



Faculty of Engineering

**IMPROVING ERGONOMICS WORKING CONDITION IN MEDIUM SIZED
MANUFACTURING INDUSTRY**

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**IMPROVING ERGONOMICS WORKING CONDITION IN MEDIUM-SIZED
MANUFACTURING COMPANY**

MAS NOR ZAMIRLAH BINTI ZAMIRHAN

A dissertation submitted in partial fulfillment
of the requirement for the degree of Bachelor of
Engineering with Honours
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Dedicated to my beloved parents, Zamirhan Bin Keria and Raden Za'arah Binti Bohan,
family, friends and one who need it

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ABSTRACT

This project is a case study on the working condition in terms of ergonomics in local manufacturing company. Ergonomics has been a very popular term of which task should fit the workers and not the other way around. Various benefits, for example, improve productivity of the workers is very profitable especially in the manufacturing industry. This report presents the exposure of workers and manager to implement ergonomics working condition in the company especially the layout of the company which indicates the arrangement of the machines and equipment. The Human Activity Analysis is important to investigate the risk of injuries faced by the workers while manning tasks. Further improvement and changes can be done with the help of the result of the analysis. By reducing the risk of injuries that might occur due to the inergonomic working conditions, the productivity of the manufacturing industry can be improved.

ABSTRAK

Projek ini adalah satu kajian kes mengenai suasana kerja dari segi ergonomik dalam syarikat pembuatan tempatan. Ergonomik telah menjadi istilah yang sangat popular di mana tugas harus sesuai dengan pekerja dan tidak sebaliknya. Pelbagai manfaat, sebagai contoh, meningkatkan produktiviti pekerja adalah sangat menguntungkan terutamanya dalam industri pembuatan. Laporan ini membentangkan pendedahan kepada pekerja dan pengurus untuk mengaplikasikan suasana bekerja ergonomik di syarikat itu terutama susun atur yang menunjukkan susunan mesin dan peralatan. Analisis Aktiviti Manusia adalah penting untuk menyiasat risiko kecederaan yang dihadapi oleh pekerja semasa mengendalikan tugas. Penambahbaikan dan perubahan boleh dilakukan dengan bantuan daripada hasil analisis. Pengurangan kadar risiko kemalangan semasa bekerja akan meningkatkan pendapatan dan produktiviti syarikat.

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LIST OF ABBREVIATIONS

CNC	- Computer Numerical Control
HAWS	- Hand Arm Vibration Syndrome
HF	- Human Factor
HR	- Human Resource
HSE	- Health and Safety Executive
MMH	- Manual Material Handling
MSD	- Musculoskeletal Disorder
NEA	- National Ergonomics Association
NIOSH	- National Institute for Occupation Safety and Health
RULA	- Rapid Upper Limb Analysis
SME	- Small Medium Enterprise
ULD	- Upper Limb Disorder
WRMSDs	- Work Related Musculoskeletal Disorders

CHAPTER 1

INTRODUCTION

1.1 Introduction

This project is about the research conducted to propose the suitable design for workstation that applies ergonomics and safety factors focused for medium-sized metal-based manufacturing industry. By increasing safety factors and considering ergonomics of the workers, this research is expected to increase the productivity of the company. There are many research on the safety and ergonomics working condition in the workplace, but less for medium-sized industry that runs a metal-based production. By understanding the needs of the worker, we can propose a better working condition that later will increase productivity of the industry itself.

1.2 Background Study

This project is research based conducted in medium-sized manufacturing industry that runs metal-based production. As ergonomics application have so many advantages in industry, the local manufacturing industry may have taken part in this concept application. The research is conducted through visiting the company that runs a metal-based production which implies major in manual material handling.

1.3 Scope of Study

This project covers the topic of safety factors at workplace. The importance of safety, especially in material handling in the manufacturing industry is focused on this project. More important than that, in every manufacturing company that uses the full human power in handling the machine and to complete the manufacturing process, it is concerned about the need of the worker in terms of their performance in working. Through this topic, this research will discuss on the ergonomics and the natural need of the human body. At the end of this project, we can identify the suitable or improved layout of the workstation and correct posture of the human body while manning the manufacturing process.

