

ORIGINAL ARTICLE

Ergonomic Risk Factors and Job Performance of Electronic Employee in Malaysia

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ABSTRACT

Introduction: Ergonomics is the scientific study of the interactions between humans and other elements of a system to improve human well-being and overall system performance. In larger scope ergonomics examines human behavioral, psychological, and physiological capabilities and limitations. It has given a huge impact on the workers comfort which directly affects the work efficiency and productivity. In Malaysia, the electronics industry is the leading industry in the manufacturing sector and one of the largest employers. This study was conducted to examine the relationship between ergonomics factors and job performance among employees in electronics industry. **Material and Method:** A total of 155 employees in electronic industry were involved as respondents in this study. A cross-sectional study was conducted using self-administered questionnaires consisting of sections on physical ergonomics, cognitive ergonomics, and organizational ergonomics and job performance. The data were analysed using SPSS version 25, and descriptive statistics, person correlation and multiple linear regressions were used to identify the factors associated with job performance. **Results:** The findings showed that there is a significant relationship between ergonomics factors (physical ergonomics, cognitive ergonomics, and organizational ergonomics) and employee performance with $p < 0.05$. While the multiple linear regression analysis found that the most contributing ergonomics factors was physical ergonomics that significantly affects job performance in the electronics industry in Malaysia. **Conclusion:** Ergonomics factors can be used to promote improved performance and productivity from the employees in the organization such as awareness training and education.

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INTRODUCTION

Ergonomics is an essential variable impacting every employee's work performance in an organisation. One of the significant assets of any corporate organisation is the employees. Hence, giving full attention to employees' ergonomic demands is crucial as it enables them to effectively fulfil their responsibilities and improve their overall performance and outcomes. The IEA characterizes the field of HF/E into three domains of specialization: physical, cognitive, and organizational. Physical ergonomics focuses on the physical-elements, interactions, and activities. Cognitive ergonomics focuses on human mental processes and perception. Organizational ergonomics focuses on optimizing the surrounding organizational aspects of the system in which human workers operate (1). Shahzadi et al (2)

stated that performance of the employee is considered as what an employee does and what he doesn't do. Employee performance involves quality and quantity of output, presence at work, accommodative and helpful nature, and timeliness of output. Sheila (3) mentioned that the type of workplace surrounding and environment a business provides their employees speaks volumes regarding how the organisation values their people. The growing proportion of workers in manufacturing industry means that many workers are potentially exposed to ergonomic risk factors at the workplace, which may consequently affect their health. The authors suggested a guideline to implement interventional ergonomics programmes at the workplace and improve the musculoskeletal health of workers in the manufacturing industry in Malaysia (4). Ergonomics has gained attention and take into consideration by the workers in the different fields of works recently. It has given a huge impact on the workers comfort which directly affects the work efficiency and productivity. It is vital for the workers to realize the importance of the ergonomics to assess potential ergonomics risk factors

existed around their workplace (5). Previous study has been focusing on risk factors of ergonomics and MSD in manufacturing industries such as automotive manufacturing (6-8), electronic manufacturing (4, 9-10), metal stamping industry (11), and rubber manufacturing (12). In this study, the main objective to identify relationship between ergonomics factors such as (physical ergonomics, cognitive ergonomics, and organizational ergonomics and job performance among manufacturing employee, which is quite different from previous study.

As mentioned in previous research by Chandwani et al. (13), the science of creating or redesigning the workplace to fit the task and enhance safety, comfort, and productivity is known as ergonomics. They also added that a proper setup would help the organisation meet the ergonomics requirement for employees' safety and health and reduce their risks of injury. Additionally, ergonomics concepts enable workers to balance their activities and need to enhance productivity, physical, physiological, social, mental, and emotional health, safety, and work satisfaction and performance (14). By improving work conditions and embracing human-centred production methods, manufacturing businesses can recognise the human element as a crucial and valuable component. Work-related ergonomics plays a significant role in achieving this goal. According to Gualtieri et al., ergonomics is divided into three broad groups that deal with the physical, cognitive, and organisational elements of human-system interaction (15).

Kumar & Bezawada (16) mentioned that great looking spaces can encourage employees to perform well. In this case, physical ergonomics have become one of the common things that happened in all organization. In addition, Sing et al. (17) mentioned that workers suffer from MSDs for a variety of reasons, including repetitive movement and unpleasant posture as a result of a poor working environment. Inappropriate workstation design may result in physiological or psychological consequences like aggravating job satisfaction, crowding stress, fatigues, and high blood pressure (18). Other comparable types of consequences include psychosomatic health complaints which are chronic fatigue, burnout, mental strain, and musculoskeletal disorders leading to poor employee productivity (19). On the other hand, employee's performance might be lower due to the mental workload. Mehta (20) mental workload, fatigue and stress from overloaded cognitive subsystem have been shown repeatedly to impair numerous areas of human physical capabilities.

