

The Effect of Job and Environmental Factors on Job Satisfaction in Automotive Industries

**Siti Zawiah Md. Dawal
Zahari Taha**

**Department of Engineering Design and Manufacture, Faculty of Engineering
University Malaya, Kuala Lumpur, Malaysia**

A methodology was developed for diagnosing industrial work, which includes questionnaire, observation, measurements, data collection and statistical analysis. A survey was conducted to investigate the relationship between job satisfaction and factors that affect work design in 2 automotive manufacturing companies in Malaysia. A basic work design model was proposed. The aim of this model was to determine the factors that influence employees' perception towards their work. A set of multiple-choice questionnaires was developed and data was collected by interviewing employees at a production plant. The survey focused on job and environmental factors. The results supported the proposed model and showed that job and environmental factors were significantly related to job satisfaction. They highlighted the significant influence of age, work experience and marital status on job satisfaction. Further, environmental factors, especially the surroundings, context dependence and the building's function, also had a significant impact on job satisfaction.

job satisfaction environmental factors job factors survey employees' perception

1. INTRODUCTION

Industrial work design is defined as a specification of work content, method and relationships to satisfy the requirement of the worker and the system [1]. A major impetus to the study of industrial work design came from Brodner [2], Brodner [3], and Wobbe and Brodner [4], who pointed out that industrial work design must be developed as an integrated whole, taking into consideration the inter-dependencies among skills, organization and technology. In addition, Rohmert and Raab [5] also developed a model of stress and strain which adopted the human-centered concept. Later, Das [1] combined the three approaches, i.e., the technology-centered, the human-centered and the sociotechnical approaches to develop a comprehensive model.

The concept of job satisfaction is typically defined as an individual's attitude about work roles and the relationship to worker motivation

[6]. There can be no job satisfaction where there is no motivation [7]. The job satisfaction and job dissatisfaction theory of Herzberg, Mausner and Synderman [8], distinguishes two separate groups of factors influencing individual job satisfaction and dissatisfaction. The first group called motivators leads to job satisfaction and the second group called hygiene leads to job dissatisfaction.

The most important evidence that indicates the worsening conditions of an organization is the low rate of job satisfaction [7]. Thus job satisfaction is the key to establishing a healthy organizational environment in an organization. Nonetheless, factors related to job satisfaction are relevant in the prevention of employee frustration and low job satisfaction because employees will work harder and perform better if they are satisfied with their jobs [9, 10, 11, 12, 13, 14, 15, 16].

Many researchers have discussed factors affecting job satisfaction [8, 17, 18, 19, 20, 1]. In

short, factors affecting job satisfaction in work design can be divided into psychological, social, physiological, organizational, technological and economical ones [1].

An industrial work design model can provide a complete picture of factors involved in a work system [1]. It can be used as a tool for diagnosing work design in industry effectively. In this paper a basic work design model is proposed. Its aim is to establish job and environmental factors that affect job satisfaction, which in turn affect work design. Therefore the objective of this study is to investigate the relationship between job and environmental factors that affect work design. In doing so a methodology has been developed to accomplish the objective.

2. MODEL DEVELOPMENT

Studying the effects of industrial work design is a complex issue because ergonomics itself is multidisciplinary in nature. To understand the problems, it is necessary to identify various factors affecting work design as well as their effects on work design itself [1].

The study was divided into two phases. The first phase was to find the relationship between job satisfaction, work task and environmental factors. In the second phase the relationship of job satisfaction, job organizational and social factors were investigated. Only the first phase is discussed in this paper.

Hackman and Oldham [17] developed a convenient measurement tool for diagnosing and evaluating job design. The theory proposed that the three critical psychological states

were created by the presence of five “core” job dimensions, which were skill, identity, significance, autonomy and feedback. Yet, the theory was not expected to work with equal effectiveness for all individuals. Differences among people moderated how they reacted to their work. “Growth needs strength” appears to be a useful way to conceptualize and measure such differences. The basic observation was that people who have high needs for personal growth and development would respond more positively to a job high in motivating potential than people with low growth need.

Das [1] proposed a work system model comprising of three basic elements, human, machine and job, interacting closely within the work system envelope. It was the only model that included all the three important elements that depicted a real scenario in industry. Unfortunately, no experimental studies of the model have been published. However it is a formidable task to perform control experiments to determine the effects and interactions of the various work design factors [1].

Both of the aforementioned models were used as a basis for developing the proposed model. Empirical results from the first model suggested that the core job dimensions were significantly and strongly related to job satisfaction measures [20]. On the other hand, Das [1] predicted that not only job dimensions were related to job satisfaction and suggested various other factors involved in the design of industrial work. Both models have some factors in common and could be considered as complementary to each other. The proposed model is shown in Figure 1.

