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# ERGONOMIC ASSESSMENT IN WOOD-BASED PRODUCTION SITE: A PRELIMINARY STUDY

**Nor Fadiana Amat Rahim[1], Sharizal Ahmad Sobri[2], Wan Omar Ali Saifuddin Wan Ismail[3], Andi Hermawan[4], Mazlan Mohamed[5], Boon Jia Geng[6], Teo Pao Ter[7], Norshah Afizi Shuaib[8]**

[1,2,4,5,6,7]Advanced Material Research Cluster, Faculty of Bioengineering & Technology, Universiti Malaysia Kelantan, Jeli Campus, Kelantan, Malaysia
[3]Faculty of Innovative Design & Technology, Universiti Sultan Zainal Abidin, Gong Badak Campus, Terengganu, Malaysia
[8]School of Manufacturing Engineering, Universiti Malaysia Perlis, Pauh Putra Campus, Perlis, Malaysia
[2,8]Green Design & Manufacturing Group, Centre of Excellence Geopolymer & Green Technology (CEGeoGTech), Universiti Malaysia Perlis, Perlis, Malaysia
[2]Global Entrepreneurship Research & Innovation Centre (GERIC), Universiti Malaysia Kelantan, Kelantan, Malaysia
E-mail: sharizal.s@umk.edu.my

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**ABSTRACT:** Ergonomic deficiencies are considered to be the major causes of workplace safety hazards, inadequate security and decreased productivity and performance of workers. Ergonomic assessment is an unbiased assessment of the risk factors in the work environment that may lead to musculoskeletal injuries or accidents of workers. This case study focuses on the ergonomic assessment in the production site of a wood-based product company in the state of Selangor, Malaysia. The aim of this case study is to identify the risk factors in such a way that the organization can make significant improvements to the operating climate. During the observation period, major ergonomic deficiencies and lack of awareness among employees occurred at the production site. The results are capable of demonstrating the value of protection for workers and as a reference point for the wood-based industry. Employees and employers should therefore play a vital role in implementing a successful ergonomic practice.

**KEYWORDS:** Ergonomic assessment, Work environment, Safety, Productivity, Factory layout design.

## I. INTRODUCTION

The ergonomic assessment, also considered a workstation assessment, evaluates an individual's work place to ensure that it is constructed to prevent injury and increase efficiency. The tests help recognize the ergonomic hazards such as repeated activities which can trigger tensions, inadequate design of the work area, and inappropriate use of equipment that may contribute to the creation of work-related musculoskeletal disorders (MSDs) [1]. International Association of Ergonomics (IEA) states that human factor or also known as ergonomic is the scientific discipline connected with understanding person and other element relationships. It is the practice that applies design theory, concepts, data, and methods to maximize human health and overall efficiency of the system [2]. In order to prevent both catastrophic and non-catastrophic injuries, it is possible to manage either controllable or uncontrollable variables within the workplace by developing an ergonomic concept for the design of the workplace [1]. Ergonomic defects are known to be the major causes of workplace health risks, a poor degree of protection and a decreased productivity and efficiency of employees.

Effective use of ergonomics in the design of the workplace may result in a combination between the qualities of the worker and the specifications of the work. It will improve the productivity of workers, provide wellness, mentally and physically well-being and work satisfaction to workers. Several research studies have provided promising results on the application of ergonomic principles in workplaces, computer design, job design, environment and facility layout [3].

A private-limited company founded in 2016 specializing in restoration, interior design and decoration for residential and commercial purposes. The business is located in Shah Alam, Selangor, Malaysia. The services and items offered by the firm include wainscoting, 3D architectural designs, custom doors, arches and borders, decorative panels and other services related to interior and restoration. The company has agreed not to reveal its name, but the company is permitted to publish the findings of this case study.

