

INFLUENCE OF ENVIRONMENTAL FACTORS ON JOB SATISFACTION IN MALAYSIAN AUTOMOTIVE INDUSTRIES

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ABSTRACT

A relationship between selected environmental factors and job satisfaction was developed for employees in the automotive industries in Malaysia. Methods in developing the relationship include questionnaire design, data collection and statistical analysis. A set of multiple-choice questionnaires was developed and data collected by interviewing the employees at the production plant. One hundred and seventy male subjects between the ages of 18 to 40 years with a mean age of 26.8 and SD of 5.3 years and mean work experience of 6.5 and SD of 4.9 years took part in the survey. The survey focused on selected environmental factors and job satisfaction. The results showed that job environment factors were significantly related to job satisfaction. Further, they also highlighted that there were significant influences of age, work experience and marital status on job satisfaction. This implied that the older, married and more experienced workers were highly satisfied with their work compare to the younger, single and less experienced workers.

Keywords: Age, Environmental Factors, Experience, Job Satisfaction, Marital Status, Work Design

1.0 INTRODUCTION

The primary objective of this research is to investigate the influence or the relationship between job environmental factors and job satisfaction which will consequently affect work design. Industrial work design can be defined as the specification of work content, method and relationships to satisfy the requirement of the worker and the system as described by Das [1]. Historically, a major impetus to the study of future industrial work design came from Brodner, Wobbe and Brodner and Brodner [2, 3, 4], who pointed out that industrial work design must be developed as an integrated whole, taking into consideration the inter-dependencies among skills, organisation and technology as pointed by Das [1]. Rohmert and Raab [5] have developed a model of 'stress and strain' which adopts the human centered concept and later Das [1] combined the three approaches *i.e.* technology-centered approach, human-centered approach and socio-technical approach to develop a comprehensive model. An industrial work design model can provide a complete picture of factors involved in a work system described by Das [1]. It can be used as a tool to diagnose work design in industry effectively.

Researchers such as Nadin *et al*, [6] have suggested a number of work design strategies in order to enhance the quality of work. However, according to Oldham [7] little attention is given to the actual process of work design. There is a need for the development of tools to assist this process as pointed by Clegg [8]. This suggests the need for a more thorough understanding of the various factors that are affecting industrial work design and in turn job satisfaction. Furthermore, work design research can make progress by applying what is already known and adopting a holistic approach by asking more comprehensive set of research questions as proposed by Holman and Clegg [9]. What is badly needed is an approach to the design of work system that is human centered and that adequately addresses critical dimension of various factors that are affecting work design. The primary objective of this research is to investigate the relationship between job satisfaction and job

environment that affect work design. The methodology developed to address the objective includes questionnaire design, observation, measurements, data collection and statistical analysis.

2. METHODOLOGY

The job diagnostic survey (JDS) developed by Hackman and Oldham [10] was used as a tool to diagnose the job environmental in the survey. The JDS used was translated and modified to suit the Malaysian population. The questionnaires used in the survey consist of a set of Likert-type scales multiple-choice items as suggested by Rodeghier [11]. The relationship between job satisfaction and the tested factors were analysed statistically using correlations and regression.

2.1 The Survey

The questionnaires were distributed to the subjects individually. Two automotive manufacturing industries were involved in the survey, which will be called Auto1 and Auto 2 respectively. One hundred and seventy male subjects between the ages of 18 to 40 years took part in the survey.

2.2 The Questionnaires

The questionnaires consisted of a set of Likert-type scales multiple-choice items (Rodeghier) [11]. Basically, the questionnaires were designed in two sequential sections covering:

- General background data *i.e.* age, gender, years of employment, marital status and education levels.
- Environmental factors *i.e.* air temperature, humidity, noise and light.

The environmental factors were also tested and defined as follows:

- **Air temperature and humidity**

An important consideration on the effects of thermal environment is psychological parameters such as level of arousal and motivation

as well as other factors that contribute to individual differences as shown by Parsons [12]. The questionnaire developed on thermal comfort (temperature and humidity) adopts ASHRAE definitions as “the condition of mind which expresses satisfaction with the thermal environment”. The reference to “mind” indicates that it is essentially a subjective term. On the other hand, warmth discomfort has been shown to be related to the stickiness caused by un-evaporated sweat; for example trapped in clothing [12]. As a result, the enquiries on thermal comfort include satisfaction or comfort and discomfort on the condition explained above by ASHRAE and Parsons [12, 13]. In addition, thermal environment measurements *i.e.* work place temperature and relative humidity were taken at each workstation.

