ENHANCEMENT OF PRODUCTIVITY IN TEXTILE INDUSTRIES THROUGH WEAVERS ERGONOMIC FACTORS

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ABSTRACT

Hand loom is one of an ancient method and it is most widely used in India. Large scale of textile production is dependent upon the handloom process throughout India and many people lifelike based on the weaving. It employees skilled and unskilled workforce in the production and they make weaving as their profession. In earlier days they do the weaving in leisure time now it became as a major work for them. Now a day’s weaver’s is working for a long time in a handloom. So they are affected by physical and mental stress in weaving process. The main aim of this paper is to improve the weaving method and to increase the handloom productivity with effective output by weavers. A questionnaire is framed to conduct the survey on weavers to reduce the stress and difficulties that they are affected during weaving based on ergonomics and SPSS software. After analyzing the problems of weavers, the
necessary suggestions and some changes in weaving process are given to improve their work without stress.

Key words: Handloom, Weavers, Ergonomic Issues, Productivity, SPSS Method.


1. INTRODUCTION

Ergonomics is the scientifically concerning with the understanding of combination analysis among humans and other components of a system, and the profession that applies theory, principles, data and methods to design in order to improve human well-being and overall performance. Human factors and ergonomics is a multidisciplinary field incorporating contributions from psychology, anthropometry engineering, industrial design, statistics and it is helpful to study of designing equipment and devices that apt to human body and its cognitive abilities. Proper ergonomic design is necessary to prevent repetitive strain injuries and other musculoskeletal disorders, which can develop over time and can lead to long-term disability. If the workplace and environmental condition of the industry are often unsatisfactory then it will decreases the productivity. So a study of ergonomic factors or facilities affecting worker’s in weaving is important. In a weaving industry ergonomics plays a major role, if proper ergonomic facilities are not provided it will affects the performance of the company.

2. LITERATURE REVIEW

The work and time study techniques is raising the efficiency of utilization of the factors of production have been used for all manufacturing and service sectors as a scientific approach were discussed in several papers [1-5]. In the content of study a product is analysed in terms work/time during the process of model production. In order to measure efficiency of product, time survey is made and by the help of that method standardized time is calculated. Actual time and standardized time is compared and as a result it is aimed that measuring inevitable times and take necessary precautions against them [6-9]. The concept of value engineering, its job plan and the effective implementation of it through a case study were discussed. Efforts have been put into the articulation of the paper to make it coherent which can be easily perceivable [10-12]. A case study has been discussed and an analysis has been carried out by this process to achieve the product optimization. Various tools are used for the analysis of the product while evaluating the product at different phases. At the end the results obtained after implementation of this technique are discussed [19-22]. The performance analysis is the ongoing monitoring and reporting of functions accomplishments, particularly progress towards pre established goals was represented. This work describes a case study which is under observation, by preliminary
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analysis several issues are came out which is hampering the performance of production line so to analyzing the production line and find out issues to enhance the production line which is a need. To measure the performance of production line OEE method is used [23-25]. Based on the above literature an attempt was made to increase the productivity by adopting the appropriate ergonomic factors in the textile industries.

3. METHODOLOGY

The framework of the project is shown in Figure 1, from analysis the nature of work to find the ways to enhance the productivity is explained.

![Methodology flow chart](image)

**Analysis the nature of work:** Before finding the risk factors through questionnaire the weavers Welfare measures, working methods, physical motions, safety and the environmental factors of weaving workstation and feasibility study is done on the questionnaire and unwanted questions are removed. Only questions that is relevant to weaving are added

- To identify physical, environmental, cognitive and organizational ergonomics risk factors through interview with weavers with questionnaires contain questions on ergonomic risk factors.
- To made statistical analysis by using answers provided by weavers.
- To find out which risk factor affects the weaving.
- To provide possible suggestion to reduce fatigue and to get improved ergonomics which relieves the weavers from stress hence improves their productivity.