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Ergonomics studies have developed data and recommendations for industrial applications. The characteristics of the ergonomic nature of equipment, workstations and applications are well established [3]. Indeed, there is still a low level of acceptability and minimal implementation in the industrial sector, especially in the small manufacturing sector. The construction of machinery and facilities is the main concern of the design of the work system. Inadequate or inadequate attention is given to the job system overall [4, 5]. Failure to follow ergonomic standards causes inefficiency and suffering to the user. Ergonomically deficient workplaces can affect emotionally and physically stress, rising inequality and reduced quality of the product [6].

While health and safety experts have worked and urged to improve the safety and health of employees at workplace, ergonomic approaches are still seeming as one of the issues in the company. Therefore, this study was conducted to analyse and help to improve the workability and workplace design in this company to make working conditions better thus increasing the productivity.

## II. THEORETICAL BACKGROUND

Physical discomfort is always existing in human wellbeing. Low physical stress, such as bed rest, joint immobilization, or space travel, causes short-term damage. Long-term poor performance is associated with a variety of musculoskeletal, neurological, physiological, and behavioral and various disorders [7]. World Health Organization (WHO) has classified "work-related" diseases as multifactorial, suggesting that a variety of risk factors such as physical, occupational, psychosocial, socio-cultural, individual and organizational can contribute to the spread of these disorders [8]. Musculoskeletal disorders (MSDs) have been known as having occupational etiological causes since earlier of the $18^{th}$ era [9].

Ergonomics is the science of fitting a worker's task. Designing work stations and equipment to minimize MSDs will help employees remain safe and help the company minimize or remove high costs dealing with MSDs. Ergonomic problems were often being associated with computer or mouse, but in fact there are many motions that can cause MSD conditions such as repetition, awkward postures, force, vibration, static motions and quick motion. Works such as manual handling, heavy lifting, twisting movement, manufacturing and productions are likely can be a cause to MSD [10].

In [11] has provided a way of assessing when activities are perceived to be extremely repetitive. He claimed that a process with a cycle time of lower than half a minute, or more than half percent of the cycle time requires conducting the similar sort of fundamental loop, may be categorized as highly repetitive. Providing a variety of jobs is one way to reduce the likelihood that consumers will encounter signs of ill health. In factory environments, workers conducting extremely repetitive assembly-type operations would be given a work rotation, in which they would switch from one role to another for a period of time. The goal of rotation is to give them a break from a specific feature of a process that may be deemed dangerous by transferring them to a completely different role where the previously defined dangerous item is not present [12].

In order to promote the use of ergonomics, ergonomists need to prove that this will offer greater benefits than costs. Ergonomics is not a method that needs to be used just once or just several times. To be successful, it is necessary to retain ergonomics as a resource that should be used every day in the workplaces [13]. While it has been recognised for improving the workplace by understanding workers' characteristics, equipment and software specifications for systems and working practices in accordance with ergonomic concepts, there are several problems that ergonomics should and would resolve. This change will contribute to the protection of staff and the quality of work. It can also contribute to the quality of life by providing reliable and secure communication networks, increasing efficiency and minimizing costs [13].

## III. METHODOLOGY

Adopted from the method by [3], the ergonomic assessment in production site can be assessed through these system components: the worker/human operator, machinery, task, work station, environment, and management by individually observed the workers at the company. Materials for the assessment, such as the checklist, the ergonomic evaluation form and the risk factor guidelines, were used and collected from the OSHA database [14].

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## IV. RESULTS AND DISCUSSION

The ergonomic assessment was based on the observation in production site of the company. Firstly, the workers or the human operator. The production performance in the company is largely depends on the workers. However, there are no ergonomic and safety training provided in this company. Training and awareness are required not only to warn people on what they are doing when at work in order to prevent premature exhaustion, injury or discontent; training should also draw attention to the potential implications of working in unsuitable gestures and the serious adverse effects of bad habits. The purpose of the training would be to ensure that the staff prevents injuries or ill health as a result of their manner in which they do the job [12].