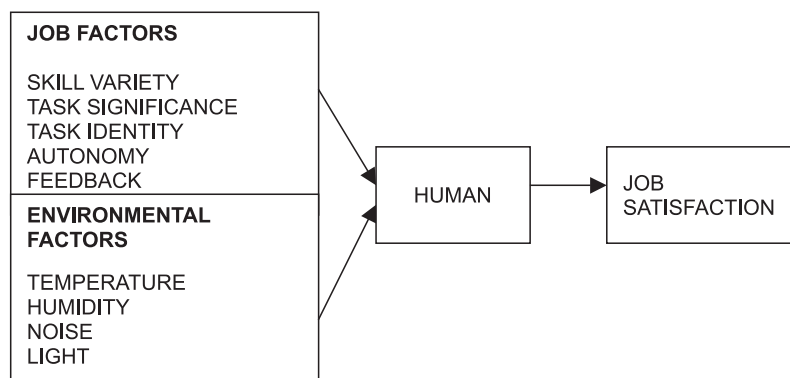


Figure 1. Proposed basic industrial work design model.

Five job factors were tested: skill variety, task significance, task identity, autonomy and feedback. In addition, four physical environmental factors were also tested to assess workers' perception: relative humidity, ambient air temperature, noise and light.

3. METHODOLOGY

The job diagnostic survey (JDS) [17] was used as a tool for diagnosing the characteristics of the job and environmental factors in the survey. The JDS was translated into Malay to suit the Malaysian population. The questionnaires consisted of a set of Likert-type-scale multiple-choice items [21]. To identify the relationship between job satisfaction and the tested factors, the data were analyzed using statistical methods to determine means and correlations.

3.1. Participants

The questionnaires were distributed to the subjects individually. Two automotive manufacturing industries (Auto 1 and Auto 2) were involved in the survey. One hundred and seventy male subjects between the ages of 18 and 40 took part in it.

Of the 170 male participants interviewed, 80% in both companies held an SPM certificate (equivalent to O levels) while others held an SPM certificate with other skill certificates. Sixty-nine percent of participants in Auto 1 were married, 31% were single. On the other hand, 87% of the participants in Auto 2 were single and 13% were married. The subjects were between the ages of 18 to 40 with the mean age of 26.8 (*SD* = 5.3). Their mean work experience was 6.5 years (*SD* = 4.9). The age and years of employment are presented in Figures 2 and 3.

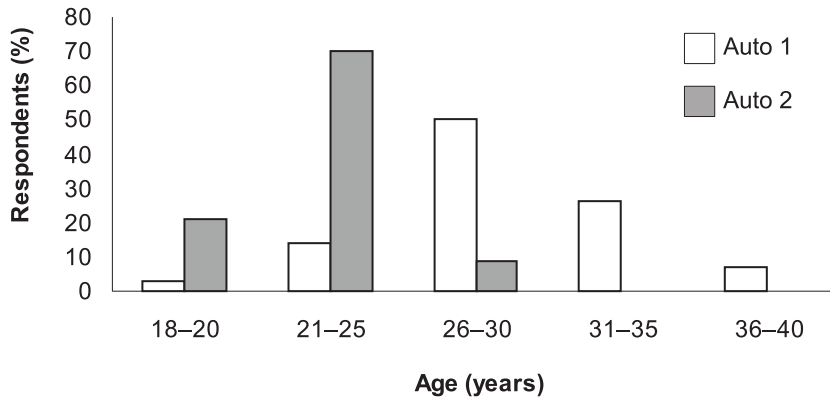


Figure 2. Age factor.

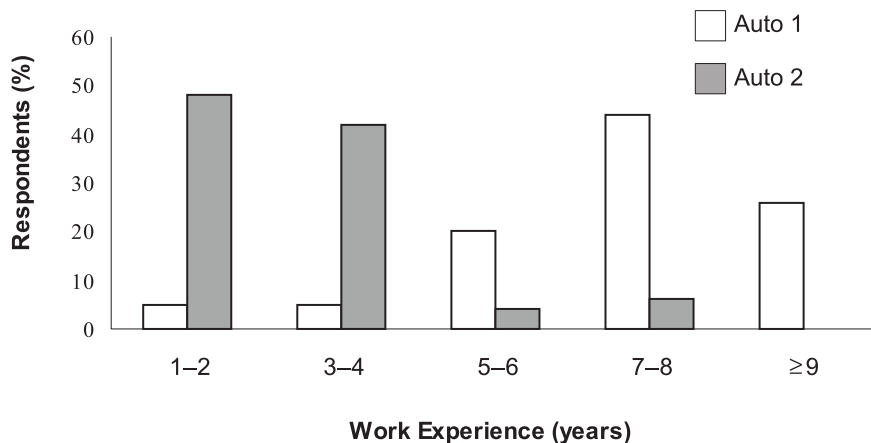


Figure 3. Experience factor.

The respondents were divided into five groups as indicated in Figure 2. Similarly, five ranges for work experience were indicated in Figure 3.

