



**ERGONOMIC ANALYSIS IN IMPROVING THE PROCESS OF ASSEMBLING  
WOVEN BAGS**

This report is submitted in accordance with the requirement of the University Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering with  
(Hons.)

by

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## **DECLARATION**

I hereby, declared this report entitled “Ergonomic Analysis In Improving the Process of Assembling Woven Bags” is the result of my own research except as cited in references.

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## **APPROVAL**

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirement for Degree of Manufacturing Engineering (Hons). The member of the supervisory committee is as follow:

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## ABSTRAK

Pembuatan industri terdiri daripada proses memasang manual terutamanya dalam bahagian pembungkusan. Pemasangan manual memerlukan kutrat manusia untuk melaksanakan tugas tersebut. Stesen kerja yang baik menyediakan kemudahan dan peralatan yang selesa mengikut prinsip ergonomik. Walau bagaimanapun, ergonomik yang lemah boleh memberi kesan buruk di mana kecederaan boleh berlaku akibat daripada kecederaan Musculoskeletal (MSD) atau sakit pada sistem muskuloskeletal manusia, termasuk sendi, ligamen, otot, saraf, tendon, dan struktur yang menyokong anggota badan, leher dan sakit belakang boleh berlaku. Melaksanakan faktor ergonomik dalam industri boleh menjadikan pekerja lebih selesa untuk melakukan kerja mereka dengan kepuasan yang lebih baik. Faktor ergonomik juga akan memberi motivasi terhadap produktiviti mereka. Satu syarikat terletak di Cheng Melaka, Assess Product Sdn Bhd dalam pembuatan Beg Polipropilena (Beg PP) untuk pembekalan kepada institusi pertanian domestik di kedua-dua sektor Kerajaan dan swasta mengalami beberapa isu. Selepas membuat pemerhatian dan perbincangan bersama penyelia, tugas yang paling kritikal adalah pemasangan manual beg tenunan di bahagian pembungkusan. Tujuan kajian ini adalah untuk menganalisis penambahbaikan pemprosesan pemasangan manual beg tenunan di bahagian pembungkusan. Penambahbaikan ergonomik ke stesen kerja akan dilaksanakan dengan menggunakan data pengukuran antropometri untuk mengubah suai reka bentuk sistem stesen kerja mengikut ukuran purata pengendali. Postur badan yang berbeza telah dikaji semasa tugas pemasangan oleh pengendali. Hasil postur daripada kerja mereka digunakan dalam menganalisis RULA (Rapid Upper Limb Analysis) yang mungkin mempunyai skor postur kerja yang tidak baik. Hasil analisis RULA memerlukan pemodelan manusia untuk melihat kebiasaan kecederaan yang berlaku di bahagian badan pengendali selepas satu hari bekerja. Dari analisis tersebut, penambahan komponen baru atau kaedah yang lebih baik akan disyorkan supaya dapat membantu menyelesaikan masalah pengendali semasa proses manual memasang beg tenunan.

## ABSTRACT

Industrial manufacturing consist of manual assembling process especially in the packaging section. Manual assembling require human nature to done the task. A good workstation provide a comfortable facilities and equipment considering ergonomics principle. However, a poor ergonomics can have an adverse effect where injury might happen due to Musculoskeletal disorders (MSDs) injuries or pain in the human musculoskeletal system, including the joints, ligaments, muscles, nerves, tendons, and structures that support limbs, neck and back pain can occur. Implementing ergonomic factor in industry can make the worker more comfortable to perform their works with a better satisfaction. Ergonomic factor also motivate their productivity as well. A company located at Cheng Melaka , Assess Product Shd Bhd manufacturing Polypropylene Woven Bags (PP Bags) is supplier to domestic agricultural institutions both in the Government as well as private sectors having the some issues. After make an observation and discussion with the supervisor, the most critical task is the manual assembling of woven bags at the packaging section. The aim of this study is to analyse improvement for manual assembly processing of woven bags at the packaging section. The improvement of ergonomic towards the workstation will be utilize by using anthropometry measurement data to redesign the workstation system follow the average measurement of the operator. Different body posture have been study during assembling task by the operator. The result of their work posture being conduct by using RULA (Rapid Upper Limb Analysis) analysis that might having a bad score of work posture. The result of RULA analysis require for the human modelling to observe the injury occur at the common body part of the operator after a day work. From the analysis, a new addition of component or recommended method that can help the operator to solve the problem during the manual process assembling of woven bags.