**Figure 1. The coating process**

**Figure 2. Manually sanding process with unsuitable chair provided**

Bad work practices such as no personal safety equipment (PPE) were worn by staff, inadequate training for proper use of machinery, and no suitable work chairs available in the fabrication area as shown in Figure 1 and Figure 2. This proved the lack of ergonomic knowledge of the employers and employees. The fundamental principle of ergonomics is the machines should be fully safe in construction and operation. Nevertheless, it is also frequently a source of injuries in the manufacturing field. Ergonomically built equipment and adequate safety awareness will greatly minimize incidents and injuries from the machines.

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**Figure 3. The cutting process**

In this company, there are no proper safety training given to the workers and the cutting area are not protected and easy to access which could be the sources of injury. The machines in this company are still new and no poor modifications are made to the machines as shown in Figure 3 and Figure 4. The machines are ergonomically design to improve safety to the workers.

**Figure 4. The edging process using the edging machine**

Works constructed without ergonomics is known to have generally reduced efficiency [15]. Every task given are well design and the procedure and instructions are provided to the workers. The great work design leads to fewer potential of accidents. This shows that the task system component is ergonomically practiced. The design of the workplace was poorly designed because it has a small production site or known as fabrication area as shown in Figure 5. Based on Figure 6 and 7, it shows that there is no proper place to store the wood panel stocks, the chipboard stocks, and the stock of the finished products. The spraying or coating room is also having a limited space and poorly designed as shown in Figure 8. There was a limited work space, and the workplaces were deemed to have a bad layout and not well planned. Working posture is primarily influenced by the architecture design of the workplace. Effective use of ergonomic measures in the design of the work environment can also substantially minimize any injuries in the workplace.

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**Figure 5. The fabrication area**

**Figure 6. The area for stocking the wood panels**

**Figure 7. The paint and wood panel stocks area**

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**Figure 8. The coating or spraying room**

The environment is a big issue at the production site. The site was dry and dusty as seen in Figure 9. Excessive noise from a metal saw or a table saw often gave rise to certain problems. No earmuffs or earplugs were given to the staff. The spraying room was so suffocating because of the dust and the scent of paint, but no acceptable clothing is provided. Sufficient attention should therefore be given to the environmental issues.

**Figure 9. The dusty production area with the finished product stocks**

Lastly, the control processes which the management has failed to comply with the safety laws, such as the wearing of the PPE. However, the company has a proper housekeeping process, such as cleaning or record keeping, as seen in Figures 10 and 11, which encourages effective work within the company. By identifying the components of the system and the ergonomic attributes of the company, while no large accident or disability has occurred, ergonomic deficiencies are easily defined. Ergonomic development may lead to a safer and more physically productive working climate. It would also help to reduce injuries and associated costs, while at the same time increasing the well-being, efficiency and morale of staff. Ergonomic compliance policies and resulting modifications make it easier for the company to comply with the laws and regulations.

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**Figure 10. The checklist of the materials used for finishing paint (satin glo)**

**Figure 11. The consumable usage list for the coating paint (matex)**

## V. CONCLUSION

This case study was undertaken to determine the ergonomic problems at the production site and the preliminary findings were helpful for the company. The ergonomic approach in the company was not well implemented as the ergonomic deficiencies or problems still exists. Insufficient ergonomics awareness and understanding among employers and workers may be the reason for low implementation of ergonomics in the work station. Management did not control the safety features of the workplace and did not implement safety rules or provide safety performance guidance and training.

Implementation of ergonomic assessments able to help workers by enhancing their work environment and assuring that they have workstations that reduce stress on their bodies. It also benefits the organization by rising efficiency, enhancing employee engagement and reducing operating costs. Overall, investing in ergonomics would foster a healthier workforce and a culture of health.

A few recommendations could be made to improve this study such as the activities of the workers can be recorded and captured to be used for analysis using tools such as RULA, REBA and QEC [2]. The involvement of the managers also should be considered to fill in the ergonomic assessment forms. The company should have better understanding and knowledge about the importance of an ergonomic assessment because it gives a lot of benefits to the company. Provide the workers with suitable PPE, trainings and guidance to boost up their performance. Perfect design of the work station could improve the productivity of the company. Finally, workers and managers in the company should play a critical role in the adoption of effective ergonomic practices.

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