• **Noise and Light**

The term comfort is not usually used when assessing the effect of noise on the occupants of the buildings. In practice, annoyance levels are the most useful criterion according to Parsons [12]. In this study, noise level was measured throughout the workstations and the average is taken using dB(A) values. Therefore, enquires on noise include annoyance or comfort or discomfort on work place condition. Light can cause discomfort to the occupants of an environment as well as positive sensations such as pleasure and emotional sensations [12]. Enquires on light includes satisfaction or comfort and discomfort to see the task during work. Lights are measured throughout the workstations in Lux.

2.3 The Analysis

The data were analysed for correlations using spearman rank order correlation technique. Reliability tests were obtained for all factors tested in the survey using Cronbach’s α . This is to test the reliability of each question in the survey. Finally, data were analysed using regression analysis.

3.0 RESULTS

The results are divided into several sections covering:

- (i) General back ground data
- (ii) Reliabilities measures and environmental measurements
- (iii) Correlations of job satisfaction with job environment.
- (iv) Regression analysis.

3.1 General Back Ground Data

Eighty percent of male respondents interviewed in both companies held SPM certificate (equivalent to “O” levels) while others held SPM certificate with other skill certificates. 69% of the respondents in Auto 1 were married and 31% were single. On the other hand, 87% of the participants in Auto 2 were single and 13% were married. The respondents from Auto 1 were between the ages of 23 to 40 years with the mean age of 31.3 and SD of 3.9 years and mean work experience of 10.6 and SD of 3.8 years. On the other hand, the respondents from Auto 2 were between the ages of 18 to 27 years with the mean age of 22.6 and SD of 2.1 years and mean work experience of 2.6 and SD of 1.8 years.

The age factor was normally distributed but work experience was not. Work experience for Auto 1 was negatively skewed while work experience for Auto 2 was positively skewed. The responses indicated that 83% of the respondents from Auto 1 were 26 years and above while 90% of the respondents from Auto 2 were below 26 years. Only 17% of the respondents from Auto 1 were 25 years and below while 10% of the respondents from Auto 2 were 25 years and above. This was because Auto 1 had been established longer than Auto 2.

As for work experience, 90% of the respondents from Auto 1 had worked for more than 5 years. Another 10% had work experience of less than five years. Conversely, 90% of the respondents from Auto 2 had work experience of 4 years and below. Only 10% had work experience of between five to eight years. Respondents in Auto 2 were younger and less experienced than respondents in Auto 1.

3.2 Reliability Measures and Environmental Measurements

Questionnaire reliability was tested using Cronbach alpha (α). Cronbach’s alpha is derived from the average correlations of all the items on the scale [11].

Comparing the reliability measures of Hackman and Oldham [10] with Auto 1 and Auto 2 (see table 1), the present reliabilities appear adequate. For the environmental factors the reliabilities were high in Auto 1 for temperature, noise and light. However, temperature, humidity and noise showed high reliabilities in Auto 2. Humidity for Auto 1 and light for Auto 2 showed moderate reliabilities.

Table 1: Environmental measurements for Auto 1

Work Area	Average Lux reading (lux)	Relative Humidity (RH)	Room Temperature (°C)	Noise (dBA)
1	500	65	31.4	71-90
2	580	67	30.7	68-90
3	500	66	31.4	65-90
4	390	71	31	67-90
5	700	76	31	64-93
6	460	78	30.4	68-90
7	480	77	30.7	75-80
8	670	77	31	68-90
9	650	59	30.2	74-90
10	740	55	32	70-90
<i>Average value at 10 different places</i>	567	69.1	31	69-90

