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Perception of IEQ Factors on Workplace Satisfaction Using Kano Satisfaction Model: A Case Study of Malls in Hot-Humid Climate

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ABSTRACT

This study reveals retailers' perception of and their preference to some selected IEQ factors in relation to their workplace. Retailers of two types of malls (mixed-mode ventilated and Air conditioned malls) were studied under the following objectives: 1) To determine the retailers' perception of some IEQ factors in each mall, and 2) To develop a pattern of the impact of retailers' perception of some IEQ factors on their overall workplace satisfaction using the Kano satisfaction model. A subjective IEQ measurement was carried out and descriptive analysis was done on retailers' responses to reveal their level of satisfaction after which a regression analysis was carried out on their perception of some IEQ factors. The results revealed that the air-conditioned ventilated mall recorded the highest mean satisfaction votes. Results also indicated that retailers in the mixed-mode ventilated malls considered air movement within their workplace as a necessity as the negative influence has a greater impact (regression coefficient 3.35, -4.29*) on overall satisfaction. However, the absolute magnitude of the impact between satisfied and dissatisfied groups is not significantly different, thus, 'air movement' in the mixed-mode ventilated malls is categorized as proportional factor. Whereas, retailers in the AC mall responded to satisfactory air movement as something not expected (regression coefficient 3.27**, -2.19^{NS}). On the other hand, retailers in the AC mall expected a controlled environment like theirs to thermally satisfy its occupants. Findings from this study will provide a better understanding of workers' expectations and concerns with regard to their indoor environmental conditions.*

Keywords: Hot-humid climate; Kano's satisfaction model; mixed-mode ventilated malls; retailers' perception; thermal comfort

INTRODUCTION

Malls generally are immense energy consumers due to their huge cooling and lighting demand. Discovering means of improving energy performance in shopping malls; and at the same time improving its indoor environmental quality (IEQ), has led to malls taking advantage of natural ventilation and day lighting within their indoor space. This has led to a new design trend in the Malaysian shopping malls where openings are created within the shopping spaces to admit outdoor air and light into the indoor environment. These malls thus, operate on both mechanical and natural ventilation in different spaces within the buildings. This practice of combining natural ventilation and mechanical ventilation in a building is referred to as "mixed-mode ventilation", which offers huge advantages for energy reduction while still maximizing comfort (Deuble and de Dear 2012; Huang et al. 2014; Thomas 2014). Mixed-mode ventilated buildings also performs excellently particularly with regards to thermal comfort and indoor air quality (Deuble and de Dear 2012; Brager and Pigman 2013). Furthermore, occupants of mixed-mode ventilated buildings have been revealed to be more satisfied with their indoor condition which in turn leads to their high productivity compared to their counterparts (Brager et al. 2007; Brager and Pigman 2013).

In Malaysia, new malls emerging are incorporating the mixed-mode ventilation strategy. And the most common form is having a large naturally ventilated common/central

space connected with individually air-conditioned retail lots (Hamlyn et al. 2012; Ibiyeye et al. 2015). This type of arrangement can be grouped under 'Zoned' mixed-mode ventilation strategy (where different zones within a building operate on different conditioning strategy, one zone can be operating on air-conditioning while the other is perating under natural ventilation). Since these types of malls are becoming popular in hot and humid climate like Malaysia and considering the length of time a retailer will spend within the mall's space, there is need to study retailers' responses to and their perception of their indoor environment.

Studies on IEQ has been centred on office buildings due to the effects IEQ has on workers' productivity (Kim and de Dear 2012a; Altomonte and Schiavon 2013; Kamaruzzaman et al. 2015). Few IEQ studies have also been done in other building types e.g hospitals (De Giuli et al. 2013), educational buildings (Che-Ani et al. 2012; Choi et al. 2014; De Giuli et al. 2014; Fadeyi et al. 2014; Turunen et al. 2014; Wan Yusoff and Sulaiman, 2014; Yee, 2014; Salleh et al. 2015), residential buildings (Hafizal et al. 2012; Li et al. 2013), green certified buildings (Mohan 2012). These studies have revealed the significant influence IEQ has on workers'/occupants' health and productivity. Although some IEQ studies have been conducted on shopping malls, very few have been reported on hot-humid climatic region and almost none has been carried out in Malaysia.