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 workers in Auto 1 were 26 and over while 90% of the workers in Auto 2 were under 26. Only 17% of the Auto 1 workers were 25 and under while 10% of the Auto 2 workers were 25 and over.

As for work experience, 90% of the workers in Auto 1 had worked for more than 5 years. Another 10% had work experience of less than 5 years. Conversely, 90% of the workers in Auto 2 had work experience of 4 years and less. Only 10% had work experience of between 5 and 8 years. Respondents in Auto 2 were younger and less experienced than their counterparts in Auto 1.

3.2. Questionnaires

The questionnaires were designed in three sequential sections covering (a) general background data, i.e., age, gender, years of employment, marital status and education levels; (b) job factors, i.e., skill variety, task identity, task significance, autonomy and feedback from the work; and (c) environmental factors, i.e., air temperature, humidity, noise and light.

The five job factors were tested and defined as follows, according to Hackman and Oldham [17].

Skill variety: the degree to which a job requires a variety of different activities in carrying out the work, which involves the use of a number of different skills and talent of the employee.

Task identity: the degree to which a job requires completion of a “whole” and identifiable piece of work, i.e., doing a job from beginning to end with a visible outcome.

Task significance: the degree to which a job has a substantial impact on the life or work of other people whether in the immediate organization or in the external environment.

Autonomy: the degree to which a job provides substantial freedom, independence and discretion of the employee in scheduling work and in

determining procedures to be used in executing a particular job.

Feedback from job: the degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or her performance.

Four 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 [22]. The questionnaire on thermal comfort (temperature and humidity) adopted American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) [23] definitions as “the condition of mind which expresses satisfaction with the thermal environment”. The reference to the 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 unevaporated sweat; e.g., trapped in clothing [22]. As a result, the enquiries on thermal comfort include satisfaction or comfort and discomfort on the condition explained in this paragraph. 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 buildings. In practice, annoyance levels are the most useful criteria [22]. In this study, noise level was measured throughout the workstations and the average was taken using dB(A) values. Therefore, enquiries on noise included annoyance or comfort or discomfort at the work place. Light can cause discomfort to the occupants of an environment as well as pleasure and positive emotional sensations [22]. Enquiries on illuminance included satisfaction or comfort or discomfort when looking at a work task. Illuminance was measured throughout the workstations in lux.

3.3. Analysis

The data were analyzed for correlations using Spearman’s rank order correlations technique. Reliability tests were obtained for all factors tested in the survey using Cronbach’s α .

4. RESULTS

The results were divided into several sections covering job and job satisfaction factors, environmental factors, reliabilities measures, and correlation of job satisfaction with job and environmental factors.

4.1. Job Factors and Job Satisfaction

The summary of the responses for job satisfaction and job factors in the two companies are illustrated in Figures 4–9. Most factors were statistically normally distributed except for task significance, which was negatively skewed. The 5-point Likert-type scales ranged from 1—*very little* through 3—*moderate* to 5—*very much* and are presented in each figure.

Obviously, respondents from both companies reported maximum score at moderate level of Likert-type scale for job satisfaction, skill variety, task identity, autonomy and feedback factors.

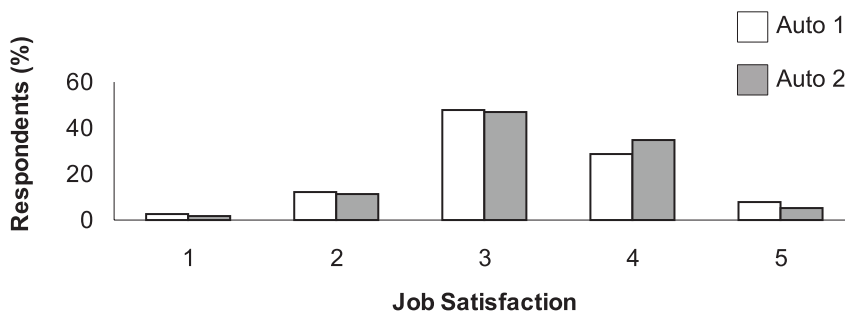


Figure 4. Job satisfaction factor on a 5-point Likert scale.

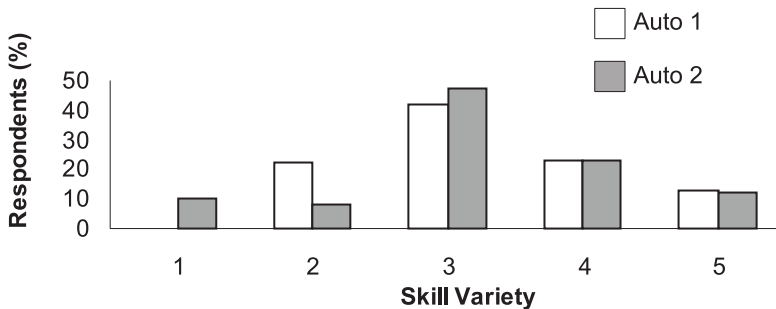


Figure 5. Skill variety factor on a 5-point Likert scale.