Organizational ergonomics inspects techniques to optimise the complete work environment. This comprises identifying ways to promote teamwork, advance communications, raise output and strengthen the whole quality of a product (21). In Malaysia, studies

have shown that low employee performance occurs due to accidents, health problems and stress at work. This situation affects the performance of the organization, reduces the quality of work, increases the cost of workers' compensation, and ultimately interferes with the development of the organization and the growth of the national economy (22).

MATERIALS AND METHODS

This study was conducted in one of electronics manufacturing company located at Bayan Lepas, Pulau Pinang. The factory that consists of manufacturing of industrial, medical needs and automotive. the employees are consisting of day shift and night shift. Employees will be having day shift for a week and shifting to night shift for another week and the rotations keep on going. Cross-sectional research was utilised in this study. The questionnaire is distributed to the employee to acquire data and information. Employees were allowed to respond to the question based on a Likert scale. The scale ranges from 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, to 5 = Strongly Agree. This type of scale is used where it best suits the study, as highly accurate results can be attained.

In this study, primary data was collected through a questionnaire. Specifically, an online questionnaire was created using Google Forms. Subsequently, the researcher distributed the questionnaire to the employees through the Google form link. Results from Google Forms were used as data in research. Sampling technique was selected randomly based on the phone number of the employee in the industry. The study population was the operators from the main headquarter factory at one of electronic industry in Pulau Pinang. The population for this study is 260, hence the amount of sample size is 155. The sample size in this study is determined using table of Krejcie & Morgan (23).

This study used questionnaires adopted from previous studies to investigate the relationship between independent variables such as physical ergonomics, cognitive ergonomics, and organisational ergonomics. All the questions were in closed form. The questionnaire comprised five sections from Section A to E. Section A queries the respondents' demographics by gathering personal information such as age, gender, race, period of service and highest education level. This information is vital to clarify the respondents' background at an early stage. Sections B, C and D were the primary sections of this questionnaire, as the sections focused on the independent variables, namely physical, cognitive, and organisational ergonomics. The questions for physical ergonomics, cognitive ergonomics, and organisational ergonomics, comprising five questions each, were adapted from Asogawa and Nduibuisi's study (1). Section E contains the study's dependent variable, namely job performance. Five questions for this section

were adapted from Borsos (24) and Ahmad (25).

The pilot test was conducted before the actual study for reliability test. The reliability of the instrument was measured by using Cronbach's alpha values and the results for physical ergonomics (0.77), Cognitive ergonomics (0.71), Organizational ergonomics (0.71) and Employee performance (0.82). The results of the scale in which it should be more than 70% (> 0.7), while the results below the scale of 0.7 indicate that the questionnaire is unreliable and cannot be used for the actual study.

This study was approved by Department of Management, Faculty of Defence Studies and Management, National Defence University of Malaysia (NDUM), reference number UPNM (FPPP) 05.05/01 JIL 4 (45)

RESULTS

Demographic profile of the respondents

According to the data analysis in Table I, female respondents are higher (66.5%, $N = 103$) than male respondents (33.5%, $N = 52$). The difference between female and male respondents is 33.5% ($N=51$). Most of the respondents are Malay (54.8%, $N = 85$). The second highest number of respondents are the Indians (26.5%, $N = 41$), followed by the Chinese respondents (13.5%, $N = 21$). The least number of respondents are others, with 5.2% ($N = 8$).

Table I shows that the majority of respondents comprised two age groups, namely 26-35 and 36-45 years old. Thus, the employees are in their middle age, which is between 26 years old to 45 years old. In addition, according to Table 1, the percentage of respondents aged between 20 to 25 years old is 21.3% ($N = 33$). The respondents aged 46 to 55 are the least, with only 16.8% ($N = 26$).

As for the period of service, most respondents served selected electronic company in Pulau Pinang for six to ten years (32.3%, $N = 50$), followed by 11 to 15 years (31.0%, $N = 48$), one to five years (20.6%, $N = 32$), and the least were those who served for above 16 years (16.1%, $N = 25$). Table 1 also reveals that most respondents have SPM as their highest education level (34.2%, $N = 53$), followed by a degree (31.0%, $N = 48$), diploma (18.1%, $N = 28$), STPM (9.0%, $N = 14$), others (5.2%, $N = 8$) and lastly, PMR (2.6%, $N = 4$).

