ORIGINAL ARTICLE

ERGONOMICS STUDY IN THE STRESS LEVEL AMONG ELECTRONICS ASSEMBLY LINE WORKERS

Kamarulzaman MK[1], Muhammad Nubli AW[2*] and Ezrin HS[3]

[1]BI Technologies Corporation Sdn Bhd (21929 -T), A-1445 Jalan Tanjung Api,25050 Kuantan, Pahang, Malaysia
[2]Centre of Modern Languages and Human Sciences, Universiti Malaysia Pahang, Gambang, Kuantan, Pahang, Malaysia
[3]Occupational Safety and Health Program, Faculty of Industrial Sciences and Technology, Universiti Malaysia Pahang, Kuantan, Pahang, Malaysia

***Corresponding author: Muhammad Nubli**
Email: nubli@ump.edu.my

ABSTRACT

Human and cognitive ergonomics become one of essential elements in industrial field nowadays due to employer concern on physical, spiritual and emotional of their workers. The need of industrial today required operator's cognitive functions with less manual human control but in reality human judgement cannot be eliminate as there are various task that only can be perform by human. The objective of this study is to investigate the level of stress among Muslim electronics assembly line workers in electronic factories in Malaysia. The method used in this study is a survey questionnaire. The study is to compare the stress level between male and female, different ages of worker, years of working experience and task deliver in the plant to perform their duty and contribute to company. The tool administered is DASS 42 questions which distributed to the 360 worker from different level which is staffs and operators. Based on it, emWavePro device are used to test workers biofeedback performance in order to determine target persons for stress management module implementation. Workers performances in terms of productivity are measure after complete module implementation. The result may shows that workers that undergo this programed as a subjects improve their work performance by increasing productivity. Workers may came to work with positive attitude that impact positive environment to the plant. Using DASS, 319 of electronics assembly line workers are evaluated and from that 18 workers are identified with extremely severe of depression, anxiety and stress. From 18 workers, 61.1% are come from age between 19 and 29 years old with working experience less than 5 years. These 18 workers had potential to influence others that can disturb positive environment on the plant and change it to negative environment. Cognitive ergonomics is one of important elements to be focus as it impact workers performance every day. Not only physical, spiritual and emotional of the workers also contribute to the plant achievement in general.

Keywords: *Stress, Biofeedback, Electronics Operators, Cognitive Ergonomics*

INTRODUCTION

Stress always present in people life. It is occurs due to the interaction between human mind and surrounding environment that will affect physical and mental condition[5]. Recently, occupational stress is a negative emotion that fully affected the worker's performance and shall become a source of concern to measure and reduce it. There are several factors related with stress at workplace contribute to lower worker's productivity such as demanding from the company in term of work, poor guidance from supervisor and from workers, too long working hours and many other prominent factors[5]. Increasing number of assembly line operators in electronics manufacturing industries were recorded due to the higher demand from external and internal resources to hire more workers to operate in production line. This brings the manufacturing company to get excellence results by pushing their workers to operate the production. However, it contributes to occupational stress and the workers even do not realize that their psychological condition are under pressure. Regardless of the workplace, professional or non - professional, stress can significantly impact workers unless they recognize and manage the symptoms (example: absenteeism) and factors (example: overtime at work) that contribute to the problems.

As the previous survey showed, some workers are under occupational stress, and this will directly affect the company's production, which can reduce the profitability of the company. This problem will have a major negative impact on the company from time to time. The idea of improving the productivity of workers by highlighting issues of work stress among workers was based on the previous survey known as the Employee Engagement Survey (EES). Previous data showed that employees in TT Electronics Kuantan's electronics manufacturing had some stress - related workplace issues. Based on the previous survey, management had decided to look on stress issues as one of the key issues to solve in order to achieve better worker performance. An immediate action was taken by implementing "Happy Room" as a stress management centre. The Happy Room section was divided into 4 groups that are equipped with information related stress management, stress level measurement, relaxing music and videos,

and some activities that can provide worker comfort. The main purpose of this paper is to investigate on depression, anxiety, and stress (DASS) scale among electronics assembly line operators and was conducted as requested by the company's management to improve the productivity of workers.

