CHAPTER 3

AN INVESTIGATION OF ERGONOMIC FACTORS IN IBS MANUFACTURING PLANT

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Abstract

Ergonomics is the behavior, ability and limits for creating a systems, machines, tools, tasks and work environment that is productive, safe and effective for human use. It is a common problem in the Industrialized Building System (IBS) manufacturing without being noticed by workers. Hence, a method must be implemented so that this problem can be solved. In particular, the research was carried out to identify activities that can lead to ergonomic, therefore it will providing the solution to the workers when they do work. For data collection, questionnaire was used to carrying out this research, the questionnaire was distributed to workers in IBS manufacturing. After that, the data was analyzed statistically. Data were processed by using the SPSS software as method to get the relative index and frequency of percentages. The workers are satisfied with the solution to ergonomically. The results of this research are expected to help the workers from determining cause and solution to ergonomic and it will prevent this problem from recurring. Then the parties are involved in IBS manufacturing can give full attention to ergonomic factor.

Keywords—ergonomic factors, IBS, manufacturing plant

1. INTRODUCTION

Construction activity in Malaysia is a source of economic development and industrial infrastructure. It is the heart of the country's socioeconomic development, the construction industry to generate jobs and contribute to the industrial sector to another. At the same time, several of technologies that has been used to improve the quality and reduce the risk of the development of the country, including in the Industrialized Building System (IBS). IBS is a method in construction that is built using prefabricated components.

The IBS system already exist a long time but has no market due to lack of exposure on this system. Furthermore, to avoid this problems, Kementerian Kerja Raya Malaysia (KKR) create a strategies to replacing conventional method of construction to the IBS system. This is because it can reduce labor costs, duration of time to completing the construction, safety at workplace and at the same time to improve the quality of construction by reducing waste at the construction materials...
[1]. The implementation of this system is very important to reduce foreign workers and reduce the cost of construction activity [2].

Therefore, when the IBS system is used, the risk of ergonomic aspects in IBS Manufacturing should be upgrade. Manufacturing is a dangerous occupation sectors others that construction, agriculture and service industries [3]. This is because, the workplace is set up based on the efficient movement or the perfect place to put the machines and tools without taking into the situation of workers. The reduction in error and increasing a productivity toward a workers will give effectiveness and efficiency in work [4]. Normally, workers had to adapt in any situation at work without being aware of the potential health risks experienced. Unfortunately, the human body cannot be adapted to all situations. Incompatibility between the ability of workers and the work will lead to inefficiencies in production, a decrease in the quality of work, increased levels of errors, accidents and shift work.

However, safety aspects in ergonomics should be taken seriously and find a solution. This is to prevent accidents from happening. The organization or employer in this industry need to be sensitive to the issue of occupational safety and health to ensure any employees in the organization. Employers and employees must work together with responsibilities for safety and health at work. This is to ensure the safety, health and well-being of every employee in every organization will be more secure. Reducing a level of productivity is the failure of companies to give priority to the safety of workers.

Therefore, the priorities in the development is to protect the safety of workers from injury. Accidents and injuries at construction sites can be avoided if a good safety program will take place and at the same time increase the productivity of workers [3].

2. MANUFACTURING OF INDUSTRALIZED BUILDING SYSTEM

The IBS is a method in construction that is built by using prefabricated components. The risk of ergonomic aspects in IBS Manufacturing should be upgraded. Ergonomics associated with human and equipment and usually involves the interaction between humans and the environment [2]. This is because the work that arranged and productive work based on an efficient of movement. Normally, workers had to deal with the risk of not realizing the potential health risks experienced. Unfortunately, the human body cannot be adapted to all situations to face many obstacles and risks. Incompatibility between the ability of workers and the work will lead to inefficiencies in production, a decrease in the quality of work, increased levels of errors, accidents and shift work. By Board of Certification for
Professional ergonomists (CPE) (1993), ergonomics interpreted as 'how to adapt to the needs of working abilities and human capacity'. Indeed, ergonomics is important in ensuring safety, health, comfort, effectiveness and quality of each workers.

2.1 Ergonomic Principles

There are 12 of ergonomic principles that need to be addressed to maintain safety and health to the workers and applied in a working systems [3]. Figure 1 shows Ergonomic principles.

![Figure 1: Ergonomic principles](image)

2.2 Ergonomic Risk Factors

Ergonomic risk factors will occur is an awkward postures, excessive force, repetitive works, static posture static postures; sustained exertions, contact stress and external factors / environment such as vibration, light, temperature and sound [3]. Working attitude that is not suitable with of the body can cause physical complaints such as pain and muscle disorders [6]. Exposure to ergonomic hazard is a risk factor for early warning of serious problems that are more progressive physical signs and symptoms that can lead to serious injury. Disclosure long period of time to risk factors will reduce the quality of life.
2.3 Strategies to reduce ergonomic factors

In IBS manufacturing, risk factors and ergonomics factors is evaluated carefully. This is because, the workers use a variety of body movements and posture to make something work. This is very important and strategies so that problems related ergonomic problems is by not occur in IBS Manufacturing. According to [6] ergonomic problems can be solved as in figure 2.