Zhao et al. (2015) studied occupant perceptions and health outcome in 14 retail buildings in Texas and Pennsylvania with the aim to understand employees' perception of all indoor environmental parameters. The study revealed that the employees' responses had a high correlation with the measured parameters and the air exchange rate is the most influential parameter that affects employees' perceptions and a health outcome. On the other hand, Martellotta et al. (2016) used different statistical analysis to the interaction between users' satisfaction and different IEQ contributing factors in retail a building located in Southern Italy. At the end of the study, the visual and thermal comfort showed a linear relation with overall satisfaction, therefore, proved to have the highest impact on users' satisfaction.

Carrilho da Graça et al. (2012) presented results from thermal and airflow simulation of an existing naturally ventilated shopping mall in Lisbon, Portugal. The simulation was carried out on the present natural ventilation system design in order to address winter thermal comfort problems. Malls don't only present ventilation issues; according to Xu et al. (2014) malls also contain a wide range of products that can emit various indoor pollutants which have been associated with serious health issues. Several studies (Li et al. 2013; Amodio et al. 2014; Hu and Li, 2015; Sun et al. 2015; Tao et al. 2015) have looked into the indoor air quality aspect of IEQ in malls to identify those pollutants that could threaten the health of both shoppers and retailers. The acoustic comfort (Della Crociata et al. 2013; Meng and Kang 2013) and lighting (Omar 2012) in malls has also been studied. However, little is known about the performance of malls in a hot humid climate like Malaysia particularly those malls operating under mixed-mode ventilation strategies, considering the popularity of these types of malls in recent times. This study therefore reveals retailers' perception of and their preference to some selected IEQ factors with regards to their workplace. Retailers of two types of malls (mixed-mode ventilated and fully air-conditioned malls) were studied under the following objectives: 1) To determine the retailers' perception of some IEQ factors in each mall, and 2) To develop a pattern of the impact of retailers' perception of some IEQ factors on their overall workplace satisfaction using the Kano satisfaction model.

METHODOLOGY

The two mixed-mode ventilated malls used in this study were chosen from a list of Malaysian mixed-mode ventilated shopping malls as identified in Ibiyeye et al. (2015) where six operating Malaysian malls were identified and grouped based on their design concept. Both mixed-mode ventilated malls operate under 'Zoned' mixed-mode ventilation strategy, and they were chosen particularly because of their size, location and design concept.

The steps taken in identifying all three case study malls (two mixed-mode ventilated malls and one fully air conditioned mall) and their characteristics are recorded in detail in Ibiyeye et al. (2015). However, Figure 1, 2, 3 shows the images of the three case study malls. Figures 1 and 2 shows the central naturally ventilated spaces in both mixed-mode ventilated malls indicating the natural ventilation and day lighting openings. A detailed description of the three case study malls can be found in Ibiyeye (2017), and Ibiyeye et al. (2018).

Data were collected from retailers occupying the central naturally ventilated space of the two mixed-mode ventilated malls. For the purpose of this study, the two mixed-mode ventilated malls will be tagged MM1 and MM2 while the fully air conditioned mall will be tagged AC mall. The obtained data were analysed using SPSS software version 21 and excel spreadsheet.

FIGURE 1. Interior views of MM1

FIGURE 2. Interior views of MM2

FIGURE 3. Interior views of AC mall

OCCUPANTS' GENERAL SATISFACTION SURVEY

To fulfill the first research objective, which is to determine the retailers' perception of some IEQ factors (temperature, air quality, and air movement) in each mall, a subjective IEQ measurement was carried out. To accomplish this, paper-based IEQ assessment surveys were conducted using the questionnaire developed by the Center for the Built Environment (CBE) at the University of California, Berkeley. The survey has been used extensively for IEQ studies (Frontczak 2012; Kim and de Dear 2012a; Kim and de Dear 2012b; Altomonte and Schiavon 2013). It has been extensively tested and refined. The survey is intuitive to use; it preserves respondents' confidentiality, it is also a good benchmarking source for building's performance and in addition, it permits the specific causes of dissatisfaction to be identified (Peretti et al. 2010; Peretti and Schiavon 2011).