This paper objective is to investigate on the level of stress among Muslim assembly line operator at an Electronic Factory by using DASS Survey and interview session. This procedure was conducted at new developed counselling centre at TT Electronics Kuantan called Happy Room. This study will be impact their work performance as workers' productivity is related to the actual production generated by each worker for each paid work and there is a beneficial impact on company's quality standard also. When worker productivity increases, it enables the economics of the company to increase the production of goods and services based on relationship between the quantity of work and the effort made [10] . The increasing of worker productivity will influence the profit of the company. Worker productivity is also referred to the invention of the workplace environment where workers are facilitated and guided in continuing to produce production efficiency in the performance of their duties and functionalities[7]. Also in order to boost productivity, there are several factors that leaders of the organization must take into account, having a proper and well - organized mission, performance must be directly focused on winning goals, it is important to evaluate workers performance to recognise faults and inaccuracies, implement measures to improve the performance [7]. As mentioned by[10] productivity at work is identified with the connection between the production of the company and workload worker, where this relationship could be affected by a variety of phenomena. An instance is that productivity depends entirely on the worker's effectiveness and/or physical effort at work. Despite the fact that there are variety of factors influencing the management of worker productivity, things such as accumulation of capital, technical changes, organization of production and psychological conditions experienced by workers as a response to the environment in which their activities occur [10].

METHODS

Quantitative Method

Quantitative method is one of the research method that usually adopted for certain phenomena related with objectives and will be monitored through data collection and data analysis [15]. In this research, quantitative method was used to achieve the objective which is to investigate on the level of stress among assembly line operators. This research used questionnaire form that has been developed by[8]. The analysis result involved larger number of respondents to measure the depression, anxiety and stress scale.

Depression Anxiety Stress Scale (DASS 42-items)

The DASS-42 has become a self - survey scale of 42 items capable of measuring the negative psychological states [8]. This measurement involved three dimensions of depression, anxiety and stress. Each dimension contains 14 items (see Appendix A). Depression dimensions assess the level of frustration, life depreciation, interest or involvement, as well as anhedonia and inertia. The dimensions of anxiety are the observation of automatic stimuli, muscle changes, anxiety about the condition and anxiety effect, while the pressure dimension studies the level of non - specific stimulus. For instance, the assessment of the degree of calm, stimulus nerves, stress and depression and lack of patience. DASS-42 can determine the stress level among assembly line operators in this paper.

Survey Form

According to [15], the chosen research method should be in line with the objectives of the study. Through this method, the objective of the study to be achieved is to measure the level of depression, anxiety, stress and discover the heart rate variability (HRV) spectrum among stress worker. To achieve this objective, a survey form is used to obtain background information of the participants as well as the level of understanding of the three negative emotional in the individual as well as identifying the causes for the problem. [17] said that the use of survey forms was relevant as the participants responded individually.

Section A is a survey to obtain demographic information from the respondent. This survey contained six questions that were asked about gender, age, department, position, scope of work and years of work. Section B is aScale of depression, anxiety and stress was introduced by Gordon and Baucom (1999) and translated into French by Shackelford et al. (2008). Respondents were asked to use four-point scales for measuring the extent to which each individual state experienced over the last week. Scores were computed for each subscale by summing the scores for the corresponding items (Azhar, Abbas, Wenhong, Akhtar, & Aqeel, 2018).The DASS-42 items method is a Likert in the form of 0 to 3. The items presented provide a positive impression with the lowest value of 0, whereas the item showing the negative is the highest value of 3.

