UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ANALYSIS ON HUMAN FACTOR FOR MANUAL HANDLING WORKER AND DESIGN FOR IMPROVEMENT OF TABLE WORKSTATION IN MANUFACTURING INDUSTRY

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

(Manufacturing Design) (Hons)

by

NUR ALINA BINTI SAMSUDIN

B051210194

930221016470

FACULTY OF MANUFACTURING ENGINEERING

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DECLARATION

I hereby, declared this report entitled "Analysis on Human Factor for Manual Handling Worker and Design for Improvement of Table Workstation in Manufacturing Industry" is the results of my own research except as cited in references.

Signature : ……....

Author's Name : Nur Alina Binti Samsudin

Date : 8 JUNE 2016

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design) (Hons). The member of the supervisory is as follow:

…….....……

DR. ZULKEFLEE BIN ABDULLAH

(Project Supervisor)

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ABSTRAK

Pekerjaan secara manual boleh membuat masa keletihan pekerja menjadi lebih cepat apabila mereka bekerja dalam postur yang janggal atau bekerja untuk masa yang lama. Kajian ini memberi tumpuan kepada stesen kerja sisip bungkusan lipatan di sebuah syarikat pembuatan vakum. Di stesen kerja yang sedia ada, pekerja perlu melakukan kerja lipatan bagi memasukkannya dalam bungkusan. Para pekerja juga perlu melakukan kerja berulang-ulang. Oleh kerana postur kerja tidak betul atau janggal, pekerja boleh terdedah kepada pelbagai faktor risiko ergonomik. Di dalam stesen kerja pakej vakum memasukkan lipatan, terdapat dua faktor ergonomik risiko yang terlibat yang postur kerja janggal dan pergerakan berulang-ulang. Ketinggian meja kerja adalah tetap, tetapi ketinggian pekerja adalah berbeza. Keadaan ini boleh menyumbang kepada sakit pinggang dan keletihan kepada pekerja. Oleh itu, produk yang akan diliputi dalam projek ini adalah meja kerja. Projek menggunakan soal selidik, perisian CATIA, "Quality Function Deployment" (QFD) dan "Rapid Upper Limb Assessment" (RULA) untuk menentukan keperluan pekerja, merekabentuk semula stesen kerja dan menilai postur kerja pekerja. Kajian ini dijalankan di syarikat Flextronics Technology, Senai di Johor Bahru.

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ABSTRACT

Manual jobs can make the time-to-fatigue for the worker become shorter when they work in awkward posture or working for a long time. This study focuses on the package insert folding workstation in a vacuum manufacturing company. In the existing workstation, the operators have to perform the folding work of the insert in the packaging. The workers also have to do a repetitive work. Due to incorrect or awkward working posture, the workers may expose to various ergonomics risk factors. In the vacuum package insert folding workstation, there are two ergonomics risk factors involved which are awkward working posture and repetitive movement. The table's height is fixed, but the heights of the operators are different to each operator. This condition can contribute to low back pain and fatigue to the operator. Thus the product that will be covered in this project is a table workstation. This project applied questionnaire survey, CATIA software, Quality Function Deployment (QFD) and Rapid Upper Limb Assessment (RULA) Analysis to determine the operator's requirements, redesign the workstation and evaluate the working posture of the operator. The survey was conducted in the Flextronics Technology, Senai in Johor Bahru.

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DEDICATION

Special dedicated to my parents,

Samsudin Bin Yasin

Faridah Binti Paichan

For my supervisor,

Dr. Zulkeflee Bin Abdullah (Lecturer)

Thank you for your supports for me to do the best in my Final Year Project. Thank you also for guiding me to accomplish this project efficiently. And to all my supportive siblings and friends, thank you for the support and prayers. May ALLAH bless all of you.

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Praise is being to Allah, the Lord of the Worlds. Peace and served on the beloved Prophet Muhammad, his family and his companions.

First of all, I would like to take this opportunity to thanks my Final Year Project Supervisor, Dr. Zulkeflee Bin Abdullah for guidance and encourage me to carry out my project successfully.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

CAD	Computer Aided Design
CATIA	Computer Aided Three Dimensional Interactive application
HoQ	House of Quality
MSDS	Musculoskeletel Disorder
QFD	Quality Function Deployment
REBA	Rapid Entire Body Assessment
RULA	Rapid Upper Limb Assessment

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CHAPTER 1
INTRODUCTION

1.1 Introduction/Background

Fatigue is a reaction of continuous tiredness or weakness and can be physical, mental or both. According to (Baker & Dawson 2007) the fatigue connected with tiredness and reduced readiness is not quite the same as physical fatigue or exhaustion that is brought by long and/or hard physical work. There are many accidents in the manufacturing industries are the result of fatigue. Fatigue is a risk in workplace because it affects ability to think clearly and act correctly. This is due less alertness so that workers cannot perform well and less productive. Fatigue and diminished readiness coming about because of inadequate or low quality rest that can prompt a few wellbeing related outcomes, including moderated response time, decreased basic leadership capacity, misguided thinking, diversion amid complex undertakings, and loss of mindfulness in basic circumpostures (Flower & George 2012). Those whose feel fatigued are poor at realising their own level of impairment. The worst, workers can sleep in the middle of a task, which can have serious consequences. Weakness, psychosocial workload and deficient rest have been perceived as real results of this expanded work power amongst working populaces (Dawson et al. 2011).