The CBE survey itself was designed to take a respondent 10 to 15 minutes to complete (CBE 2015). The survey questions consist of an evaluation of seven IEQ factors which includes: occupants' background survey (i.e., gender, age, etc.), office furnishings and layout, office cleaning/ maintenance, indoor air quality, thermal comfort, lighting and acoustic comfort. In other to fulfill the objectives and purpose of this study, the questionnaire was modified and the specific factors considered are: occupants' background survey (i.e., gender, age, etc.), thermal satisfaction (indoor temperature), indoor air quality satisfaction (indoor perceive odour), indoor air movement satisfaction, and overall building performance satisfaction. For each IEQ factor, the occupant's satisfaction was evaluated using a 7-point satisfaction scale (1 representing 'very unsatisfied' to 7 representing 'very satisfied') With the modification, the final questionnaire was divided into five sections and it took around 5 to 7 minutes for a respondent to fill the questionnaire.

The questionnaire was translated into the local language (Bahasa Melayu) for easy understanding and comprehension and at the end a bilingual (Bahasa Melayu and English) was used to accommodate foreign respondents that do not understand the local language. A preliminary study was conducted prior to the actual survey, this took place on the 19th of December 2015 (Saturday) in a mixed-mode ventilated mall located in Seri Kembangan, Selangor. The actual questionnaire survey was carried out in all the three case study malls on weekends (Saturdays and Sundays) within the month of March 2016 since malls are generally more visited during the weekends (Klinmalee et al. 2009; Hu and Li 2015). At the end of the survey a total of 138 correctly filled questionnaires were collected (45 in MM1, 45 in MM2 and 48 in the AC mall).

USERS' BACKGROUND SURVEY

Questions under this part were to obtain information about users' demographic characteristics such as age, nationality, gender, and work position held.

SATISFACTION VOTES

For thermal satisfaction votes questions were formulated to establish the users' perception of the indoor temperature (which was tagged 'TempSAT' for the analysis) within their workplace. In addition to this, retailers were asked to indicate any means of control accessible to them within their workplace. Similar to thermal satisfaction, questions under the Air quality (IAQSAT) and Air movement satisfaction (AMSAT) were formulated to establish users' perception of the air quality and air movement within their workplace. Finally, respondents were asked to rate the overall satisfaction level of their workplace (WPSAT) and also to rate the overall building performance (BuildPerfSAT) based on the combined effects of the previously evaluated factors ('TempSAT', 'IAQSAT', and 'AMSAT') all on a 7 point scale of 1 representing 'very unsatisfied' to 7 representing 'very satisfied'.

DATA ANALYSIS

Descriptive statistical analysis was carried out on respondents' responses. The mean responses of retailers in all case study malls to the measured IEQ parameters was done in order to fulfill study's first research objective. To fulfill the second research objective, which is "to develop a pattern of the impact of retailers' perception of some IEQ factors on their overall workplace satisfaction using the Kano satisfaction model", a regression analysis was carried out. The regression analysis involved the retailers' workplace satisfaction (WPSAT) and their satisfaction of three of the measured IEQ factor from occupants' general satisfaction survey (TempSAT, IAQSAT, and AMSAT). The strength each IEQ factor has on the retailers' workplace satisfaction was grouped under two circumstances: 1) when the IEQ factor has a positive impact on workplace satisfaction, and 2) when the IEQ factor has a negative impact on workplace satisfaction (Kim and de Dear 2012a; Kim and de Dear 2012b; Martellotta et al. 2016). This is based on the concept developed by Kim and de Dear (2012b) where it was stated that in respects to buildings, the impact of IEQ factors on workers' workplace satisfaction differs and this differences depends on each IEQ factor's perceived performance level. With this grouping, each IEQ factor will be categorised as basic, bonus or proportional factors based on their influence on retailers' workplace satisfaction as defined in Kano's satisfaction model (Kim and de Dear 2012a; Kim and de Dear 2012b).