Table 2: Environmental measurements for Auto 2

Work Area	Average Lux reading (lux)	Relative Humidity (RH)	Room Temperature (°C)	Noise (dBA)
1	582	57	32.0	85-89
2	304	58	32.2	85-89
3	280	65	32.4	85-89
4	285	55	32.7	85-89
5	614	56	32.0	85-89
6	712	57	32.0	85-89
7	653	63	32.1	85-89
8	450	65	32.4	85-90
9	710	58	32.6	85-90
10	813	68	32.0	85-90
<i>Average value at 10 different places</i>	540	60.2	32.2	85-89

The average value for lux reading in Auto 1 was 567 lux while the average of 540 lux for Auto2. Relative humidity was higher in Auto 1 (69.1RH) than in Auto 2 (60.2 RH). On the other hand, the temperature was higher in Auto 2 (32.2 °C) than Auto 1 (31.0 °C). The average noise in Auto 1 was 69 -90 dBA while the average was 85 -89 dBA for Auto 2.

3.3 The Correlation Coefficient

The correlations between job satisfaction and job environment factors are illustrated in Figure 1. In summary, the results indicated that there were significant correlations between job satisfaction and job environment factors. Almost all correlations showed significant values. However, there were several factors which strongly supported the studies. The factor showing strong significant correlation in Auto 1 was light. While the factor showing strong significant correlation in Auto 2 was humidity.

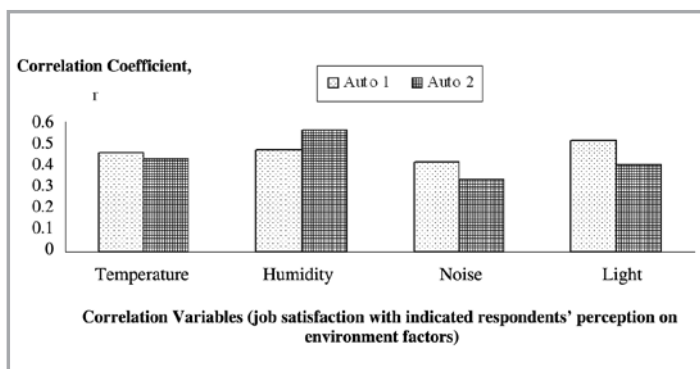


Figure 1: Correlations of job satisfaction with four environmental factors

3.4 Regression Analysis - Model Summary

To see how well a model fits a set of data, Pearson correlation coefficient r is most frequently used. A summary of the models in Table 3 indicates r (Auto 1 = 0.948 and Auto 2 = 0.921) as the correlation between the predictor factors combined and the dependent factor. The above values are quite large, indicating that the linear regression models can be predicted from independent variables.

R square indicates the proportion of the variability in the dependent factor which is taken into account by the regression model. Factors were identified to be significant for Auto 1 and Auto 2. The significant factor for Auto 1 was noise with R^2 value of 0.898 while significant factors for Auto 2 were noise and perception on humidity with R^2 of 0.848. Here about 90% (Auto 1) and 85% (Auto 2) of the variability of job satisfactions were explained by factors mentioned above. The results indicated that about 85% of the observed variability of job satisfaction in both models was explained by the two independent variables. The value was very high and indicating only the remaining of about 15% was not explained. The observed values of 0.90 and 0.85 indicated that the linear regression models predicted well [14]. Therefore, it could be concluded that perception on noise influenced job satisfaction in Auto 1 while noise and perception on humidity influenced job satisfaction in Auto 2.

Adjusted R Square is a better reflection of the proportion of variability explained by the regression model since R^2 always increases when the regressor variable is added to a regression model therefore it is not always a good indicator of model

Table 3: Model summary (Auto 1 and Auto 2)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Auto 1	0.948	0.898	0.884	0.1845
Auto 2	0.921	0.848	0.829	0.2683

Dependent factor: Job Satisfaction

adequacy (Montgomery *et al*) [14]. Note that the difference between “R square” and “Adjusted R square” for both models are very small. Thus, here both adjusted R2 or R2 can be used.

3.5 Linearity Test

Evidence indicating that the relationships between the dependent and independent factors were linear could be shown using scatter plots. Scatter plots of Job Satisfaction against Regression Studentised Deleted (Press) Residual for Auto 1 and Auto 2 are shown in Figures 2 and 3. Job satisfaction is the dependent variable. The factors are scattered without showing any pattern giving evidence that the dependent and independent factors are linear [16].