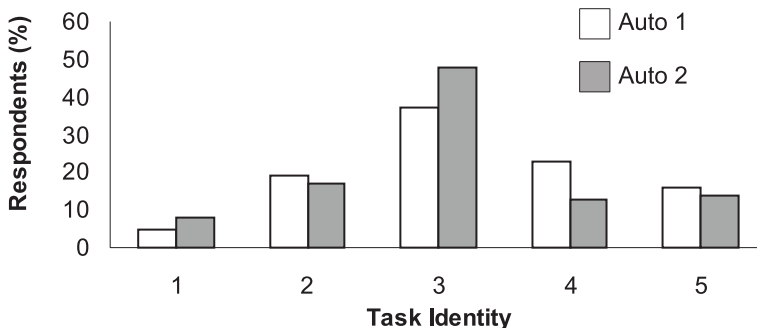


Figure 6. Task identity factor on a 5-point Likert scale.

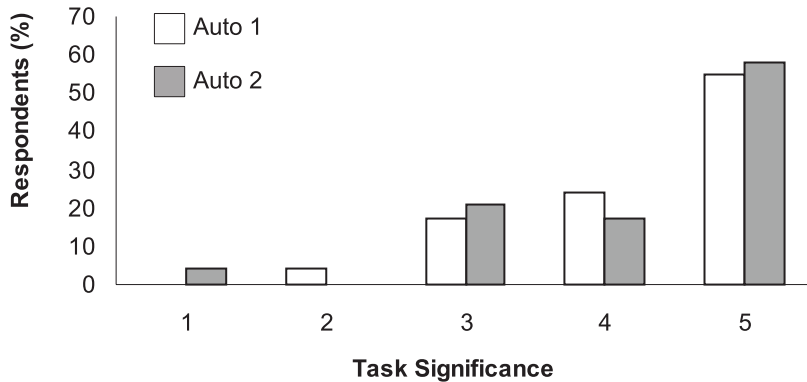


Figure 7. Task significance factor on a 5-point Likert scale.

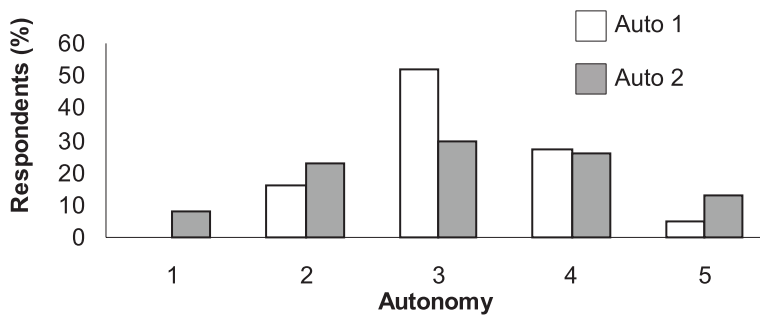


Figure 8. Autonomy factor on a 5-point Likert scale.

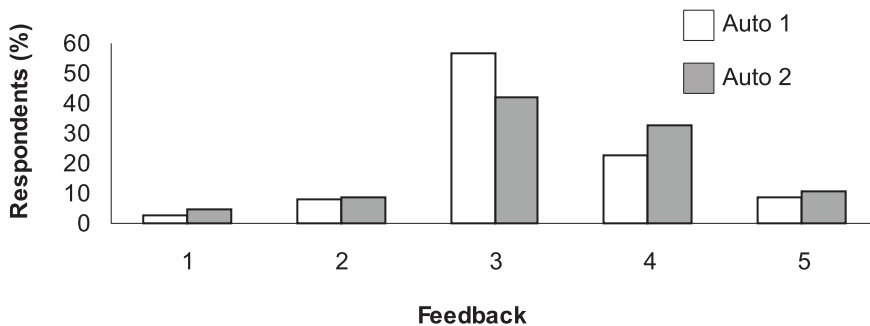


Figure 9. Feedback factor on a 5-point Likert scale.

On the other hand, only task significance showed maximum score at high level of Likert-type scale for both companies.

Normality plots were examined for all factors using normality probability plot and detrended normal plot. These were taken into account prior to using any transformation and later analyzed statistically. It can be seen that 50% or more respondents from both companies chose a Likert-scale 3 for job satisfaction, skill variety, task identity, autonomy and feedback. On the other

hand, more than 60% of the respondents from both companies chose a Likert-scale 5 for task significance.

4.2. Environmental Factors

Responses for the environmental factors are shown in Figures 10 to 13 respectively. Normality plots were examined and it was noted that most factors were normally distributed.