Relationship between Physical Ergonomics, Cognitive Ergonomics, Organisational Ergonomics, and Job Performance

Table II shows the strongest linear relationship between physical ergonomics and job performance ($r = 0.641$, $p = 0.000$, α adjusted = 0.05). The correlation coefficient (r) of 0.683 indicates a moderate positive linear relationship between physical ergonomics (X1)

Table I: Respondent's Demographic Profile

Characteristics	Frequency	Percentage (%)
Gender		
Male	52	33.5
Female	103	66.5
Total	155	100.0
Race		
Malay	85	54.8
Indian	41	26.5
Chinese	21	13.5
Others	8	5.2
Total	155	100.0
Age Group		
20 – 25	33	21.3
26 – 35	48	31.0
36 – 45	48	31.0
46 – 55	26	16.8
Above 55	0	0
Total	155	100.0
Period of Service		
1 – 5 Years	32	20.6
6 – 10 Years	50	32.3
11 – 15 Years	48	31.0
Above 16 Years	25	16.1
Total	155	100.0
Highest Education Level		
PMR	4	2.6
SPM	53	34.2
STPM	14	9.0
Diploma	28	18
Degree	48	31
Others	8	5.2
Total	155	100.0

Table II: The Finding for the Relationship between Physical Ergonomics, Cognitive Ergonomics, Organisational Ergonomics, and Job Performance

	Job Performance		
	Magnitude of Relationship	Coefficient (r)	p-value
Physical Ergonomics	Moderate	0.641	0.000
Cognitive Ergonomics	Weak	0.443	0.000
Organisational Ergonomics	Very Weak	0.227	0.005

and employee performance (Y). This finding suggests that the employee performance rating also increases as the score for physical ergonomics (X1) increases. This finding supported the research hypothesis that a positive relationship exists between physical ergonomics (X1) and job performance (Y).

The second strongest linear relationship was found between cognitive ergonomics and job performance ($r = 0.443$, $p = 0.000$, α adjusted = 0.05). The correlation coefficient (r) of 0.683 indicates a weak positive linear relationship between cognitive ergonomics (X2) and job performance (Y). This finding clearly supported the research hypothesis that there is a positive relationship between cognitive ergonomics (X2) and employee performance (Y).

The weakest linear relationship was found between organisational ergonomics (X3) and job performance ($r = .227, p = .000, \alpha \text{ adjusted} = 0.05$). The correlation coefficient (r) of 0.227 indicates a weak positive linear relationship between organisational ergonomics (X3) and job performance (Y). Nevertheless, this finding still clearly supported the research hypothesis that there is a positive relationship between organisational ergonomics (X3) and employee performance (Y).

The Most Contributing Factors between Physical Ergonomics, Cognitive Ergonomics, Organisational Ergonomics, and Job Performance

As depicted in Table III, the largest beta coefficient (standardised coefficient) obtained was 0.652 for physical ergonomics (X1), and this value corresponds with the highest t-statistic of 7.306. Hence, after accounting for the variance explained by all other predictor variables in the model, this variable stands out as the primary contributor in explaining the dependent variable, employee performance. It suggests a 0.089 standard deviation increase follows one standard deviation increase in employee attitude and performance.

The beta value for organisational ergonomics (X3) was the second highest (0.103). This result indicates that a 0.071 standard deviation increase follows one standard deviation increase in organisational ergonomics in job performance. Subsequently, the beta value for cognitive ergonomics (X2) was the smallest (0.092), indicating that it made the least contribution. Thus, one standard deviation increase in cognitive ergonomics is followed by a 0.092 increase in job performance.

DISCUSSION

Wilson (26) conclude that ergonomics is the theoretical and fundamental understanding of human behavior and performance in purposeful interacting sociotechnical systems, and the application of that understanding to design of interactions in the context of real settings. Our findings showed that there is a significant relationship between ergonomics factors (physical ergonomics, cognitive ergonomics, and organizational ergonomics) and employee performance. While the most contributing ergonomics factors was physical ergonomics that significantly affects job performance in the electronics industry in Malaysia. This finding supported by Omar (27) et al as they prove that ergonomics does effects job performance among employees. Hellar (28) studied the

role of workplace ergonomics on employee performance. The study revealed that physical ergonomics affect employees’ performance. The study recommended that more training on workplace ergonomics to boost employee awareness supports the objective. The lack of comfort due to workplace environment impact could trim down job performance and organizational productivity. The effects of ergonomics in the work environment need to be emphasized in an organization as they can affect organizational performance (29). Naharuddin & Sadegi (30) clarify the factor of physical workplace environment that could affect the employees’ performance. According to Boles et al. (31) when the employees are physically and emotionally have the desire to work, then their performance outcomes shall be increased. Some research had shown that there are some positive impacts when a proper workplace environment such as the machine design, job design, environment, and facilities design (32).