KANO'S SATISFACTION MODEL

Kano (1984) developed a theory of attractive quality that has been widely used in satisfaction surveys (Zhu and Tsai, 2010; Kim and de Dear, 2012a; Kim and de Dear, 2012b; Kalyvioti, 2013; Martellotta et al. 2016). In his theory, he was able to come up with a set of methods to distinguish between three types of product requirement and their different relationships with customer's satisfaction. These product requirements, when met, influences customer's satisfaction in different ways. This relationship was classified into three distinct categories (See Figure 4):

1. Must-be requirements (basic factor) these are regarded by the customers as minimum requirements. It causes extremely dissatisfaction if not fulfilled, but will not in any way cause increase satisfaction when fulfilled (Kano 1984; Kim and de Dear 2012a).

2. Attractive requirements (bonus factor) sometimes referred to as 'surprise' or 'delight' attribute as they are not expected by customers. When fulfilled, customers are extremely satisfied but do not cause dissatisfaction when not fulfilled. However, the positive effect of its fulfilment greatly affects overall satisfaction compared to the negative effects of it non-fulfilment (Kano 1984; Kim and de Dear 2012a).

3. One-dimensional requirements (proportional factor) with respect to these requirements, customers overall satisfaction or dissatisfaction is proportional to the level of their fulfilment/performance. That is, the lower the levels of its fulfilment/performance, the more dissatisfied customers are and vice versa. The customer usually explicitly demand these requirements (Kano 1984; Kim and de Dear 2012a).

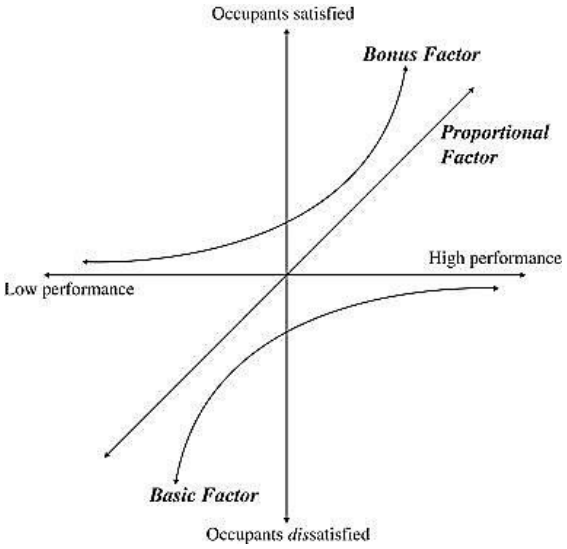

FIGURE 4. Kano's satisfaction model (Kano 1984).

REGRESSION ANALYSIS

To group each IEQ factor as either basic, bonus or proportional factors based on their influence on retailers' workplace satisfaction as defined in Kano's satisfaction model, the same procedure used by Kim and de Dear (2012a), Kim and de Dear (2012b), and Martellotta et al. (2016) was adopted. Survey samples were divided into three groups using dummy coding (coded 0 or 1); (i) those who were highly satisfied with the factor in question (respondents who rated their satisfaction at the top two levels, i.e. 6 and 7), and (ii) occupants who were highly dissatisfied with the said factor (respondents who rated their satisfaction at the lowest two levels, i.e. 1 and 2), and (iii) those occupants who were indifferent to the factor (respondents who rated their satisfaction level in the middle of the scale, i.e. 4), this third group is thus referred to as the reference group.

Regression analysis was then carried out with retailers' overall workspace satisfaction (WPSAT) as the dependent variable, and the other three factors (TEMPSAT, IAQSAT, and AMSAT) as independent dummy variables. The regression analysis, therefore, produced two coefficients (equation 1) for each of the factors i.e. one for the 'satisfied group', to measure the impact when performance of the IEQ factor is perceived as performing well (positive coefficient), and the other for the 'dissatisfied group' to measure the impact when performance of the IEQ factor is rated as poor (negative coefficient).

$$OS = b_0 + b_{1.factor_1}X_{1.factor_1} + b_{2.factor_1}X_{2.factor_1} + b_{1.factor_2}X_{1.factor_2} + b_{2.factor_2}X_{2.factor_2} + b_{1.factor_3}X_{1.factor_3} + b_{2.factor_3}X_{2.factor_3} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

OS: retailers' overall satisfaction score with workspace
b_0: average of overall satisfaction score of reference groups
X_1: dummy value for satisfied group of IEQ factors
X_2: dummy value for dissatisfied group of IEQ factors
b_1: regression coefficient for satisfied group (impact on overall satisfaction when performance on individual IEQ factor is deemed satisfactory)
b_2: regression coefficient for dissatisfied group (impact on overall satisfaction when performance on individual IEQ factor is deemed unsatisfactory).