Table 1 – Scaling Item

Answer	Scoring
Indirectly depicts my situation	0
Rarely describe my situation	1
Many / often describe my situation	2
Very often describe my situation.	3

Table 2 – Index of DASS Scale Rating

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Very severe	28+	20+	34+

In this research, the assembly line operators in an electronics manufacturing at Kuantan was chosen as a respondents. Respondents were able to cooperate and complete the questionnaire as requested by management. The selection of participants is based on extremely severe of depression, anxiety and stress. This sample was examined to investigate the root causes that contributed to the problem mentioned.

RESULTS

Demographic Profile

A total of 360 questionnaires were distributed among electronics assembly line workers and 319 responses were received, resulting in a response rate of 88.61%. Based the Table 1, the results of the survey showed that female respondents were more than male respondents. It can be seen based on the results of the analysis that showed that male were 32 with 10% and female respondents were 287 with 90%. This is because female are more likely to work in an electronics manufacturing compared to male. Besides that, majority of the age of respondent is in range of 19-29 years is 176 people with 55.20%. Followed by the age group between 30-39 years is 60 people equal to 18.80%. The range between 40-49 years represented 21 people with 6.60%. Lastly, only 62 respondents at age between 50-60 (19.40%).

Table 3 illustrate profile of respondents in this study. There are 4 departments involved in this study which are Agilent, ASL, Keysight, Magnetic and Moulded. Majority of respondents are from magnetics department with the total number 156 respondents equal to 48.9%. Keysight and moulded involved the same number of respondents, 43 people with 13.50%. The minority who of respondents in department of Aerostanrew Line is 24 equal to 7.50%. It's because the department of Aerostanrew Line is still new in the company and was declared last year in 2018.

From the participated respondents required to the number of years working in the industry, the respondents that have works more than 30 years which are 46 respondents equal to 14.40% followed by 21-30 years with 21 respondents equal to 6.60%. This is because this company of electronics manufacturing are well establish for a long time and have large number of workers with a good experience and more expertise. Length of services between 11-20 years consists of 11 respondents equal to 3.40%. The total number of respondents between 5-10 years is 59 equal to 18.5%. Then the majority of respondents who were working less than 5 years consist of 182 respondent equal to 57.10%. The percentage of services less than five years is higher than others. An electronics manufacturing hired new workers with less experience and also provided them with training and proper guidance.

All the 319 respondents are assembly line operator which show that all the respondents help management to investigate depession, anxiety and stress scales (DASS-42items) workers at workplace and improve worker's productivity by involve direct and indirect with implementation of "Happy Room" in company.

Table 3 – Profile of respondents

Category	Frequency	Percent (%)
Gender		
Male	32	10.0
Female	287	90.0
Age		
19-29	176	55.2
30-39	60	18.8
40-49	21	6.6
50-61	62	19.4
Department		
Agilent	53	16.6
Aerostanrew Line	24	7.5
Keysight	43	13.5
Magnetic	156	48.9
Moulded	43	13.5
Length of services		
Less than 5 years	182	57.1
5-10 years	59	18.5
11-20 years	11	3.4
21-30 years	21	6.6
More than 30 years	46	14.4

Table 4 - number of respondents and percentage for each of three negative emotional

Negative Emotional	Depression		Anxiety		Stress		High DAS	
Number of respondents (%)	27	8.46	167	52.35	61	19.12	18	5.64

Based on DASS-42 items, the data was analysed and calculated using existence formula from [14]. The higher score for each of the three negative emotional shows that are person were under psychology problem. The lower the score, the better of the individual result. The result for DASS-42 item shown in Table 4. The data analysis represented result for each of the three emotional and also the overall result for respondents who extremely severe for depression, anxiety and stress. Total 27 respondents equal to 8.46 % having a depression problem. From the 8.46% of the depressed workers, 13 respondents are between the ages of 19-29, 6 respondents are between 30-39 years old and only 4 respondents between the ages of 40-49 and 50-59 were depressed according to this study.