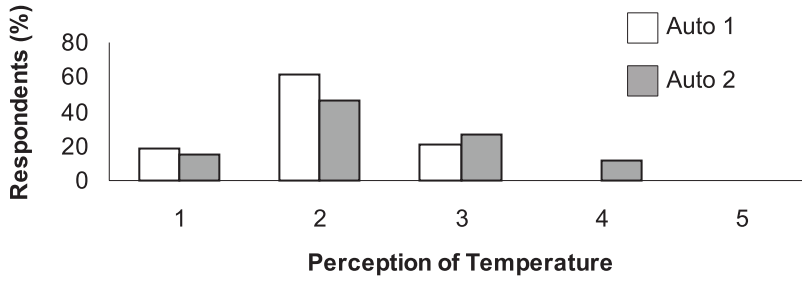


Figure 10. Perception of temperature on a 5-point Likert scale.

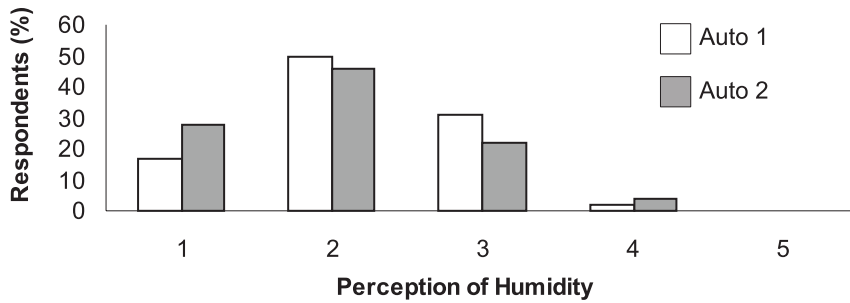


Figure 11. Perception of humidity on a 5-point Likert scale.

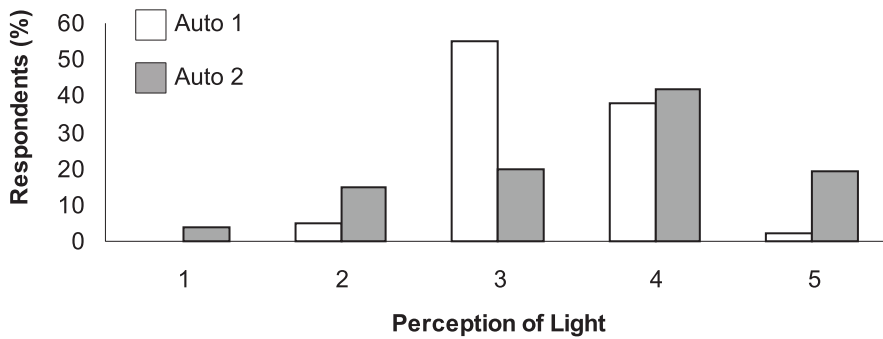


Figure 12. Perception on light on a 5-point Likert scale.

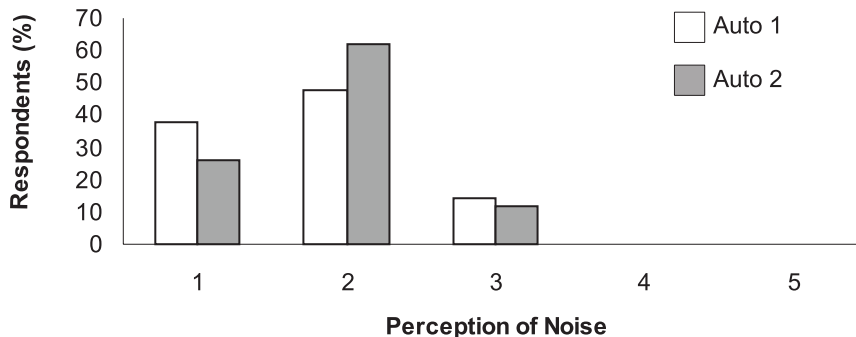


Figure 13. Perception of noise on a 5-point Likert scale.

The 5-point Likert-type scales ranged from 1—*very uncomfortable* through 3—*moderate comfort* to 5—*very comfortable* and are presented in each figure. It can be seen that 50% or more respondents from both companies chose a Likert-scale 2 for temperature, humidity and noise. As for light more than 50% of the respondents from Auto 1 chose a Likert-scale 3 while more than 40% of the respondents from Auto 2 chose a Likert-scale 4.

4.3. Reliabilities Measures

Questionnaire reliability was tested using Cronbach α (Table 1). Cronbach α was derived from the average correlations of all the items on the scale [21]. Out of 20 reliability measures in both companies, 12 had reliabilities above .7. The rest had reliability measures around .6. The results indicated that the reliabilities measures were high for job factors in both companies especially for skill, task identity, autonomy and feedback with values from .69 to .88.

As for environmental factors the reliabilities were high in Auto 1 for temperature, noise and light. However, temperature and humidity showed high reliabilities in Auto 2. Humidity for Auto 1 and light for Auto 2 showed moderate reliabilities. Assumptions on reliability were based on statistical reasoning [21], since no references were found except for job factors [18]. Here the value of .65 and above were considered high

and ones between .65 and .30 were considered intermediate. Factors with reliabilities lower than .5 were not considered for further analysis.