**Questionnaire development:** The idea got from analyzing the performance measures has analyzed to prepare a questionnaire. The questionnaire contains 66 questions of 5 point scale. It has 5 different scales as follows:

- Job stress
- Organization factors
- Anthropometric factors
Environmental factors
Welfare measures

**Tools used:** Two types of tools are employed in finding the weavers performance measures. They are as follows:
- Questionnaire
- Interviews

**Questionnaire:** A questionnaire was developed by us to collect the data to find out the risk factors. The questionnaire was developed as per the pre assessment made on the workplaces. The questionnaire consists of 66 questions in 5 scales. Each scales having equal number of questions.

**Interviews:** To know the weavers performance through interview schedule method. Interviews are based on the ergonomic factors that affect their performance. Since factors or problems faced by weavers on different sectors in the workstation. Attitude of each and every worker towards workstation will be different and can be traced more efficiently through interviews based on their working and personnel factors.

4. **DATA COLLECTION AND ANALYSIS**

The study of performance measures through weavers was conducted among the weavers in work place. Data collection was done through questionnaire method and according to their answer it is recorded in five point scales. (Strongly agree, agree, disagree, Undecided and strongly disagree), questionnaire are selected based on the ergonomic factors, ergonomic factors are considered from the weavers work and from their adopted condition, this are aspects taken to frame out a question.

**Physical Ergonomics Factors**
- Working Postures
- Musculoskeletal
- Anthropometric

**Cognitive Ergonomics Factors**
- Stress
- Working place
- Co-weavers

**Organizational Ergonomic Factors**
- Facilities
- Incentives
- Wages
- Hospital benefits

**Environmental Ergonomics Factors**
- Heat
- Sound
- Light
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- Noise
- Illuminations

5. QUESTIONNAIRE FRAMING AND SURVEY

The study is based on framed out questionnaire and survey, review is done to check the after questionnaire is selected in order to check the reliability of the questionnaire. By conducting the study we can find out the initial response about the questionnaire and the modifications needed on the questions can be made finalized and also suggestions where asked from ergonomists based on selected questionnaire. The selected question grouped together in the basics of ergonomic factors.

5.1. SPSS Software for Analyzing

SPSS is a Windows based program that can be used to perform data entry and analysis and to create tables and graphs. SPSS is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more. SPSS is commonly used in the Social Sciences and in the business world, so familiarity with this program should serve you well in the future. SPSS is updated often. This document was written around an earlier version, but the differences should not cause any problems. If you want to go further and learn much more about SPSS, I strongly recommend Andy Field’s book (Field, 2009, discovering statistics using SPSS). Those of us who have used software for years think that we know it all and don’t pay a lot of attention to new features. I learned a huge amount from Andy’s book.

5.2. Statistical Analysis

The reliability analysis of various factors are analysed and the results of the loading range for the different factors are given in Table 1.

Table 1 Results of Reliability Analysis

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Factors</th>
<th>No. of Items Used</th>
<th>No. of Samples Taken</th>
<th>Loading Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Physical Ergonomics Factors</td>
<td>20</td>
<td>25</td>
<td>0.602-0.680</td>
</tr>
<tr>
<td>2</td>
<td>Cognitive Ergonomics Factors</td>
<td>01</td>
<td>25</td>
<td>0.679</td>
</tr>
<tr>
<td>3</td>
<td>Organizational Ergonomics Factors</td>
<td>07</td>
<td>25</td>
<td>0.614-0.633</td>
</tr>
<tr>
<td>4</td>
<td>Environmental Ergonomics Factors</td>
<td>01</td>
<td>25</td>
<td>0.627</td>
</tr>
</tbody>
</table>

5.3. Bar Chart

The various factors affecting the productivity and physical ergonomics were analysed and results are given in the following Figure 2 to Figure 8.
Figure 2 Frequency Results of Neck

Figure 3 Frequency Results of Arm

Figure 4 Frequency Results of Lower Back Bone
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**Figure 5** Frequency Results of Upper Back Bone

**Figure 6** Frequency Results of Knee after Weaving

**Figure 7** Frequency Results of Knee Joint
Similarly, the frequency results were analysed regarding the family issues, illumination and other factors related to the productivity are shown in the following Figure 9 to Figure 11.
6. RESULTS AND DISCUSSION

6.1. Physical Ergonomics

**Neck:** Weaving involves highly inspection job, where the weavers spend more than 8 hours. The weavers were found to adopt different types of posture continuously and repetitively for performing weaving. Above all these circumstances, there is backrest to relax during rest pauses.