## **DEDICATION**

**"Success is never an accident. It is always the result of a commitment to excellence, intelligent planning and focused effort as well as good guidance from good people."**

**My humble effort I dedicated to my sweet and loving,**

Father (Hj Agus Salim Salim Bin Ahmad Junid)

Mother (Hjh Dewi Hati Binti Ismail @ Md On)

**Along with my honoured supervisor and Co. supervisor,**

Associate Professor Dr Hafidz Fazli Bin Md Faudi

Encik Mohd Fazli Bin Mohd Asari

And all my friend for giving me moral support, encouragement, cooperation, understanding, and also contribution to this research until this thesis is completely done.

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## LIST OF ABBREVIATION

RULA	=	Rapid Upper Limb Assessment
MSDs	=	Musculoskeletal disorders
WMSDs	=	Work-related Musculoskeletal Disorders
COP	=	Centre of pressure
CATIA	=	Computer Aided Three-Dimensional Interactive Application
SOP	=	Standard Operation Procedure

# **CHAPTER 1**

## **INTRODUCTION**

This chapter is intended to provide comprehensive background of the study. The explanation about what are the aim of the project to be. The descriptive of problems statement, objective, and the project scope.

### **1.1 Background**

The purpose of ergonomics is to optimize safety, health, comfort and efficiency of the human in the work system. There are a lot of physical activities in an ergonomic sense involve reaching, , repetitive motion, bending, lifting heavy objects, high force exertion, and working with vibrating equipment. It is very important to implement ergonomics as a priority to protect the workers in terms of safety and health policy.

By applying ergonomics, the chances of increasing work efficiency and productivity will make the tool or machine fit the users efficiently. Thus satisfaction achieved by the workers. Factors of work posture, exertion force, repetition motion of work and vibration which contribute in the higher rate of injury need to be considered strictly while designing the workstation. In order to give a huge impact on work efficiency and to produce high quality products and to increase productivity, the principle of ergonomic must be apply. (M.Muhundhan, 2013). Nowadays, manufacturers realized that providing a ergonomics workplace is cost saving instead of spending more money on machine, material, and workers, (Gurunath et al. 2012). Thus workstation that follow the principle ergonomics designed with proper modular structure provides many advantage to



industry such as increase the motivation and moralize satisfaction of employee and bring up their higher performance, and processing quality.

The human factor including comfort design and functional design is a way of interaction between the products and system which also make the user and workers fit the working environment. By implementing the proper workstation design productivity and efficiency of the worker can be improved in terms of quality and quantity. These factor can be reduce such as repetition of work, force, posture which contribute to higher rate of injury. Placing the materials, tools and controls within easy reach makes the lower fatigue to the workers. A well organised workplace minimises material handling, improves efficiency and reduces operator fatigue. It is benefit for an engineer that tend to be able applying the manufacturing system following the ergonomic principle and industrial functions successfully. Physiologists, medical doctors and industrial nurses can certainly diagnose a lot of ergonomics problems relevant to industrial safety, but sometimes lack in term of technical background to recommend how a technical system can be redesigned to optimize the physiological cost of human beings.

## **1.2 Problem Statement**

Usually, working in sitting position give a huge impact toward industrial workplaces and could be more effective. During performing processing jobs, sitting position is among the most significant position as the worker experience large degree of freedom especially working on handling assembling process, and reaching of materials and tools. There are machine or workstation that have been designed for the worker to processes jobs in standing position. Other reason, perhaps the worker prefers to stand instead of sitting even though the processes jobs can be performed in sitting position, or the workstation is not equipped with sitting facility. Working in sitting can be considered as versatile position because the support of leg by chairs and having large degree of freedom. Thus the position help them do their task more efficient and in a safe condition. As a result, this working position consequently contribute toward increasing the productivity of the industry. However, the worker will experience the uncomfortable body feelings after a long period of time works in sitting position and throughout their working hours. The

muscle getting fatigue at the end of workday. The potential of having injuries is higher if the worker continues the same working posture for a long period of time. According to the previous research, if the worker spent over fifty percent of the total working hours during a full work shift in poor position, they might affect to prolong poor working posture (F. Tomei, 1999).