The growth of muscle fatigue is typically due to rejection in the power limit of muscle, which implies that constrictions maintained after the start of muscle fatigue. The results of weakness can be classified as either transient danger, normally identified with poor wellbeing results, and/or long haul dangers identified with lessened physical and/or mental wellbeing (Dawson et al. 2011).

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Manual treatment of burdens may bring about clutters because of steady and expanding debilitating of the musculoskeletal framework when there is nonstop lifting or taking care of exercises. Differential reactions to different sorts of work exposures can bring about very variable fatigue results (Dickerson et al. 2015). The common example for the disorder is low back pain. Manual handling can impact in weakness, and lead to wounds of the back, neck, shoulders, arms or other body parts. Along these lines, ergonomic workstation and working posture assumes a vital part to stay away from those turmoil and danger. An applied structure for incorporating ergonomics into planning economical work frameworks adequately to dispose of the wellbeing dangers (Radjiyev et al. 2015). The discomfort feel by worker will also reduce working efficiency. Efficiency of specialist incredibly relies on ergonomic configuration of workstation (Shinde & Jadhav 2012a).

1.2 Problem Statement

Although nowadays there are automatic methods that have been used in assembling commercial ventures to build profitability and proficiency, there are still heaps of manual taking care of employments, especially for get together and upkeep occupations. Manual jobs can make the time-to-fatigue for the worker become shorter when they work in awkward posture or working for a long time. In the existing workstation design, the operator has to fold package insert for vacuum packing process in discomfort working posture. The workers also have to do a repetitive work. Due to incorrect or awkward working posture, the workers may expose to various ergonomics risk factors. In the vacuum package insert folding workstation, there are two ergonomics risk factors involved which are awkward working posture and repetitive movement. The workers will feel discomfort at their low back pain and experienced muscle fatigue as well. Other than that, the workers enthusiasm will be affected since they suffered from the pain and would affect the productivity. For sure the company has production target for the manufacturing and delivering of product and it will affected if the worker have to refer to medical treatments or medical leave. More beneficial

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representatives result in less wellbeing claims, better security records, and more noteworthy profitability (Flower & George 2012). The more pain the worker feel, the longer the time needed to recover. It was estimated that shorter process durations would give more powerful strong recuperation inside a workload piece, decreasing markers of weakness for each deliberate result (Dickerson et al. 2015).

1.3 Objective

The aim of this project is to performing analysis on muscle fatigue that has been experience by manual worker at Flextronics Technology (P) Sdn. Bhd.

This can be accomplish by following these objectives:

- To review and study the knowledge in the area of muscle fatigue.
- To assess ergonomic experience and working posture of operators while performing the package insert folding.
- To suggest the improvement design for the table workstation.

1.4 Scope of Project

This project comprises the design and analysis of muscle fatigue for worker who does manual tasking during working. In order to analysis the time-dependent reliability is analyzed and demonstrated through probabilistic modeling of worker posture during working. The working posture and movements of the operators will be analysed during the 10 hours of working period. This is to know and get information on how bad the posture and time working for the worker. To improve the time-to-fatigue for the worker during doing manual task the management system has to be technological redesign and the workstation have to be improved.

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1.5 Conclusion

All through this part, the background of study, the issue articulation, goal of the study, and the extension and also restriction in finishing this study have been distinguished. From the foundation of study, the issue articulation has achieved and the targets of the study were recognized from that. The essential basic of the human investigation and muscle weakness likewise have talked about in foundation study. At that point from the target, the scope has been identified.

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CHAPTER 2
LITERATURE REVIEW

This chapter begins with workstation design for manufacturing industry, and then followed by fatigue detection and prediction. Additionally, review of ergonomic experience and working posture of manual handling worker. Finally, literature survey on simulation of working posture is explained.

