

ERGONOMIC PROBLEMS AND STRESS AMONG WORKERS IN A MANUFACTURING COMPANY

ZURAIDA HASSAN
NURUL HAYATI HANISAH MOHD SARIF
*School of Business Management
University Utara Malaysia*

Abstract

Ergonomics is one of the most important elements which influence both the productivity and the quality of workers' output. Avoidance of the ergonomic consideration while designing the work and work process increases stress among workers. The main purpose of this paper is to identify the relationship between ergonomic factors and stress among manufacturing workers. This quantitative research was conducted in Bangi, Selangor. A total of 100 completed questionnaires were used in the data analysis process. Findings show that work design, work process design, working hours, and workload have significant and positive relationships on stress among the respondents.

Keywords: *Ergonomic factors, stress, manufacturing sector, work design, work process design, workload.*

Introduction

Working life is full of hassles, deadlines, frustrations, and demands. For many people, stress has become an ever-present factor in their lives. Stress is an interaction between an individual and the environment characterized by emotional strain that affects a person's physical and mental condition (Brown, 2011). Stress is omnipresent, and found in all organizations. Stress is not always bad. In small doses, it may help people perform under pressure and motivate them to do their best. But when one is constantly running in emergency mode, the mind and body pay the price. Stress may lead to serious mental and physical health problems. It could also affect relationships at home and work.

Stress can be caused by many factors related to work or personal life (Byars & Rue, 2006). In the workplace, there are several factors that contribute to workplace stress such as work demands, low levels of control, poor support from supervisor and co-workers, lack of role clarity, poorly managed change, bad work design, long working hours and so on (Rossi, Quick & Perrewe, 2009).

No matter whether the workplace is professional or non-professional, stress may affect workers if they fail to recognize the symptoms and factors that contribute to this problem. The main purpose of this research is to investigate the relationship between ergonomic factors and stress among workers in one manufacturing company. This research was conducted per the request by the management of the company to help them reduce a high absentee rate and medical leave by the workers, by examining the relationship between ergonomic factors and stress (Nurul Hayati Hanisah, 2012). The significant contribution of this research is to help the workers and the company in identifying the factors that contribute to workplace stress and suggesting preventing measures.

Literature Review

Work related stress is “the adverse reaction people have to excessive pressures or other types of demand placed on them at work” (Health and Safety Executive, 2012). It could hit anyone at any level of the business. Recent research shows that work related stress is common and not restricted to particular sectors, jobs, or industries. If stress remains excessive and prolonged, mental and physical illness may develop (Rossi et al., 2009). Work related stress occurs because a person is incapable of coping with the demands being placed on them. Stress, including work-related stress, may be a significant cause of illness and is known to be linked with high levels of sickness absenteeism, staff turnover and other issues such as more errors (Faridahwati, Chandrakantan, Edora, Ghazali, Hadziroh, Ismandi, Md. Lazim & Zuraida, 2006).

Ergonomics has been defined as a multidisciplinary science that seeks to comfort the workplace and all of its physiological aspects to the worker (Goetsch, 2005). Ergonomics-used design and evaluation techniques make tasks, objects, and environments more compatible with human abilities and their limitations. Ergonomics also seeks to

improve productivity and quality by reducing workplace stressors, the risk of injuries and illnesses, and increasing efficiency (Carayon, 2011).

In modern times ergonomics has become a major source of stress for employees in an organization. In ergonomics, there are stressors that have a negative impact on the performance of employees. Ergonomic factors such as poor design of work, including work process, workstation design, shift work, humidity, and long working hours could increase the stress level among the workers, (Zafir, 2012). This could increase the likelihood of ergonomic illness as such as cumulative trauma disorders (CTD), repetitive strain injuries (RSI), back pain, shoulder pain, fatigue, and other illnesses (Karwowski, 2001).

A better physical environment at the workplace can boost the employees and ultimately improve their productivity. Experience has conclusively demonstrated that organizations with good working conditions outproduce those with poor conditions. The economic return from investment in an improved working environment is usually significant. In addition to increasing production, ideal working conditions improve the safety record, reduce absenteeism, tardiness, and labor turnover, raise employee morale, and improve public relations (Freivalds & Niebel, 2009).