TABLE 1. Reliability Measures Using Cronbach's α for Tested Factors

Tested Factors	α Auto 1	α Auto 2
Job factors		
Skill variety	.77	.79
Identity	.76	.69
Significance	.61	.63
Autonomy	.72	.69
Feedback	.86	.88
Environment factors		
Perception on temperature	.72	.69
Perception on humidity	.64	.86
Perception on noise	.76	.67
Perception on light	.78	.64
Job Satisfaction	.89	.82

4.4. Environmental Measurements

The average value for lighting in Auto 1 was 567 lx while the average of 540 lx was observed in Auto 2. Relative humidity was higher in Auto 1 (69.1 RH) 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 dB(A) while the average was 85–89 dB(A) for Auto 2 (Tables 2 and 3).

TABLE 2. Environmental Measurements for Auto 1

Area	Average Lx Reading	Relative Humidity	Room Temperature (°C)	Noise (dB(A))
1	500	65	31.4	71–90
2	580	67	30.7	68–90
3	500	66	31.4	65–90
4	390	71	31.0	67–90
5	700	76	31.0	64–93
6	460	78	30.4	68–90
7	480	77	30.7	75–80
8	670	77	31.0	68–90
9	650	59	30.2	74–90
10	740	55	32.0	70–90
Average value	567	69.1	31.0	69–90

TABLE 3. Environmental Measurements for Auto 2

Area	Average Lx Reading	Relative Humidity	Room Temperature (°C)	Noise (dB(A))
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	85-89
9	710	58	32.6	85-89
10	813	68	32.0	85-89
Average value	540	60.2	32.2	85-89

4.5. Correlation Coefficient

In summary (Figure 14), the results indicated that there were significant correlations between job satisfaction, job and environmental factors. There were several factors that strongly supported the

studies. Four factors that contributed to significant correlation in Auto 1 were skill variety, task identity, autonomy and light. The two factors that had strong significant correlation in Auto 2 were skills variety and humidity (Figure 15). The results are discussed in the next section.

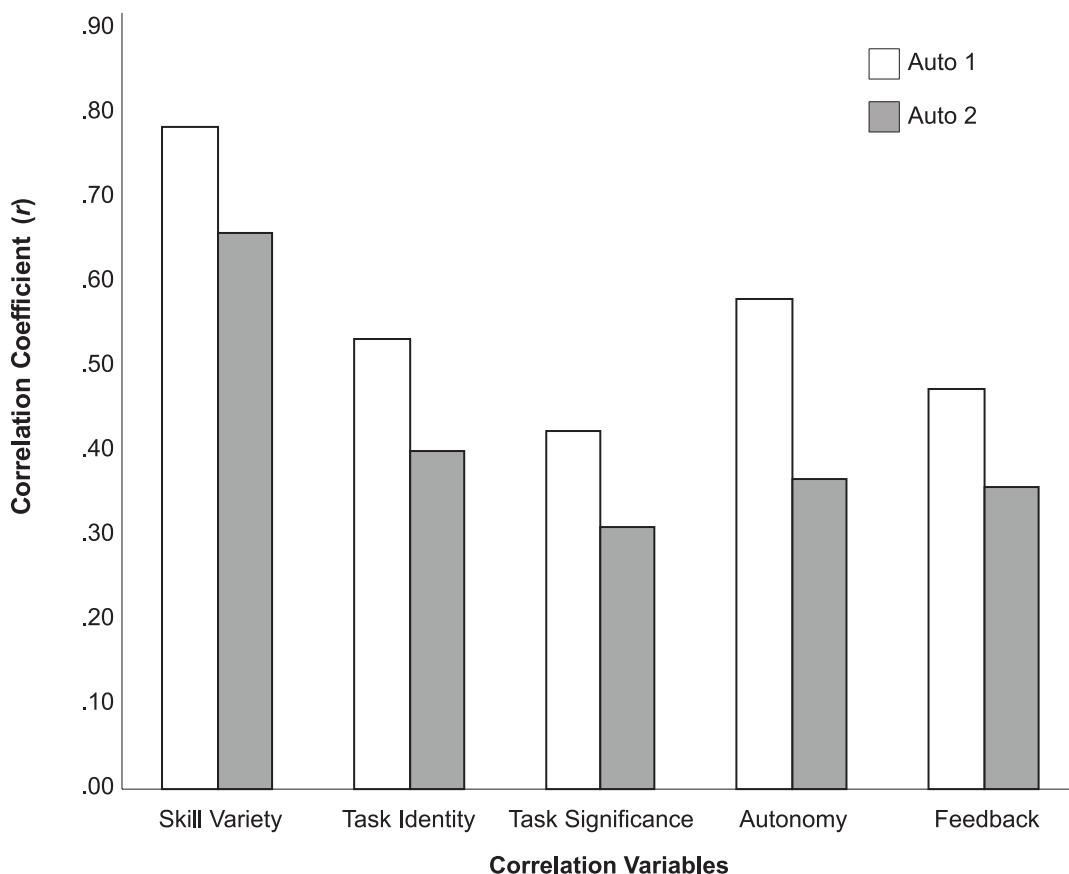


Figure 14. Correlations of job satisfaction with five job factors.