This objective was supported by Hamidi et al. (33), who studied the relationship between the physical workplace environment and employee performance. According to this study’s conclusions, the physical office environment is vital in sustaining employee performance. Organisations must evaluate their physical office environment to improve employee performance and fulfil the company’s goals. Study conducted by Yusof (4) among manufacturing workers found that the pain experienced by the workers at the lower back, upper back, shoulders, left foot, and thighs was higher compared with that at other body parts. In addition, the results showed that the level of risk of injury was high for the participants because of postures in the vertical lift zones, torso twisting, and sideways bending, and because of their hand distance from lower back. This study also supported by Shiela (3), as they concluded that having work/task design that are repetitive makes employees feel tired and bored and that insufficient rest time for the employees also leads to health conditions that negatively affects performance.

Alzahrani (34) who examined workplace ergonomics and academic staff performance in the College of Education at Umm Al-Quran University in Mecca found that physical ergonomics positively correlates with employees’ performance. Hence, if an organisation creates and provides an excellent ergonomic workplace, people will perform better while executing their tasks. According to Nawaz et al.35, employees feel that effective

Table III: Estimates of Coefficients of the Three-Factor Multiple Linear Regression Model to Explain the Variation of Job Performance (Y)

Employee Performance (Y)	B (Unstandardised Coefficients)	Std. Error	Beta (Standardised Coefficients)	t	p-value
Constant	.513	.349	.00	1.468	.144
Physical Ergonomics	.652	.089	.574	7.306	.000
Cognitive Ergonomics	.092	.092	.078	.998	.320
Organisational Ergonomics	.103	.071	.091	1.443	.151

Notes: R= 0.650, R2 = 0.423, Adj. R2 = 0.411, F (3, 151) = 36.883, P = .000

workplace design will increase their productivity at work and further added that ergonomic designed furniture provides an ideal work environment that matched with the individual's physical capabilities. Therefore, the business community must be well educated to ensure that they can appreciate the advantages of creating a better working environment to increase productivity. A company that offers a better work environment able to improve the employees' well-being, boosting productivity and reducing healthcare costs.

In their study on the effects of a workplace intervention in cognitive ergonomics on cognitive strain and well-being, Kalakoski et al.(36) noted that cognitively taxing settings had an immediate impact on job performance. The primary finding of this study revealed a significant connection between job performance and cognitive ergonomics. This second objective was also supported by Chandwani et al. (13), who undertook a study related to cognitive ergonomics emphasis on stress. The study mentioned that stress may help workers to work effectively and accomplish their goals. Nevertheless, excessive work-related stress can lead to health effects such as anxiety, depression, sleeping problems, fatigue, and loss of interest in work, which may contribute to low productivity and performance.

Past research by Paais and Pattiruhu (37) in Indonesia, showed that employees' performance was influenced by motivation and leadership, which are also variables of organisational ergonomics. Thus, their finding revealed that organisational ergonomics is crucial for every organisation in the hotel and tourism industry to ensure employees' performance increase and directly affect business success. This objective is also backed by Akinbola and Popoola's (38) research on organisational culture, organisational structure, unsuitable sitting, lighting, processes, workstation space, design, and temperature as factors influencing organisational success. The findings revealed that workplace design and suitable ergonomics techniques significantly impact employee productivity and organisational performance. The three ergonomics factors in this study positively influence the job performance. Corlett (39), it is even more important when referring to the performance of work, for improving the ergonomics of a workplace is not just a matter of changing one component. This finding supported by Fritsher-Porter (40), as he concluded that an ergonomically workplace environment can probably increase efficiency, productivity, and performance in the organization. On the other hand, studies have shown that practically, an effective ergonomics may improve quality of work life and performance, decrease in musculoskeletal disorders and increase in productivity and in attention to high differences of using ergonomics among developed and developing countries (41).

CONCLUSION

A strategic ergonomic approach can optimize human well-being and on the whole system performance. Furthermore, the study's results clearly proved that the three ergonomics factors namely physical ergonomics, cognitive ergonomics, and organisational ergonomics, which play a crucial part in job performance. Therefore, managers and supervisors should give serious consideration to the ergonomics factors identified as influential in job performance among Electronics employee in Pulau Pinang. In addition, the awareness training and education should be implemented to improve employee performance mainly and to prevent the development of MSD symptoms among employees.

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