

ERGONOMICS STUDY ON WORKERS IN
ELECTRICAL INDUSTRY BY USING
SIMULATION ANALYSIS

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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LIST OF ABBREVIATIONS

| | |
|-------|---|
| RULA | Rapid Upper Limb Assessment |
| REBA | Rapid Entire Body Assessment |
| MSDs | Musculoskeletal Disorder |
| WMSDs | Work-related Musculoskeletal Disorders |
| VMI | Visual Monitor Inspection |
| LBP | Low Back Pain |
| NIOSH | National Institute of Occupational Safety and Health |
| CDC | Center for Disease Control and Prevention |
| NAICS | North American Industry Classification System |
| OWAS | Ovako Working Posture System |
| OSHA | Occupational Safety and Health Administration |
| HAL | Hand Activity Level |
| LMM | Lumbar Motion Monitor System |
| SOCSO | Social Security Organization |
| GDP | Gross Domestic Product |
| RSI | Repetitive Stress Injuries |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| TLV | Threshold Limit Value |
| MLM | Manufacturing Lifestyle Management |
| IP | Intellectual property |

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ABSTRACT

Ergonomics has improved the scope on safety and minimized risk at the workplace by looking into possible factors affecting product quality, work performance, and machine efficiency. According to research and statistics nowadays, there has been a cumulative concerns in quality, health and safety requirements in numerous professions and it is difficult to overlook the issues related to ergonomics risk. The most common risks identified for work are awkward posture, contact stress, wrist injury, static posture, body fatigue, twisted spine and over bending due to too far and unreachable object. Thus, this study aims to observe, investigate and analyze a working area and the workers in the manufacturing industry by using lean and ergonomic tools. The methods used are by using the Witness Simulation Software, manual Rapid Upper Limb Assessment (RULA) and RULA in Delmia Simulation Software. Based on collecting data on workers' performance obtained from the actual manufacturing environment, simulations of these workers and statistical analysis of 23 people will be analyzed. By using the result from the first step of analysis, the sample size is reduced to 9 workers and being reduced again to 3 workers. This method will validate this finding and evaluate the exposure of individual workers to ergonomic risk factors associated with upper extremity and whole body postural. Based on the result, three workers from different processes have been selected: Toroidal Winding's worker, Epoxy worker, and VMI worker. Those that have been selected for the simulation are experiencing MSDs risk at different level, with a score of 6, 6 and 4 by using Delmia simulation and 7, 6, and 3 by using manual assessment. By looking at the result, the relation to workers' performance and MSDs did have a relation, but need to look at another aspect such as workload of each worker as well.

ABSTRAK

Ergonomik telah meningkatkan skop keselamatan dan mengurangkan risiko di tempat kerja dengan mengkaji faktor yang mungkin menjejaskan kualiti produk, prestasi kerja, dan kecekapan mesin. Berdasarkan kajian pada masa kini, kualiti, kesihatan dan keselamatan diambil kira dalam sesetengah pekerjaan. Risiko posisi bekerja yang dikenal pasti adalah posisi yang janggal, hubungan tekanan, pergelangan tangan, postur statik, keletihan, berpusing kedudukan tulang belakang, membongkok, terlalu jauh dan tidak dapat dicapai. Oleh itu, kajian ini bertujuan untuk memerhati, mengkaji dan menganalisa kawasan bekerja serta pekerja-pekerja di dalam industry pembuatan dengan menggunakan kaedah '*lean*' dan ergonomik. Kaedah yang digunakan adalah dengan menggunakan perisian simulasi Witness, penilaian '*Rapid Upper Limb Assessment*' (RULA) secara manual dan RULA menggunakan perisian simulasi Delmia. Berdasarkan data prestasi pekerja yang diambil dari persekitaran pembuatan yang sebenar, simulasi pekerja-pekerja dan analisis statistic terhadap 23 orang akan dianalisis. Menggunakan keputusan analisa awal, bilangan pekerja yang dikaji dikurangkan kepada 9 pekerja dan dicekikan lagi kepada 3 pekerja. Kaedah ini akan mengesahkan pendedahan setiap individu pekerja dengan faktor-faktor risiko ergonomik yang berkaitan dari hujung atas dan keseluruhan postur badan. Berdasarkan keputusan itu, tiga pekerja dari proses yang berbeza telah dipilih; pekerja dari proses '*Toroidal Winding*', pekerja dari proses '*Epoxy*', dan pekerja dari proses '*VMI*'. Pekerja-pekerja yang telah dipilih untuk simulasi itu mengalami risiko terhadap '*Musculoskeletal Disorder (MSDs)*' pada tahap yang berbeza, dengan skor 6, 6 dan 4 dengan menggunakan simulasi Delmia dan 7, 6, dan 3 dengan menggunakan penilaian manual. Dengan melihat hasilnya, prestasi pekerja dan MSDs mempunyai hubungan antara satu sama lain tetapi perlu melihat aspek lain seperti beban kerja setiap pekerja juga.

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