Results of studies concerning the factors contributing to stress are mixed (Sauter, Murphy & Hurrell, 1990; National Institute of Occupational Safety and Health (NIOSH), 2014), but it is clear that ergonomic factors have a significant relationship and influence on stress (Karwowski, 2001; Zafir & Durrishah, 2009; Loo & Richardson, 2012). Although ergonomic consideration has been routinely practised in designing the work and work station in the high-income countries for a long time, in Malaysia it has been difficult to implement it in most companies due to lack of management commitment and budget (Loo & Richardson, 2012). The aim of this study is to identify the relationship between ergonomic factors and stress among workers. Below is an explanation of the factors of interest in this research.

Work Design

Work design is a broad topic which involves a lot of controversy and popularity due to the fact that work design affects the workers every day in the workplace. Work design allows employees to see how their

work methods, layout, and handling procedures link together as well as the interaction between people and machines (Toracco, 2005). Work design, also known as job design, is a relatively new science that deals with designing the task, workstation, and working environment to fit the human operator better (Niebel & Freivalds, 1999).

Work design has an objective to overcome employees' alienation and job dissatisfaction that comes from mechanical and repetitive task in work (Freivalds & Niebel, 2009). DuBrin (2006) viewed work design as the process of laying out job responsibilities and duties and describing how they are to be performed. The importance of work design also comes from its potential for motivating workers (Maxwell, 2008).

Implementing good work design with the application of socio-technical systems principles and techniques will humanize the work which is important to improve job satisfaction, through-put, quality and also to reduce employees' problems (Maxwell, 2008). It is also used by organization to boost productivity (Toracco, 2005). In this paper, work design refers to a proper and ergonomical work design that involves working condition and work station design.

Piko (2006) stated that stress among workers may be caused by individual feedback towards the work environment such as work design. Ergonomically-designed workstations are one of the important strategies in reducing the work stress issues in organizations (Zafir, 2012). Good work design will increase workers, efficiency and wellbeing to maintain organizational output (Ahasan, 2002). Past research from Dempsey, McGorry and O'Brien (2004) and Tarcould, Varol and Ates, (2004) clarified that a workplace design from an ergonomic perspective could effectively improve the output and minimize stress among employees.

Work Process Design

Process design is an approach that engineering and other groups use to specify how to do or create something. Work process design also includes determining workflow, equipment needs, and implementation requirements for a particular process. Process design typically uses a number of tools, including flowcharts, process simulation software, and scale models (BusinessDictionary.com, 2014).

There are many factors that need to be taken into consideration when designing the work process such as workers, abilities and skills, workload demand, type of equipment needed to fulfill the tasks, and other resources. Ignoring one of the factors in designing the work process will create stress among workers (Torraco, 2005). For example, heavy equipment and repetitive work motion will increase stress and fatigue among the workers. It will reduce the quality and productivity of the output produced by the workers (Goetsch, 2005). It also may increase the likelihood of an accident in the workplace (Health and Safety Executive, 1999).

Working Hours

Working hours is the period of time that an individual spends at paid occupational labor (Faridahwati et al., 2006). Normal working hours range between 8 to 12 hours. But under some conditions, a worker needs to work more than 12 hours in a day. Being exposed to prolonged working hours will increase stress and health issues among them (Rossi et al., 2009). Maruyama and Morimoto (1996) found that daily long working hours were significantly related to poor lifestyle habits such as drinking and smoking among workers. This problem then leads to stress problems and health issues among them.

Kirkcaldy, Trimpop and Cooper (1997) surveyed 2500 medical and dental practitioners in Germany and found that those workers who worked more than 48 hours per week reported a higher level of job-related stress compared to those who worked less than 48 hours per week. Hitchcock, Dick, Russo and Schmit (2004) found that working at night, unsociable or unpredictable hours or for long hours showed significant associations with high levels of perceived work-related stress.