Working in poor position for a long period of time due to poor design workstation has been recognized as a main contributor towards outperforming workers' in industry. It includes occupational injuries, productivity decrement, increased of treatment and medical costs, and demoralize workers.

Static position works while sitting for a prolonged times can risks to human health. Prolonged static posture is a very common sight in manufacturing industry which is used in the assembly lines. Even though this specific working posture is being consider risky toward common of psychological human health and muscles fatigue but the worker still practiced the same working posture all around the world. (I. Halim et al, 2012). A static contraction occurred particularly at the back body and lower body such as leg which give a result consequence toward diminished function of calf muscle when having works in a static position. (J. Ader, et al, 1998). Base on the research finding, it is due to the perception of the increase in productivity rate from the efficiency of human operators while ignoring the proper working posture without considering the human health for the future.

Repetitive movement is one of the biggest problem especially for manual processing jobs. The operator might be experience Work-related Musculoskeletal Disorders (WMSDs) due to improper workstation. The industry of making batik stamp tool in SMEs Batik in Indonesia work at risky level and have been suspected. In general, the workers having activities that require them to scrape mould on squatting position in the long term. Moreover, the workers also require to perform repetitive activities. Risks associated with a mould making work activities become worst is the absence of supportive equipment for the worker to work efficiently and safe. (W. Sutari, 2015). Prolonged sitting transfers the stress on upper body to the lower parts thus resulted to lower back pain. The report from The American Podiatric Association shows 83% of industrial workers in the United States facing injury at the foot and lower body parts pain such as back pain due to

poor body posture and having repetitive task (E. Zander *et al*, 2004). A cross-sectional study found that there were important associations between WMSDs due to pain at the back, lower leg, shoulder pain and prolonged sitting. Meanwhile, based on previous study reveals that conjunction of prolonged standing and lifting weights have led to high pain prevalence in the lower back and lower limbs for 906 women at 24 semiconductor factories in Malaysia (A. Chandrasakaran *et al*, 2004).

At Assess Product Sdn Bhd, investigation of ergonomics have be go through the observation and found out that there are some lacking of ergonomics in certain workstations which are at the packaging section. The surrounding environment is too hot and uncomfortable to the workers. The level of sound also exceeding the requirement standard ( $>80\text{dB}$ ). The operator used to works in a poor body posture due to improper design of assembling tools like Figure 1.1. Working in static position for prolonged time in assembling process cause contraction of muscle stress and pain. These sitting position like Figure 1.2 is not good design of works because the woven packaging steel places in vertical. So that the its hard for them to pull out the woven bag vertically out from the assembling tools.



Figure 1. 1: Static position of operator 1



Figure 1. 2: Sitting position of operator 2



Figure 1. 3: Operator 3 packaging and classify woven bags



Figure 1. 4: Operator 4 lifting bundle of woven bags

Every day, all operator need to complete their task for 8 hour and 3 breaks times. They works in static position. The longer static posture and repetitive movement, the more fatigue and reducing performance. Operator 4in figure 1.4 need to heavy lifting the bundle of woven bag from the inventory to the packaging workstation. Every bundle weight is around 20 kilogram. Improper lifting can cause back pain for the operator. Besides, the design of the workplace also may affect the health and safety of works. The increased frequency of musculoskeletal disorders (MSDs) accentuates that an improper workstation design can enhance the chances for more injuries and result in less job satisfaction and productivity. The operator at the packaging is the last part from the process, figure 1.3. They need to classify the bundle and pack them nicely by using compressor machine. As conclusion, the implementation of effective ergonomic programs on various workstations should aid in to reduce injuries and better physical health (Mustafa Khan, 2015).

### **1.3 Objective of the study**

The purpose of this project is to:

1. To investigate the ergonomics problem from the existing manual packaging section.
2. To propose the optimum workstation design by considering the effect of ergonomics.
3. To validate the idea by using RULA analysis.