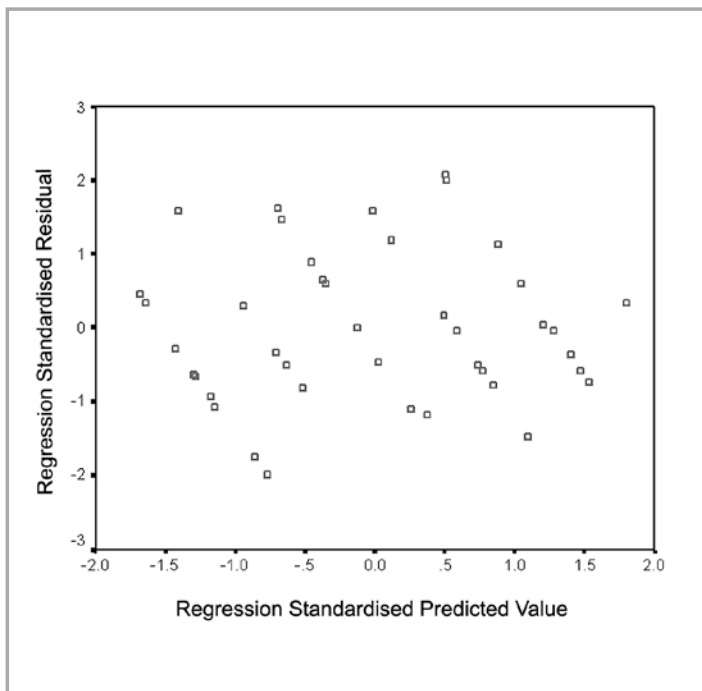


Figure 2: Scatter plot of Job Satisfaction against Regression Studentized Deleted (Press) Residual for Auto 1

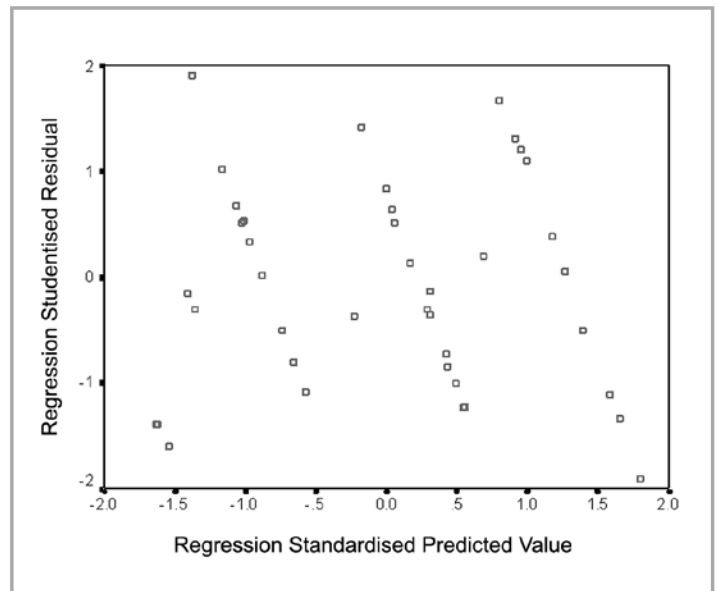


Figure 3: Scatter plot of Job Satisfaction against Regression Studentised Deleted (Press) Residual for Auto 2

3.6 Coefficient Factor

The coefficient factors table–Auto 1 and Auto 2 (see Table 4) lists the predictor factors and some statistics associated with each one. *B* is the regression coefficient for the factor. The importance of the predictor factors are shown by Beta. “t” values and the probabilities (Sig.) indicate whether the regression coefficient for each factor is greater than zero. The results showed that the t value for all the predictor factors present were significant (with $p < 0.05$), except for constants in both companies with $p > 0.05$, therefore, it could be concluded that the predictor factors predict job satisfaction in Auto 1 and Auto 2 [10].