Overtime and extended work schedules also increased the risk of hypertension, cardiovascular disease, fatigue, mental illness, musculoskeletal disorders, chronic infection, diabetes, general health complaints, and all-cause mortality (Dembe, Erickson, Delbos & Banks, 2005). Shiftwork also must receive attention as several researchers pointed out that it relates closely to work stress at the workplace (Tasto, Colligan, Skjei & Polly, 1978; Costa, 2003). The finding of past researches also proved long working hours without proper rest could increase depression and lead to stress (Cheng, Guo & Yeh, 2001; Ahasan, 2002; & Zafir & Durrishah, 2009).

Workload

The amount of work assigned to or expected from a worker in a specified time period (Faridahwati et al., 2006). There are two types of workload; first, mental workload and second, physical workload (Hjortskov, Rissén, Blangsted, Fallentin, Lundberg & Søgaaard, 2004). Both could ignite the stress stimuli if there is imbalance between the workers' capability and workload demand (Goetsch, 2005).

Factors that may contribute to stress caused by workload are sky-high demand for completing tasks, jobs that involve high risk and important decision-making processes, time constraints, limited resources, management pressure, and lack of support from superiors and co-workers (Burke, 2010). Mark and Smith (2012) and Mosadeghrad, Ferlie and Rosenberg, (2011) proved that an excessive workload and unsupportive work environment such as lack of management support and co-workers', increased unhappiness and stress among employees. Tasks that required decision-making and risk-taking also increased stress among workers (Soares, Sampaio, Ferreira, Santos, Marques, Palha & Sousa, 2012).

Based on the above discussion, the following hypotheses were analyzed in the study.

H1: There is a relationship between work design and stress.

H2: There is a relationship between work process design and stress.

H3: There is a relationship between working hours and stress.

H4: There is a relationship between workload and stress.

Methodology

Research Design

This quantitative research using the purposive sampling technique, has conducted in a manufacturing company located in Bangi, Selangor. The population of this study consisted of 200 employees from the assembly line in that company. The sample size was determined by using Krejcie and Morgan's (1970) table. The table suggested 127 samples for the 200 population size. The researchers decided to use 130 samples in order to maximize the response rate. However, only 100 respondents returned the completed questionnaires, representing a 77 per cent response rate.

Measuring Scale

The data collection process was carried via questionnaire distribution. Questionnaires with 50 questions each were adapted from Zafir and Durrishah (2009). The measures pertaining to work design, work process design, working hours, workload and job stress were measured by asking questions in the form of a 5-point Likert scale ranging from '1' (strongly disagree) to '5' (strongly agree). Questions on demographic information used both ordinal and nominal scales.

Reliability of the Questionnaire

The pilot test was conducted as a preliminary survey with the main purpose of identifying the reliability of the questionnaire adapted from past researchers. The result showed a significantly high value of reliability of all items (above 0.70). This indicates a high level of internal consistency of the items (Sekaran & Bougie, 2010). Some items were dropped and changed after the pilot test to ensure the validity and reliability of the instrument. Statistical analysis on the pilot test involved a data screening process. The data were screened earlier to ensure that the validity and reliability attributes were met as well to fulfill the multivariate assumptions.

Results

Demographic Characteristics

A majority of the respondents were female (55%) compared to male (45%), aged between 20 to 30 years old (50%), followed by 31 to 40 years old (34%). This situation is normal as a majority of manufacturing operators are women (Zafir & Durrishah, 2009). Forty two per cent of the respondents had a length of tenure of between one to five years with the manufacturing company.

Descriptive Statistics of Variables

The mean, standard deviation and variance were obtained using SPSS. The items with high mean scores were job stress (3.628), work process design (3.378), work design (3.278), working hours (3.207), and workload (3.167).

The correlation result showed a positive and direct significant relationship between the independent variable and the dependent variable. Workload showed a relatively low positive significant relationship with stress among the respondents with a correlation value of 0.474 followed by work design process ($r = 0.321$), work design ($r = 0.235$), and working hours ($r = 0.217$). Based on these results, all the hypotheses developed in the research were accepted.