### **1.4 Scope of the study**

Assess Product (M) Sdn. Bhd. (APSB) was established in May 1994 and commenced operation in late 1995. The factory located in Cheng Industrial Park, Malacca with equipment housed in a rented factory with floor area of approximately 16,000 square feet. APSB produces Polypropylene Woven Bags (PP Bags) for supply to domestic agricultural institutions both in the Government as well as private sectors

APSB final product is Polypropylene Woven Bags whose sizes depend on the requirement of the buyers. The product Polypropylene bags are mainly used as packaging medium by producers of fertilizers or as a medium of package for products such as rice seeding. Sizes of the bag depend on the designate weights of the products such as 20 kilograms, 25 kilograms, 50 kilograms and 100 kilograms bags. The bags also come in different mesh or construction and printed according to the requirement of the buyer.

Overall, the production capacity of APSB presently has a finishing line capacity to produce 1,500,000 - 2,000,000 pieces of printed bags per month. The manufacturing product divided into seven section. The packaging section is the most critical part relate to ergonomics thus packaging workstation almost the suitable area to be observe. The observation concentrated at fully manual packaging workstation consist of 4 operator works each shift for 8 hour and 3 breaks times. Started from the inventory until the packaging section finish classify in their packaging at the compressor machine. There are daily target will be consume as a task to be complete. The focused of this project only on the workstation design and posture applied by the operators.

### **1.5 Benefits of the Study**

This study brings a lot of benefits to all especially to the operator which works in a prolonged standing position, static position, heavy lifting, repetitive motion, works in vibration workstation and give a special focus on the outcomes result of the ergonomics interventions in relieving the psychological and muscles fatigue. The redesign workstation due to ergonomics intervention will provide the user and staff comfort and safety working condition. It will provide them feel so satisfy while doing assembling woven bag in workstation. The new design workstation will increase the performance and moralize the workers. In addition, the physiological limitation from assuming the working posture and the results or the effectiveness in the implementation of the ergonomic interventions would be disseminated in the industry to elevate awareness and for counter measures to be implemented where necessary.

## **CHAPTER 2**

### **LITERATURE REVIEW**

In this chapter consists of the information related to method and analysis to be used.

#### **2.1 Ergonomics**

Ergonomics is concerned with making the workplace as efficient, safe and comfortable as possible. Ergonomics can be defined simply as the study of work. More specifically, ergonomics is the science of designing the job to fit the worker, rather than physically forcing the worker's body to fit the job. Effective application of ergonomics in work system design can achieve a balance between worker characteristics and task demands. The standard operating procedure for completing the work tasks and quality was control constantly by monitoring and instruction to the disabled workers (Yuh Jang, *et al* 2018). This can enhance worker productivity, provide worker safety, physical and mental well-being and job satisfaction. Anthropometric data is required to fit in the optimum principle of ergonomics design of a workstation.

The main variables to design of ergonomic considerations involve the human, in regards to body posture and health. The machine, in terms of tools suitability and maintenance and also the work area, which includes factors such as humidity, acoustics, lighting, shift work and working hours.

### **2.1.1 Industrial Engineering approach Vs Human Factors approach**

Industrial Engineering approach is based on principles and techniques of scientific management developed by Fredrick Taylor. It is based on the analysis of operations using method-time-motion study on elements of the task. Fatigue factor is provided by standard allowance to develop the production rate whereas ergonomics / human factors approach uses physiology & biomechanics to identify fatigue factors that are neutralized by engineering & administrative controls (M. Helander,1995). The approach of human factors is the systematic application of relevant information about human capabilities, limitations, characteristics, behaviour, and motivation to the design of things and procedures people use and the environment in which they use them (Sanders et al., 1992). This involves scientific investigation to discover relevant information about human beings and their responses to things, equipment, procedures, and work environments, etc. The human factors approach also involves the evaluation of the things designed to ensure that they satisfy their intended objectives.

### **2.1.2 Human Factor based on Basic Principle of Ergonomics**

Manage the issue by applying some basic principles of ergonomic to help reduce the impact of the risk factors:

- The best position to works is to be in neutral postures.
- Reduce excessive force to prevent potential for fatigue and injury at the joint.
- Keeping things within easy reach to avoid the excessive bending of spine.
- Working at the right height with a neutral position.
- Minimise from working at the same position for a period of time which can cause fatigue.
- Do not lift or carry overload weight because when human excess their ability, they risk their body.
- Muscles need to be loaded and your heart rate needs periodic elevation by moving, exercises, and stretch.