1.4 Problem Statement

In manufacturing industry that utilizes human power to conduct manufacturing process, many accidents can happen especially to the workers. Bad working condition may lead to musculoskeletal injuries. This type of injuries often faced by the workers due to repetitive stress injuries. Overused of the body movement can lead to decrease in productivity of the worker. The worker will then take a longer time to complete task due to fatigue. The manager should be aware of the ergonomics factor and the needs of the workers in order to maintain or surpass the total current productivity. The suitable or improved layout of the workstation needed in order to achieve ergonomics in terms of productivity.

1.5 Objectives

As discussed through the problem statement, in order to minimize the injuries at workplace and increasing productivity, research should be conducted in order to implement more on ergonomics and safety working condition for the worker specifically in manual material handling. Thus, the objectives of this research are classified as;

- i. To investigate the problems regarding safety in manual material handling.
- ii. To relate the ergonomics working conditions with the productivity of the workers in the metal-based manufacturing company.
- iii. To design a better workstation layout for medium-sized manufacturing company.

1.6 Methodology

The stages of making this study are as follows:

- i. Stage 1: Literature review
- ii. Stage 2: Survey on the workers
- iii. Stage 3: Software design and analysis
- iv. Stage 4: Discussion
- v. Stage 5: Conclusion/ summary

1.7 Expected Outcomes

In this research, we expect to know the advantages of applying an ergonomics factor to the workstation. This is due to the natural need of the human body that we must fit the task to the worker and not to fit the worker to the task. We expect to help in increasing productivity of the medium- sized metal based manufacturing industry. Other than that, this research done is to increase safety awareness of the workers regarding ergonomics in the workplace.

1.8 Summary

At the end of this chapter, ergonomics is a very interesting topic to be discussed on. This is because the ergonomics topic is very important, especially in the manufacturing industry that utilizes human power that requires material handling. This chapter defines the ergonomics topic. The problem statement regarding this study is also introduced in this chapter. In order to maintain or increase productivity and efficiency, we must design a good workstation so that will reduce time for the workers in manning the process. In addition, the objective of the research and scope of study also clearly stated in order to direct the effort to achieve the desired outcome.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Ergonomics depicts an interaction of the operator with his/her working surroundings. Tools with good ergonomic design are a fundamental element to achieve a better ergonomic workplace. (Ergonomics Essential, 2009)

All of the research reviews support the hypothesis that worker's performance depends on different socioeconomic, psychological, environmental factors at work place. (Saeed, Musawwar, & Lodhi, 2013). It is defined as the way to perform the job tasks according to the prescribed job description. Performance is the art to complete the task within the defined boundaries (National Institute for Occupational Safety and Health, NIOSH)

The exceed of the human capabilities of the material handlers can lead to musculoskeletal problem which often occurs in manufacturing industry. (Way Li & Fung Liu, 2009). The main aim of enhancing ergonomics interference is a continuous improvement, this is because the ergonomics is the only success key that bring excellence and competitiveness in the market. (Irimie & Zeininger, 2015)

More than that, through implementation of improvement and initiatives that resulting from ergonomic implementation, the organization can reduce costs and increase staff satisfaction. (Elena Boatca & Cirjaliu, 2014)

2.1.1 Definition of Ergonomics

The term “ergonomics” is derived from two Greek words: *ergon*, meaning work, and *nomos*, meaning law. Referring to that, ergonomics is a science that creates the principles that must be followed to ensure work efficiency and productivity. (Upadhyay Naman Dineshchandra, 2015) An important characteristic of ergonomics is that this science can meet its purposes only by enclosing research from domains such as psychology, engineering, design, medicine and economics.

2.1.2 History of Ergonomics

Ergonomics in the United Kingdom started out of World War 2 when scientists were given task to determine the capabilities of the soldier in order to maximize efficiency of the fighting man. Since the industrial revolution, work has changed from agricultural base to city-based work environments. Further changes have occurred in recent times with an increase of females in paid employment, an increasing age of workers, and internationalization of the workforce. All of these changes have implications for a role of ergonomics. (Ergonomics Essential, 2009)

2.1.3 Scope of Ergonomics

Ergonomics focus on reducing human errors, as well as on increasing productivity. However, it may be challenging to improve safety and productivity at the same time. If the speed increasing, the time for action will decrease. This will reduce safety, but will increase productivity. However, to achieve optimal speed that consider safety is a feasible goal. (Elena Boatca & Cirjaliu, 2014)

There are three broad domains of ergonomics which are physical ergonomics, cognitive ergonomics and organizational ergonomics. In this study, the author will stress out about physical ergonomics.