**ARM:** Chair arm rests should be provide. They should allow the user's arms to rest comfortably and shoulders to be relaxed. The elbows and lower arms should rest light.

**Lower and Upper Backbone:** Lower back support in an ergonomic chair is very important. The lumbar spine has an inward curve, and sitting for long periods without support for this curve tends to lead to slouching (which flattens the natural curve) and strains the structures in the lower spine. An ergonomic chair should have a lumbar adjustment (both height and depth) so each user can get the proper fit to support the inward curve of the lower back.

**Thigh:** Anterior part of the thigh muscle hit the cloth beam with the upward movement of the legs for oscillatory treadle operation, as there exists clearance space. Hard edge of the plank digs posterior thigh muscles with downward movement of legs while treading. The seat height take into consideration the political height of the weavers and in almost every handloom unit, it was found that the foot only partially reaches the ground.

**Knee and Knee Joint:** The gap between two treadles is only about 6 to 8 cm which results single leg to operate both the two treadle so leg is automatically free pain in the leg change to another leg so, reduce the knee and knee joint pain.

**Foot:** Treadles made from thin bamboos which turns smooth and slippery due to regular use, gives minimum pressure pressing pedal by using foot to reduce the foot Pain.

6.2. Organizational Ergonomics Factors

Necessary hand tool and weaving material are kept within easy to reach By weavers in the workplace for working comfortable and safe so, we can reduce the unwanted movement and wastage production weaving time.

6.3. Cognitive Ergonomics Factors

**Relax and Breathe Deeply:** Whether you are feeling overwhelmed by the amount or work you have to do or if someone is "in your face", a good thing to do is to "breathe through your
nose”. You can't get as worked up if you force yourself to breathe through your nose. Your body simply can't maintain the same level of energy without that extra oxygen you get when breathing through your mouth.

**Take More Breaks from Your Work:** Even a five-minute break will help. Get away from your desk. Go for a walk - outside is better, but up two flights of stairs and back down is good too. Getting more exercise in general will help you reduce your overall stress levels and that will make it easier to reduce your stress level at work.

6.4. Environmental Ergonomic Factors

**Illumination:** Light is universally understood as essential to the human condition. Lights of different wavelengths also affect blood pressure, pulse, respiration rates and brain activity. Over-illumination can be reduced natural sunlight whenever possible, turning-off lights when leaving a room, or changing the type of light bulb.

7. CONCLUSIONS

In this study, factors affecting workers productivity and its relation with ergonomics were analysed. From the assessment, it was found that the productivity is affected related to ergonomic factors. A questionnaire has been prepared according to my assessment which is related to the working environment in work place and a survey is conducted among weavers of different weavers. From the result obtained from the survey T-test has been conducted to find out ergonomics risk factors which affect workers productivity. The finding of the study through subjective assessment of body pain, checklist analysis and direct observation suggest that there is a high prevalence of ergonomic risk factor related to the present handloom workplace in the weaving units and suggesting that ergonomic intervention is require in the present work situation.

To counteract the negative effect of the adopted posture during weaving operation, the backrest would be required for back muscle support during rest pauses. Seat with any backrest inclination reduces intra-disc pressure which increases lumbar nodes and reduces low back pain. Backrest reduces load on the seat which eventually reduces stress on the spinal and paraspinal structure. Backrest can be provided so that the user can use it whenever required. In a similar study it was found, backrest reduces some of the trunk loads and helps to prevent vertebral strain.

REFERENCES


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