2.1 Workstation Design for Manual Handling Worker

2.1.1 Workstation Design

Lack of planning in the design of workstation is leading to where the workers have to adapt to work conditions that were not design for safety and comfort (Hernandez-arellano et al. 2015). Significance to comfort the laborer is fundamentally determined by handy attentiveness toward the wellbeing and agreeable of the specialist. This gives a configuration architect a vital test in light of the fact that both solace and laborer security is hard to quantify. Workstation is the place for worker to perform a job while the workstation design is a pattern of working place to do a job. The workstation design is important to justify the worker perform a task in safe working posture. Mechanism that can cause fatigue are the task that being performed (Enoka & Duchateau, 2008). Improper workstation design leads to unsafe working posture, consequently contribute to injuries such as muscle fatigue or low back pain to the workers. According to Zein et al. (2015) the reason most of the industrial worker

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frequently injured is because of incorrect working posture. Improper working posture and uncomfortable posture can lead to musculoskeletal disorder (MSD). Occupational musculoskeletal disorder are referred as a major reason for wastefulness, non-appearance and fatigue (Schierhout et al. 1993). Physiological impairment can cause muscle fatigue (Enoka & Duchateau 2008). There are two criteria to design a workstation which are make different sizes and design an adjustable workstation. If the workstation is designed with different sizes and the dimensions of each size that accommodate all users (Athirah & Abdul, 2013). Design engineer can use Quality Function Deployment (QFD) as a tool to design an ergonomic workstation. Much of the time torment from standing is a consequence of unnecessary front pelvic tilt. This is the place your pelvis gets to be tilted too far forward, bringing about an unnecessary lumbar bend. This prompts lumbar plate uneven characters, danger of lump, herniation or degeneration. It likewise prompts feature joint agony which is additionally a variable for back torment. The Deep Squat Rest is an incredible activity to lessen this type of torment. It diminishes back agony by lessening the front pelvic tilt that is delivered from standing (plate weight equalization). Opening and extending the hip joint and hip muscles (hip and pelvic versatility, assuage hip snugness). Lessening the extreme S-bend in the lumbar area (diminishes danger of feature joint agony and wear). Fortifies the lower stomach muscles (counter front pelvic tilt, diminish uneven circle weight).

2.1.2 Quality Function Deployment (QFD)

Quality function deployment or QFD is a translation of customer requirements into technical requirements. Originally, QFD was proposed by collecting data and analyzing customers' demands that the next step will be transformed into engineers' requirements. To implements the QFD, the designer needs to prioritize on what the customers' demands, what they need, what they want. Then translating the needs into technical specifications and characteristics and building a quality product or service, which is by focusing on users' satisfaction. Additionally, the customers'

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requirements can be transformed into HOQ which is House of Quality. Haunser and Clausing stated in their journal that HOQ matrix is used in order to identify the customers' demands and create the important requirements of the design requirements in order to provide satisfaction to customer as cited by (Athirah & Abdul 2013). There are general steps of build the house of quality which are to list customer requirements, technical description, develop the relation matrix between customer requirements and list technical description, competitive assessment and the correlation matrix. The figure below illustrates the HOQ.

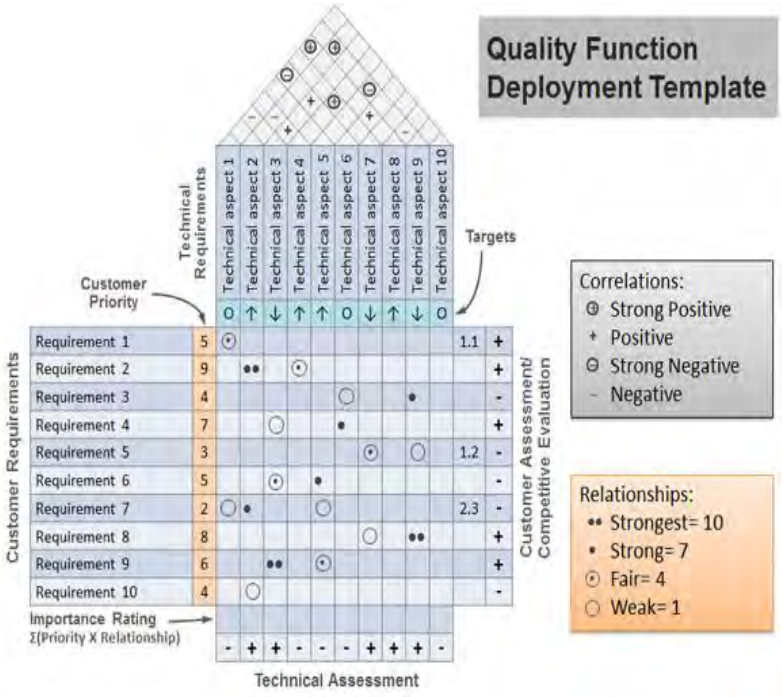

Figure 2.1 House of Quality

(Source: http://www.free-power-templates.com/articles/free-house-of-quality-template-for-powerpoint-qfd-template/)

2.1.3 Ergonomic Analysis

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