The majority of depressed workers have less than 5 years of professional working experience with a total of 16 workers. In addition, There are also 4 employees with 5-10 years of work experience. Two participants had 2130 years of work experience were depressed and only five workers with more than 30 years work experience had the same problem.There are five departments in this study where the highest number of depression is came from the magnetic department consists of 16 workers and followed by department moulded with the number of 4 workers having this problem. While the Agilent department consist of 3 respondents and 2 respondents are from the ASL department and Keysight were found depressed

On the other hand, 167 people were found anxious with a percentage of 52.35% . A total of 12 males and 155 females suffered anxiety, 12 males and 155 females. A total of 94 respondents between the ages of 19-29, 34 respondents between 30-39 and only 13 respondents between the ages of 40–49, while 26 respondents between the ages of 50–61 were anxious according to this study. The majority of the concerned workers are those with a total of 102 people with less than 5 years of working experience. There are 24 workers with work experience between the years of 5-10, and 6 people with work experience between 11-20 years. Total 13 people work between the range of 21-30 years and only 22 people had working experience for more than 30 years.

The most anxious workers are from the magnetic department consisting of 93 workers, followed

by the moulded department of 20 workers. While anxiety has been found in the agilent department consisting of 18 respondents and 13 respondents from the ASL department and 23 from the keysight department. The number of 61 respondents is represented stress with percentage equal to 19.12%. A total of 5 males and 56 females suffered stress state of health with a total of 38 respondents between the ages of 19-29, 8 respondents between 30–39 and 40-49, while 7 respondents between the ages of 50-61 were under stressed.The majority of stress workers have a working experience of less than 5 years and a total of 38 people. In addition, there are 10 workers experience work between 5-10 years and 4 respondents between 21-30 years. Only 9 respondents, however, had work experience with more than 30 years were under stress. Most of the workers were stressed came from the magnetics department with a total of 35 workers, followed by the moulded department and the agilent department with the total number of 8 workers. While stress workers were found in the keysight department consisting of 6 respondents and 4 respondents from the ASL department.

The result found that 18 respondents were extremely severe for depression, anxiety and stress. Mostly, women are respondents that having serious depression, anxiety, and stress. A total of 8 workers in the range age of 19-29 group followed by the range age between 30-39 and 40-49 showed the number of respondents of 4 persons. Meanwhile, only 2 respondents between 50 and 61 years of age had problems as mentioned. The majority of respondents who were extremely severe for depression, anxiety and stress have a working experience of less than 5 years with a total of 11 people followed by only one person who had experience between the range of 5-10 years. In addition, there are 3 workers in the range of work experience between 21-30 years and more than 30 years.

Table 3 – Respondents' demographic data which fall under category "Depression", "Anxiety" , "Stress" and "HDAS

Category	Depression		Anxiety		Stress		HDAS	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)
Gender								
Male	0	0.0	12	7.2	5	7.2	0	0
Female	27	100	155	92.8	56	92.8	18	100
Age								
19-29	13	48.1	94	56.3	38	56.3	8	44.4
30-39	6	22.2	34	20.4	8	20.4	4	22.2
40-49	4	14.8	13	7.8	8	7.8	4	22.2
50-61	4	14.8	26	15.6	7	15.6	2	11.1
Department								
Agilent	3	11.1	102	61.1	8	61.1	1	5.55
Aerostanrew Line	2	7.4	24	14.4	4	14.4	1	5.55
Keysight	2	7.4	6	3.6	6	3.6	2	11.1
Magnetic	16	59.3	13	7.8	35	7.8	11	61.1
Moulded	4	14.8	22	13.2	8	13.2	3	16.7
Length of services								
Less than 5 years	16	59.3	18	10.8	38	62.2	11	61.1
5-10 years	4	14.8	13	7.8	10	16.4	1	5.55
11-20 years	0	0.0	23	13.8	0	0.0	0	0.0
21-30 years	2	6.6	93	6.6	4	6.6	3	16.7
More than 30 years	5	18.5	20	55.7	9	14.8	3	16.7

Therefore, 18 out of 360 participants will be selected for an interview session in Happy Room and some tests will be conducted through a biofeedback script to determine whether the room is effective against the assembly line operators or not. At the same time, it will identify the root cause that contributes to occupational stress. Since the purpose of implementing Happy Room was to release stress and obtain relaxation time for workers who had conflict on their workplace life.