Table 1

Correlations between Independent Variables and Dependent Variables

	1	2	3	4	5
Stress	1				
Workload	0.474**	1			
Working hours	0.321**	0.172**	1		
Work design	0.235**	0.119*	0.102*	1	
Work process design	0.217**	0.293**	0.183**	0.111*	1

* $p < 0.05$ (2-tailed)

** $p < 0.01$ (2-tailed)

Table 2 represents the model summary. The R-value in the model summary is 0.836, showing a strong linear relationship between the variables. The R square value in the model summary is 0.787. This value indicates that 78.7 per cent of the variation in stress may be explained by the relationship between the independent variables.

Table 2

Model Summary

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
1	0.836 ^a	0.787	0.757	.5549

Table 3 displays the regression equation for every significant factor with stress at the workplace.

Table 3

Regression Equation and Related Statistics

Model		Unstandardized Coefficients		Standardized Model Coefficients	T	Sig
		B	Std. Error	Beta		
1	(Constant)	.551	.100		5.372	0.000
	Workload	.438	.022	.735	78.046	0.000
	Working hours	.209	.025	.306	6.786	0.000
	Work design	.073	.022	.133	3.784	0.000
	Work process design	.058	.029	.026	2.771	0.003

Discussion

This study indicated that there was a positive relationship between work design, work process design, working hours and work load, and stress among the workers. The result of multiple regression analysis showed that 78.7 per cent of the changes in stress at the workplace were due to its relationship with workload, working hours, work design, and work process design. The remaining 21.3 per cent was caused by other factors not studied in this research. Among these factors, the workload factor had the most noticeable effect on stress among the respondents.

This was followed by working hours, work design, and work process design factors. The results were consistent with the outcome of the Pearson correlation analysis. The Pearson correlation analysis showed that the workload factor had the strongest relationship with stress at the workplace.

Most common factors associated with workload are heavy workload and high demand of work (Holcroft & Punnett, 2009). Based on the survey, most of the respondents reported that they had too high a workload and limited time to complete the given tasks. The majority of the respondents also reported that they experienced constant pressure in accomplishing their jobs, had minimum opportunity to relax, and too much of responsibility in the company.

Working hours was the second major factor in the relationship with stress among the respondent. The common factor associated with working hours was prolonged working hours. Most of the respondents reported that they were not satisfied with the work schedule fixed by the management. They also reported that their working schedule affected their quality of family life and time scheduling. These results are in line with other studies such as those by Ahasan (2002) and Rossi et al. (2009) which reported how prolonged working hours and overtime work influenced stress among the employees. Nurul Hayati (2012) also indicated that prolonged working hours and less rest among workers had a detrimental effect on goals achievement, personal development, and quality of work life.

The third factor that had a significant and positive relationship with stress among the respondents in this study was work design. Work design involves proper and ergonomic work station design in increasing productivity and quality of work. It also includes better working conditions provided by the employers to their employees'. Based on these findings, most of the respondents reported that their working conditions and work station design were at an under satisfactory level. A majority of them agreed that their management had failed to provide them with a well-designed work station area. The result was consistent with the results of past evidence such as Dempsey et al. (2004), Piko (2006), and Zafir (2012) as a significant contribution of improper work design on stress.

The last factor that had a significant and positive relationship with stress was work process design. Work process design that involved activities in determining the workflow, equipment needs, and implementation requirements in accomplishing a task create a negative stress on the workers via negative work design implementation in the company. According to the majority of the respondents, work process design that involved work activity such as frequent standing, standing for a prolonged time, repetitive tasks and congested work station increased discomfort and fatigue among them. This finding was supported by Nurul Hayati (2012), who found that the above working conditions were a primary indicator of stress among the workers caused by improper work process design.

Limitations and Future Research

The weakness of this study is the sample size. The small sample size may not be substantial for this kind of behavioral research. Moreover, the respondents were from only one manufacturing company; hence, the results of this study cannot be generalized to the entire Malaysian manufacturing population.

In the future, the number of participants from various manufacturing companies should be increased to gain more information about the ergonomic factors that are associated with stress, because a large number of respondents might give different perceptions on ergonomic issues in their workplaces. A wider geographical area should be considered for generalizing the results to the overall population, and solid conclusions could be made.