Physical ergonomics is concerned with human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity. (Middlesworth, 2015). Moreover, the whole community will get benefits from ergonomics design. Ergonomics considers the whole work system, and the effects of the system on human and system performance. (See Figure 2.1).

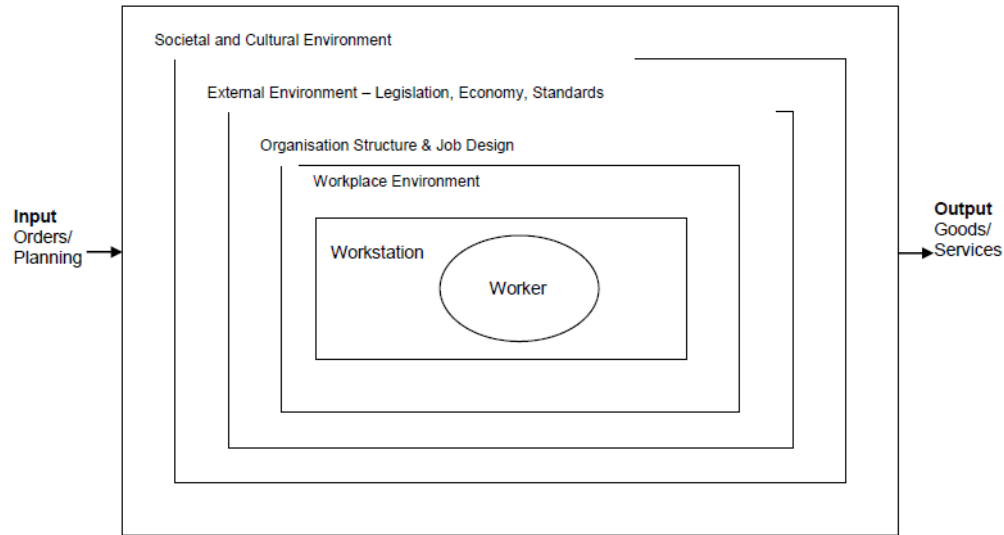


Figure 1 Ergonomics: The Systematic Study of the Human at Work

Adapted from Stevenson (1999)

Ergonomists interact and consult with various backgrounds of people. Human characteristics and capability measures from three prior factors as below. (McPhee, 2005) (See Figure 2.2)

Anatomy	
Anthropometry	Dimensions of the body (static and dynamic)
Biomechanics	Application of forces by gravity and muscles
Physiology	
Work physiology	Expenditure of energy
Environmental physiology	Effects on humans of the physical environment
Psychology	
Skill psychology	Information processing and decision-making
Occupational psychology	Training, motivation, individual differences, stress

Figure 2 Human Characteristics and Capacities Considered in Ergonomics

Adapted from Ergonomics Essential

2.1.4 Occupational Ergonomics

Good ergonomics in the workplace should improve productivity and morale and decrease injuries, sick leave, staff turnover and absenteeism. (Ergonomics Essential, 2009). There are five elements that need to be concerned when analyzing work. The table below shows the five important elements that need to be considered in ergonomics analysis of work. (Elena Boatca & Cirjaliu, 2014) (see Table 2.1)

Table 1 The five elements to consider in ergonomic analysis of work

ELEMENT	DESCRIPTION
The worker	Employees have a range of characteristics that need to be considered, including physical and cognitive capacities; experience and skills; education and training; age; sex; personality; health; residual disabilities. An individual's personal needs and aspirations are also considered.
Job/task design	The task that the employee required to do and what they actually do. It includes job content; work demands; restrictions and time requirements such as deadlines; individual's control over workload, including decision latitude, working with other employees; and responsibilities of the job.
Work environment	The buildings, work areas and spaces; lighting, noise, the thermal environment.
Equipment design	The hardware of the workplace. It is part of ergonomics that most people recognize and includes electronic and mobile equipment, protective clothing, furniture and tools.
Work organization	Includes patterns of work; peaks and troughs in workload, shiftwork; consultation; inefficiencies or organizational difficulties; rest and work breaks; teamwork; how the work is organized and why; the workplace culture; as well as the broader economic and social influences.

Source: (Elena Boatca & Cirjaliu, 2014)