DISCUSSION

Happy room is an alternative established by the company to ensure that workers' psychology is under control. So workers can spend time in this room to release stress during break time. Figure 1 shows some expected root cause contributing to occupational stress among the assembly line operators.

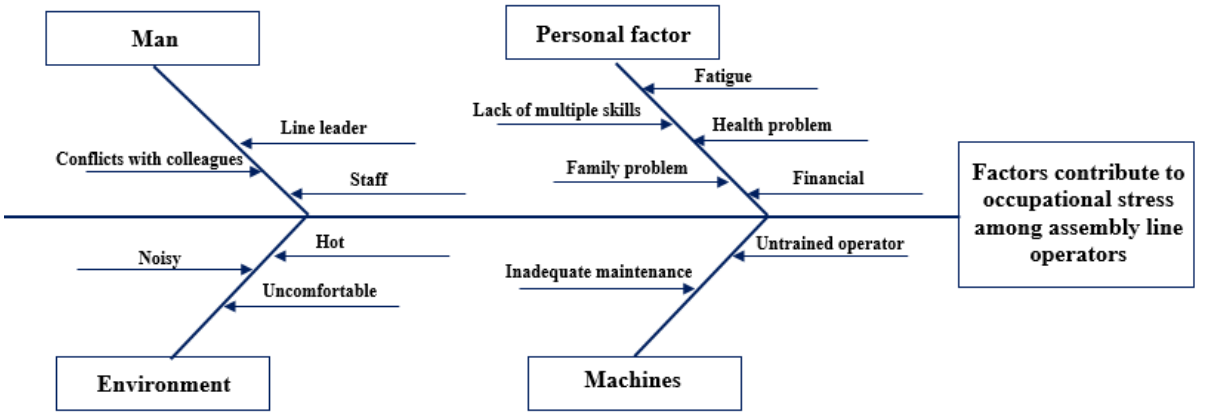

Figure 1 – Fishbone Diagram

Expected main cause that contributes to stress in the workplace is their superior called line leader. The way in which the leader manages the team actually makes the operator stress and even worse. In addition, conflicts between friends may also part of the problem as it creates a favourable condition at workplace. Staff may also the cause of the problem where some staffs are not associated with the operator, but there are also privileged ones. This will create a sense of convenience for operators dealing with related personnel. Environmental noise is also a fairly complicated factor in the work area, and it is difficult to reduce because almost every place needs machines to complete each task. Hot working conditions will also interfere with the emotions of employees, even if these conditions are rarely occurred. Work environment will cause discomfort if too many workers are placed under the same workspace.

However, personal factors also have a direct impact on the performance of workers where some workers lack multiple skills due to the lack of training provided to handle different types of tasks. Besides that, family matter is may be a common issue that usually occurs in life and the most critical factor is financial problem because some workers are willing to spend overtime to get extra wages, but only a slight increase in wages. Typically, operators are always forced to work harder to achieve company goals. This may cause overwhelming exhaustion for workers as the time spent on work and rest is unstable. Last but not least, machine handling may one of the causes that contribute to workplace stress. It is due to the worker needs to produce other tasks where the workers is incompetent. The last cause is an untrained worker who also contributes to stress among workers that may impact production performance in general.

CONCLUSION

According to this study, most females have extremely depression, anxiety and stress problems compared to male. The ages between 19-29 indicate the highest number of persons with length of service below 5 years, some of whom still new in an electronics manufacturing company and need adequate training and should be monitored to be able to do the job better. So management need to pay more attention to this target group on how to tackle them with their need as workers for their generation. Furthermore, 61.1% is a huge number that can impact plant performance in terms of profit loss and gain.

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COMPETING INTERESTS

There is no conflict of interest.

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