![Manual Handling Tasks](image1)

<table>
<thead>
<tr>
<th>Manual Handling Tasks</th>
<th>Hand-Intensive Task</th>
<th>Repetitive Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Identify the weight and place to transfer of material and the equipment.</td>
<td>• Resting when necessary, especially when doing repetitive work</td>
<td>• Exchange the work to avoid a repeated activities.</td>
</tr>
<tr>
<td>• Choosing operation method that is suitable to transfer material or the equipment.</td>
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Figure 2: Ergonomic solutions
Source: (Attwood et al., 2004)

3. ERGONOMIC FACTOR ASSESSMENT

The research methodology of this study is to ensure that the data collection methods used to be achieved the objectives. Figure 2 below describes briefly the overview of the process and workflow involved in the study.

![Methodology flowchart](image2)

Data were collected through the questionnaire of 88 of respondents. Then, the data has been analysed to find the factor and solution related to ergonomic problems in IBS Manufacturing. Data in this study were analysed by using Statistical for Social
Science (SPSS). The purpose of using SPSS is to determine the frequency distribution, central tendency and the standard deviation of the normal distribution of the data obtained. In overall, the researchers are used the method of frequency analysis and index of relativity (RI). RI was calculated using the formula below [3]:

\[
RI = \frac{\Sigma (1n1 + 2n2 + 3n3 + 4n4 + 5n5)}{5(n1 + n2 + n3 + n4 + n5)}
\]

Where,

\( nx = \) The number of respondents who agreed with the choice of \( x \)

\( x = 1, 2, 3, 4 \) & \( 5 \) as described below:

1 = Frequency for feedback "strongly disagree"
2 = Frequency for feedback "disagree"
3 = Frequency for feedback "moderate agree"
4 = Frequency for feedback "agree"
5 = Frequency for feedback "strongly agree"

RI will categorized in range of two to one decimal, in which the decimal is strongly disagree and one is strongly agree. Scale to determine the classification of the index scale relativity is as follows:

Scale relativity is as follows:

i. Strongly disagree \( \leq 0.2 \) Relative index \( < 12:35 \)
ii. Disagree \( 0.36 \leq \) Relative Index \( < 0.51 \)
iii. Moderate agree \( \leq 12:52 \) Relative Index \( < 0.67 \)
iv. Agree \( 0.68 \leq \) Relative Index \( < 0.83 \)
v. Strongly Agree \( 0.84 \leq \) Relative Index \( < 1.00 \)
4. ERGONOMIC FACTORS

To get good information about factor in IBS manufacturing, the questionnaires that have been given to the workers. Total of 88 questionnaires were distributed to workers involved in each activity of formwork, reinforcement work and concreting work at IBS manufacturing plant. From the result obtained, this research was analyzed by using Statistically Pakages for Science Social (SPSS). The results obtained from the questionnaires were analyzed using frequency analysis methods and methods of Relativity Index (RI).
4.1 Ergonomic Critical Factors

From the analysis of the collected data, it can be concluded that the total top six of relativity index from the questionnaire list ergonomic factor while doing the formwork, reinforcement work and concreting work which it representing agree category only and it arranged according to arrangement that is highest value the Relativiti Indeks.

4.2 Strategies to Reduce Ergonomic Factors

Activities that are critical to the ergonomic in IBS Manufacturing will affect the workers. Among the injuries on the outside of the physical body and the body whether its effect on long-term or short term. So that, There are several solutions that can be adopted to reduce, prevent injuries and accidents. According to figure 4, figure 5 and figure 6 shown below, for the majority of workers in IBS Manufacturey stated to Yes for the questions given.
Figure 5: Solution of ergonomic factors for reinforcement work

Figure 6: Solution of ergonomic problems for concreting work
5. CONCLUSION

In conclusion, all parties must recognize the importance of ergonomic problems in IBS Manufacturing and concerns as well as to redouble our efforts to solve the problem. Proper work procedures for carrying out IBS manufacturing needs to be applied to the workers. The workers must cooperate with the employer to comply with the terms and instructions so that the ergonomic problem can be reduced and maximize productivity. If all parties involved in the IBS construction industry, it can carry out the responsibilities and roles of each of these problems can be solved with simple ergonomics while improving productivity and work efficiency.

REFERENCES


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