If the study is to be extended to a larger sample, the response rate could be the basis for improvement in future research. A larger number of respondents will be countered with cross validation. From here, comparisons could be made to confirm the validity of the instrument and the model. A larger sample size could generate more convincing results (Field, 2013).

Conclusion

The purpose of this study was to identify the relationship between ergonomic factors and stress among manufacturing workers. Ergonomic problems have become major issues in the company studied. These were based on the high absenteeism and medical sick leave rates. Four types of ergonomic factors were studied in this research. Based on the data analysis, workload were identified as the main ergonomic problem that had a significant and positive relationship with stress among the respondents, followed by working hours, work design and work design process. The results were consistent with and supported other past research that have demonstrated that ergonomic factors are inclusive and important issues while designing.

Management plays a major role in helping their workers deal with stress caused by work. It starts with the development and implementation of stress management policies in their workplaces.

A stress management policy is a statement of commitment made by the employer in protecting their workers from stress hazards. It also talks about the management's and the workers' responsibility in reducing hazards. Stress management training is also a good way to help workers in identifying and coping with stress. Two-way communication and feedback is another method to help the employers to identify the specific problems and issues of stress among their workers. Redesigning the work and work station also contributes to reducing stress in the workplace.

References

- Ahasan, R. (2002). Human adaptation to shift work in improving health, safety and productivity-some recommendations. *Work study*, 51(1), 9–16.
- Brown, D. (2011). *An experiential approach to organisation development*. New York: Pearson.
- Burke, R. J. (2010). Workplace stress and wellbeing across cultures: Research and practices. *Cross Cultural Management: An International Journal*, 5–9.
- BusinessDictionary.com. (2014). Retrieved from <http://www.businessdictionary.com/>
- Byars, L. L., & Rue, L. W. (2006). *Human resource management*. Upper Saddle River, New Jersey: McGraw Hill.
- Carayon, P. (2011). *Handbook of human factors and ergonomics in health care and patient safety*. London: CRC Press.
- Cheng, Y. G., Guo, Y. L., & Yeh, W. Y. (2001). A national survey of psychosocial job stressors and their implications for health among working people in Taiwan. *International Archives of Occupational Environmental Health*, 74, 495–504.
- Costa, G. (2003). Factors influencing health of workers and tolerance to shift work. *Theoretical issues in ergonomics science*, 4(3–4), 263–288.
- Dembe, A. E., Erickson, J. B., Delbos, R. G., & Banks, S. M. (2005). The impact of overtime and long work hours on occupational injuries and illnesses: New evidence from the United States. *Occupational and Environmental Medicine*, 62(9), 588–597.
- Dempsey, P. G., McGorry, R. W., & O'Brien, N. V. (2004). The Effect of Work Height, Workpiece Orientation, Gender, and Screwdriver Type on Productivity and Wrist Deviation. *International Journal of Industrial Ergonomics*, 33(4), 339–346.

- DuBrin, A. J. (2006). *Essentials of management* (7th ed.). Ohio: Thomson Education.
- Faridahwati, M. S., Chandrakantan, S., Edora, I., Ghazali, D., Hadziroh, I., Ismandi, W., Md. Lazim, M. Z., & Zuraida, H. (2006). *Pengurusan sumber manusia di Malaysia*. Kuala Lumpur: McGraw Hill.
- Freivalds, A., & Niebel, B. W. (2009). *Niebel's methods, standards and work design*. New York: McGraw Hill.
- Goetsch, D. L. (2005). *Occupational safety and health: For technologists, engineers and managers* (5th ed.). New Jersey: Pearson Education.
- Health and Safety Executive. (1999). *Reducing error and influencing behaviour*. Retrieved from http://www.hseni.gov.uk/hsg_48_reducing_error_and_influencing_behaviour.pdf
- Health and Safety Executive. (2012). *What is stress*. Retrieved from <http://www.hse.gov.uk/stress/furtheradvice/whatisstress.htm>
- Hitchcock, E. M., Dick, R. B., Russo, J. M., & Schmit, J. M. (2004). *Overtime and extended work shifts: Recent findings on illnesses, injuries, and health behaviors*. New York: Centers for Disease Control and Prevention.
- Hjortskov, N. R., Rissén, D., Blangsted, A. K., Fallentin, N., Lundberg, U., & Søgaard, K. (2004). The effect of mental stress on heart rate variability and blood pressure during computer work. *European Journal of Applied Physiology*, 92(1–2), 84–89.
- Holcroft, C. A., & Punnett, L. (2009). Work environment risk factors for injuries in wood processing. *Journal of Safety Research*, 40(4), 247–255.
- Karwowski, W. (2001). *International encyclopedia of ergonomics and human factors* (Vol. 3). London: CRC Press.
- Kirkcaldy, B. D., Trimpop, R., & Cooper, C. L. (1997). Working hours, job stress, work satisfaction, and accident rates among medical practitioners and allied personnel. *International Journal of Stress Management*, 4(2), 79–87.
- Krejcie, R. V., & Morgan, D. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30, 607–610.
- Loo, H. S., & Richardson, S. (2012). Ergonomics issues in Malaysia. *Journal of Social Sciences*, 8(1), 61–65.
- Mark, G., & Smith, A. P. (2012). Effects of occupational stress, job characteristics, coping, and attributional style on the mental health and job satisfaction of university employees. *Anxiety, Stress & Coping*, 25(1), 63–78.