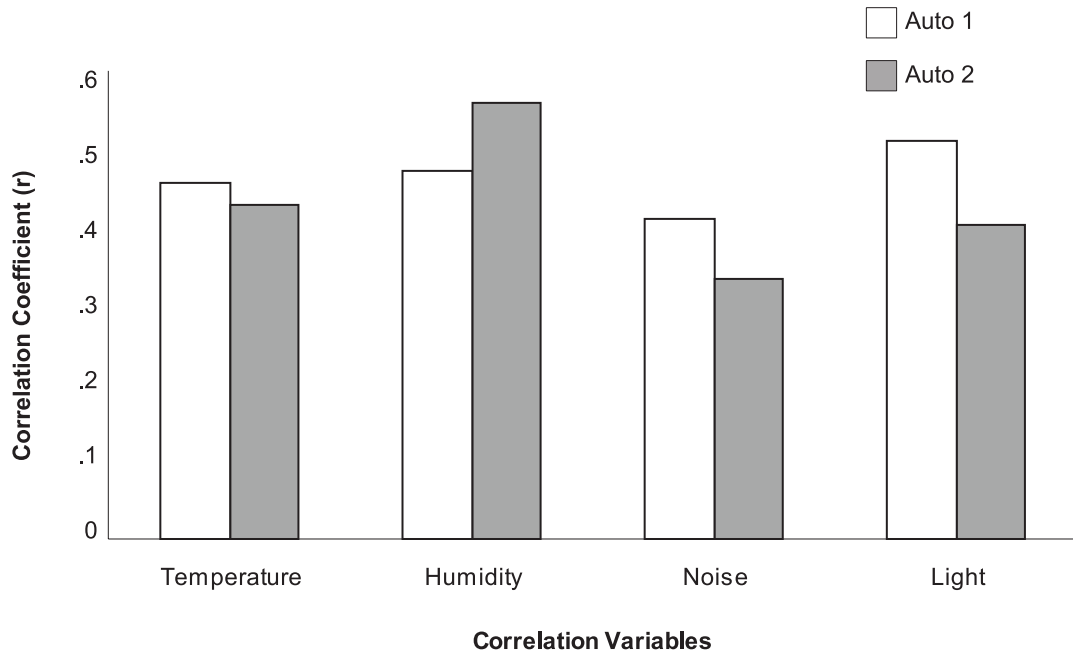


Figure 15. Correlations of job satisfaction with four environmental factors.

5. DISCUSSION

5.1. Job Factors and Job Satisfaction

The results of the study showed that there was significant positive correlation between job satisfaction and job factors. This is in agreement with empirical studies by Hackman and Oldham [17] and Umstot, Bell and Mitchell [20].

Figure 14 shows that the correlations between job satisfaction and job factors were higher in Auto 1 compared to Auto 2. One possible explanation is that the older, married and more experienced workers in Auto 1 were highly satisfied with their job compared to the younger, single and less experienced workers in Auto 2.

Age was one of the factors affecting job satisfaction. Studies in five different countries proved that elder workers were more satisfied than their younger counterparts [7]. The results also support the findings by Janson and Martin [24] and McCaslin and Mwangi [14] who found that older employees had higher job satisfaction. Lee and Wilbur [25] suggested that job satisfaction increased with age. One explanation for such a finding was that older employees were more able

to adjust their expectations to the returns of their work [26].

Lack of job satisfaction amongst younger workers might cause them to be more mobile and seek greener pastures elsewhere. 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 the relationship between job satisfaction and years of experience [27, 28]. Research done by Bowen, Radhakrishna and Keyser [11], McCaslin and Mwangi [14], Manthe [13], Boltes, Lippke and Gregory [10] and Bertz and Judge [29] found that overall job satisfaction increased as the years of experience increased.

There was no difference in the level of education reported in both companies. Most workers held an SPM certificate in both companies or an SPM certificate with other skill certificates. However, marital status highlighted different percentages in both companies (see section 3.1.). Research done by Bowen et al. [11] stated that older, married and more experienced workers had higher levels

of job satisfaction and were more committed to co-operative effort than younger, single and less experienced ones. Clark [30] also reported that married employees were more satisfied. In addition Bowen et al. [11] suggested that younger, single and less experienced workers might have still been deciding on their career and thus this might have precluded job satisfaction and organizational commitment.

Literature on the relationship between work, marital status and family has shown a spillover effect between both domains. Most of the spillover studies investigated how work or career satisfaction affected one's personal life. Benin and Nienstedt [31] examined how job satisfaction affected marital happiness and global happiness. They found that job satisfaction influenced marital happiness, and the effect of job satisfaction and fulfillment interacted with the effects of marital happiness in producing global happiness.