The regression equation for Auto 1 is found as:

$$\text{Job Satisfaction} = 0.152 \text{ Perception on Noise}$$

And the regression equation for Auto 2 is found as:

$$\text{Job Satisfaction} = 0.139 \text{ Perception on noise} + 0.252 \text{ Perception in humidity}$$

Table 4: Coefficient Factors (Auto 1 and Auto 2)

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
Auto 1 (Constant)	0.046	0.208	-	0.222	0.825
Noise	0.152	0.040	0.211	3.784	0.001
Auto 2 (Constant)	0.463	0.271	-	1.706	0.096
Noise	0.252	0.051	0.367	4.953	0.000
Humidity	0.183	0.072	0.185	2.557	0.015

Dependent factor: Job Satisfaction

The coefficient variables imply that the predicted job satisfaction increases by the associated coefficient for a change of 1 of the indicated variable.

3.7 Accuracy of the Equations

The immediate task is to test the accuracy of the equations obtained from the regression models. In this study Likert-scale of 1 to 5 is used as measurements tool, therefore all the five ranges are tested in order to evaluate the accuracy of the model equation. Only evaluation of Likert-scales 1 and 5 are shown here. The coefficient variables imply that the predicted job satisfaction increases by the associated coefficient for a change of 1 of the indicated variable. For example, if the value of perception on noise in Auto 1 model changed from 1 to 2, the value of job satisfaction will change from 0.152 to 0.304 on the Likert scale.

4.0 DISCUSSION

4.1 Environmental Factors has Significant Relation with Job Satisfaction

The correlations of the four environmental factors with job satisfaction are illustrated in Figure 1. There are significant positive correlations between job satisfaction and perception of all environmental factors. The values are from low to intermediate. The outstanding correlation for Auto 1 is perception on light and for Auto 2 is perception on humidity.

The correlations of job satisfaction with perception on temperature are about the same for both companies. Conversely, correlation of job satisfaction with perception on humidity factor is high in Auto 2 compared to Auto 1. The measurements indicate that the average temperature and humidity is slightly higher in Auto 1, Auto 1: 31°C and 69.1 RH, Auto 2: 32.2°C and 60.2 RH. Further analysis using heat index [15] on the average temperature and humidity measurements taken from both companies shows that the average temperature and humidity of Auto 1 falls exactly in the “very hot” band while average temperature and humidity for Auto 2 falls in the transition of “hot to very hot” band. The location of the assembly line in Auto 2 is in the middle of the factory compared to Auto 1 which is located near openings (doors and windows) which allow additional heat from forklifts and vehicles activities to influence the working environment nearby. The above results show that workers perception on environment corresponds to the measurements. The results are consistent with ASHRAE definition that thermal comfort is the condition of mind which expresses satisfaction with the thermal environment [16]. The correlation between job satisfaction and perception of light is higher in Auto 1 compared to Auto 2. Average measurement for lights is also high in Auto 1 compared to Auto 2. The high correlation in Auto 1 could be due to high average measurement value in lighting as light can cause discomfort or positive sensation such as pleasure and emotional sensation [1] that affect respondents’ perception. The study indicated that lighting condition in both companies are within the standard of IES *i.e.* 500-1000 lux for medium assembly [9].

The correlation of job satisfaction with perception on noise factor is slightly higher in Auto 1 compared to Auto 2. Average measurements for noise indicate that noise is on average higher in Auto 2 compare to Auto 1. This explains why Auto 1 has higher correlation than Auto 2. Psychological responses to noise can also

produce effects on mental health and emotional state especially if the noise adds to an already stressful environment [1].

The results indicate that environment condition especially temperature, humidity, noise and light affect job satisfaction in automotive industries. This is supported by the illuminance measurement taken which is within the standard of IES [17]. The management of both companies should put emphasis on temperature, humidity and noise as these measurements are outside the comfortable boundary and respondents are not satisfied with the condition therefore reduce job satisfaction. It is time to revised standard environment conditions (temperature, humidity, noise, light *etc*) for automotive industries in Malaysia in order to maintain workers’ health physically and mentally, therefore increasing productivity and job satisfaction as well as performances.

4.2 The Effect of Job Satisfaction on Age, Work Experience and Marital Status

It is obvious that Figures 1 and 3 show that the correlation between job satisfaction, job characteristics and job organisation factors are higher in Auto 1 compared to Auto 2. One possible explanation is that older, married and more experience workers in Auto 1 are highly satisfied with their work compare to the younger, single and less experience workers in Auto 2.