- Maruyama, S., & Morimoto, K. (1996). Effects of long workhours on life-style, stress and quality of life among intermediate Japanese managers. *Scandinavian Journal of Work, Environment & Health*, 22(5), 353–359.
- Maxwell, J. R. (2008, September 6). Work system design to improve the economic performance of the firm. *Business Process Management Journal*, 14, 432–446.
- Mosadeghrad, A. M., Ferlie, E., & Rosenberg, D. (2011). A study of relationship between job stress, quality of working life and turnover intention among hospital employees. *Health Services Management Research*, 24(4), 170–181.
- Niebel, B. W., & Freivalds, A. (1999). *Methods, standards & work design* (10th ed.). New York: McGraw-Hill.
- Nurul Hayati Hanisah, M. S. (2012). *Ergonomic problems and job stress: A study among workers at Nichicon (M) Sdn. Bhd.* (Unpublished doctoral dissertation). Sintok: Universiti Utara Malaysia.
- Piko, B. F. (2006). Burnout, role conflict, job satisfaction and psychosocial health among Hungarian health care staff: A questionnaire survey. *International Journal of Nursing Studies*, 43(3), 311–318.
- Rossi, A. M., Quick, J. C., & Perrewe, P. L. (Eds.). (2010). *Stress and quality of working life: The positive and the negative*. London: IAP.
- Sauter, S. L., Murphy, L. R., & Hurrell, J. J. Jr. (1990). Prevention of work-related psychological disorders. *American Psychologist*, 45(10), 1146–1158.
- Sekaran, U., & Bougie, R. (2010). *Research methods for business: A skill building approach* (5th ed.). West Sussex: John Wiley & Sons.
- Soares, J. M., Sampaio, A., Ferreira, L. M., Santos, N. C., Marques, F., Palha, J. A., & Sousa, N. (2012). Stress-induced changes in human decision-making are reversible. *Translational Psychiatry*, 2(7), e131.
- Tarcould, E., Varol, E. S., & Ates, M. (2004). A qualitative study of facilities and their environmental performance. *Management of Environmental Quality: An International Journal*, 15(2), 154–173.
- Tasto, D. L., Colligan, M. J., Skjei, E. W., & Polly, S. J. (1978). *Health consequences of shiftwork*. Washington: U.S. Government Printing Office.
- The National Institute for Occupational Safety and Health (NIOSH). (2014, June 6). Centers for Disease Control and Prevention (CDC). Retrieved from <http://www.cdc.gov/niosh/docs/99-101/>

- Torraco, R. J. (2005). Work design theory: A review and critique with implications for human resource development. *Human Resource Development Quarterly*, 16(1), 85–109.
- Zafir, M. M. (2012). Correlation analysis between ergonomics and stress at the workplace. *International Business Management*, 6(6), 648–651.
- Zarif, M. M., & Durrishah, I. (2009). Work stress issues in Malaysia. *Malaysia Labour Review*, 3(2), 13–26.