The research on relationships between work satisfaction and marital characteristics in particular was extensive and was primarily found in literature on marital satisfaction, work identity and satisfaction, and dual-career couples [32, 33, 34]. These studies suggested that career and family lives were entangled with one another and that to understand strain in one domain it was essential to have information on both facets of an individual's life [35]. Therefore further research to resolve this matter is needed.

Another outstanding factor revealed from the results was skill, which appeared to be strongly correlated in both companies. Based on the findings, it seemed that workers tended to find skill variety as an outstanding factor and that it had a major impact on job satisfaction. Hackman and Oldham [17, 19] stated that skill variety, task identity and task significance were psychological factors contributing to workers experiencing meaningfulness of their work. However, results from this study suggested skill variety had greater impact on that matter compared to other factors.

The correlations revealed the importance of skill variety especially in automotive industries. Based on the correlations, the management should pay particular attention to the other job factors, which showed intermediate-to-low correlations.

Those factors are important in determining job satisfaction [17], and thus help organizations survive and be more productive.

Das [1], Hackman and Oldham [17, 19] and Umstot et al. [20] stated that job satisfaction was one of the outputs in work design model that could be determined by job factors. Results from the study support this statement, suggesting that job factors are predictors of job satisfaction in work design.

5.2. Environmental Factors and Job Satisfaction

The correlations of job satisfaction with perception on temperature were about the same for both companies (Auto 1: $r = .456$, Auto 2: $r = .426$). Conversely, correlation of job satisfaction with perception on humidity factor was high in Auto 2 compared to Auto 1 (Auto 1: $r = .472$, Auto 2: $r = .559$). The measurements indicated that the average temperature and humidity were slightly higher in Auto 1 (Auto 1: 33 °C and 69 RH, Auto 2: 33.6 °C and 57.3 RH). Further analysis using heat index [36] on the average temperature and humidity measurements taken from both companies showed that the average temperature and humidity of Auto 1 fell exactly in the *very hot* band while average temperature and humidity for Auto 2 fell in the transition of *hot-to-very hot* band. Furthermore, the location of the assembly line in Auto 2 was in the middle of the factory—compared to Auto 1 where it was located near openings (doors and windows)—which meant additional heat from forklifts and vehicles, affecting the nearby work environment. The results in this section showed that workers' perception on environment corresponded to the measurements. The results were consistent with the ASHRAE [23] definition that thermal comfort was the condition of mind which expressed satisfaction with the thermal environment.

The correlation between job satisfaction and perception of light was higher in Auto 1 compared to Auto 2 (Auto 1: $r = .51$, Auto 2: $r = .403$). The average measurement for lights was also high in Auto 1 compared to Auto 2 (Auto 1: 645 lx, Auto 2: 533 lx). 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 [22] that affect respondents' perception. The study indicated that lighting conditions in both companies were within the standard of the Illuminating Engineering Society [37] i.e., 500–1000 lx for medium assembly. The results were consistent with workers perception on lights as 90% are happy with light condition in both companies.

The correlation of job satisfaction with perception on noise factor was slightly higher in Auto 1 compared to Auto 2 (Auto 1: $r = .472$, Auto 2: $r = .332$). Average measurements for noise indicate that noise was on average higher in Auto 2 compare to Auto 1 (Auto 1: 65 to 90 dB(A), Auto 2: 85–90 dB(A)). 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 [22].

The results indicated that environment condition especially temperature, humidity, noise and light could affect job satisfaction in automotive industries. More than 60% of the respondents felt discomfort with temperature, humidity and noise conditions in both companies. On the other hand, 90% felt comfort with light condition in both companies. This was supported by the illuminance measurement taken which is within the standard of the Illuminating Engineering Society [37]. The management of both companies should put emphasis on temperature, humidity and noise as these measurements were outside the comfort boundary and respondents were not satisfied with the conditions, therefore, job satisfaction was reduced. It may be suggested that standard environment conditions (temperature, humidity, noise, light, etc.) could be revised for automotive industries in Malaysia in order to maintain workers' health physically and mentally, therefore, increasing productivity and job satisfaction as well as performance.

6. CONCLUSIONS

In summary, the conclusions derived from this investigation are as follows.

- There is significant correlation between job satisfaction, job and environmental factors.
- The results highlight that skill variety is an outstanding factor in the study of job satisfaction for automotive industries.
- The strength of the correlation between job factors and job satisfaction is influenced by age, work experience and marital status.
- Environmental factors affect job satisfaction and the strength of correlation is influenced by the surroundings, context dependence and the building's function.

This conclusion supports our proposed model of work design, particularly for the automotive industries. Implicitly automotive industries may benefit from the methodology as it can diagnose job satisfaction to maintain performance and productivity.

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