Age is one of the factors affecting job satisfaction. Studies in five different countries prove that elder workers are more satisfied than their younger counterparts as shown by Kaya [18]. The results also support findings by Janson and Martin [19] and McCaslin and Mwangi [20] who found that older employees have higher job satisfaction. Lee and Wilbur [21] suggested that job satisfaction increases with age. One explanation for such a finding is that older employees are more able to adjust their expectations to the returns of their work [22].

The lack of job satisfaction amongst younger workers may cause them to be more mobile and seek greener pastures. If this goes unchecked Auto 2 will have a shortage of skilled and experienced workers.

Work experience is only one of the many aspects related to length of employment that can be correlated with perceived job satisfaction. However there is no literature supporting relationship between job satisfaction and years of experience as mentioned by Bedeian *et al.* and O’Rielly and Roberts [23, 24]. Research done by McCaslin and Mwangi, Bowen *et al.*, Manthe, Boltes *et al.* and Bertz and Judge [20, 25, 26, 27, 28] found that overall job satisfaction increased as the years of experience increased. There is no difference in level of education reported in both companies. Most workers hold SPM certificate (equivalent to “O” levels) in both companies or hold SPM certificate with other skill certificates. However, marital status did highlight difference percentage in both companies. Research done by Bowen *et al.* [25] stated that older, married and more experienced workers had higher levels of job satisfaction and were more committed to cooperative extension than younger, single and less experienced. In addition they also suggested that the younger, single and less experienced workers may still be deciding on their career and thus this may preclude job satisfaction and organisational commitment.

Literature on the relationship between work, marital status and family has shown that there is a spillover effect between both domains. Most of the spillover studies have investigated how work or career satisfaction affects one’s personal life. Benin

and Nienstedt [29] examined how job satisfaction affects marital happiness and global happiness. They found that job satisfaction influenced marital happiness and the effects of job satisfaction and fulfillment interacted with the effects of marital happiness in producing global happiness.

Research on relationships between work satisfaction and marital characteristics in particular is extensive and is primarily found in literature on marital satisfaction, work identity and satisfaction and dual career couples according to Blair, Ray, Gaesser and Whitbourne [30, 31, 32]. These studies suggested that career and family lives are entangled with one another and that to understand strain in one domain it is essential to have information on both facets of an individual's life [5]. Therefore further research to resolve the above matter is needed.

4.3 Regression Model for Auto 1 and Auto 2

The regression analysis can predict the importance of each factor in the equation. It can also aid in manipulating the factors in determining job satisfaction as the relative advantages of one factor over another may be clearly defined in work design. The job satisfaction equation described above is intended to provide an insight into how job satisfaction can be determined by manipulating various factors.

The model highlights that the significant factor in both companies noise R² for Auto 1 of 0.898 and R² for Auto 2 of 0.848. For humidity, environmental measurements were taken at both plants. The measurements indicated that the average humidity was slightly higher in Auto 1 than Auto 2. Analysis

using heat index by Steadman [15], showed that the average temperature and humidity measurements fell exactly in the "very hot" band for Auto 1 while average temperature and humidity for Auto 2 fell in the transition of "hot to very hot" band. The regression model implied that humidity was one of the significant factors that influence job satisfaction. However, according to this study, the results indicated that environment condition especially temperature and humidity affect job satisfaction in automotive industries. This implied that both temperature and humidity had a strong influence on job satisfaction. Therefore, the management should emphasise on these factors because they play an important role in influencing job satisfaction [12].

5. CONCLUSIONS

The results of the study indicated that there is significant correlation between job environment and job satisfaction. In summary the conclusions derived from this investigation are:

1. The strength of the correlation between job factors and job satisfaction is influenced by age, work experience and marital status.
2. There is significant correlation between job satisfaction and environmental factors.

The analyses indicated that the basic regression model give the best description of industrial work design in automotive manufacturing industries in Malaysia. Even if the models (Auto 1 and Auto 2) do not give an excellent fit in some cases they are adequate in diagnosing work design and improved job satisfaction in return. ■

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