the workers. Since the workers are not that literate, most of them have some basic schooling and some not even that. Hence designing a questionnaire has to be done very carefully and conducting the interview was done one to one which took more time. Following are the important processes as opined by the workers and the ergonomic facilitator that need to be changed, improved and added for obtaining a better working condition.

From the first step of the start of the brick making work each and every detail including all the aspects of workplace comfort has been tried to understand and analyze through questionnaire and field visits and with the combined effort of the ergonomic facilitator and the workers the following issues have been finalized as the feasible and realizable issues to be taken up for intervention to meet the objectives.

Phase-3 of the process is to check the results and to validate the targeted objectives have been met and if not than they will motivate us to do further in the same field with better intervention ideas and methods.

The feedback questionnaire was prepared with marking 'yes', 'no' and as mentioned there was a one to one filling of the questionnaire due to lack of reading abilities of the workers. The owner of the firm was also included in the evaluation phase. The results are validated on a qualitative basis, because in an unorganized sector where ergonomics is totally least important and the motivation level of the workers towards such programs is not that appreciable. Hence the results can be listed out as follows.

1) The awareness about ergonomics was brought and the importance of their participation was realized.
2) By the knowledge obtained about the hazardous postures through training, now workers are handling the material more cautiously.
3) By the introduction of hand glows there is slight reduction in complains about the hand and palm pain
4) Since the basin is changed from the metal to light weighted plastic, lifting is less stressful as reported by the workers.
5) The intermittent breaks helped the workers to hydrate themselves in between the work which of course reduced muscle fatigue and increased productivity as it was mentioned by the owner and there was wastage of material was optimized and quantity of low-quality bricks was reduced.

V. CONCLUSION

This study showed that stakeholder involvement and ccollaboration were important facilitating factors. Since there is no law enforcement in unorganized sector, the workers were not having any kind of health insurances. The schemes and facilities towards empowering the unorganized sector workers need to be thoroughly brought into practical use. The workers were made to stay around the space near the BKU which is contaminated by the process of brick firing; hence there is a need of sufficient plantation around the BKU which was not found. Hence overall the study work attempted some of the low-cost participatory interventions towards bettering some aspects of the work life of workers working in BKU and it was satisfactory and motivates to conduct many more such interventions.

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