Thus, when the positive coefficient value is greater than the negative coefficient value then the particular IEQ factor has a stronger impact on overall workspace satisfaction (WPSAT) when occupants are satisfied with the performance of that particular IEQ factor. Thus the factor is grouped as a 'Bonus Factor'. Conversely, if the negative coefficient value is greater than the positive coefficient value, then the particular factor is grouped as Basic Factor. Finally, if the two coefficients for a particular IEQ factor have approximately the same positive and negative coefficient value, then the particular factor is grouped as a Proportional Factor. This procedure is illustrated in Figure 5. The hypothesis tested for this part of the study is: Retailers of malls with different modes of ventilation have different IEQ priorities in relation to their overall workplace satisfaction.

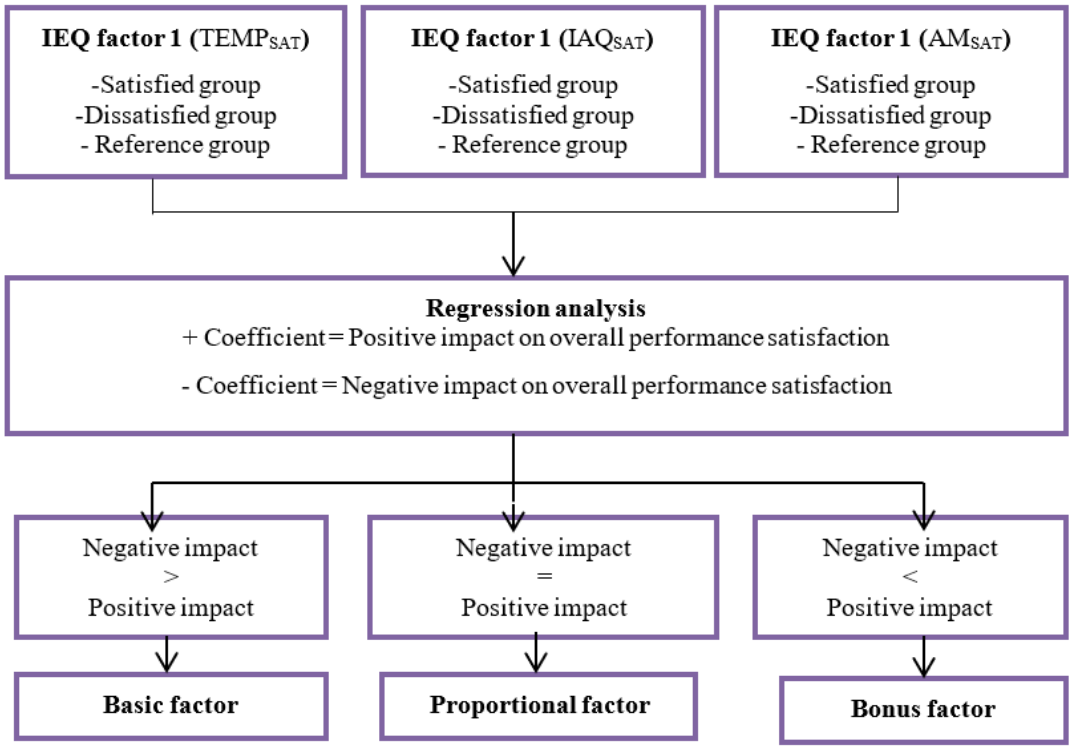

FIGURE 5. Schematic representation of the methodology used to categorize all IEQ factors into Basic, Proportional and Bonus groups (Kim and de Dear 2012a).

TABLE 1. Respondents' demographic characteristics

Variables		MM_1	MM_2	AC mall
Sample size		45	45	48
Ventilation mode		MM	MM	AC
Means of control		yes	yes	none
% Gender	Female	70.8	62.8	61.5
	Male	29.2	37.2	38.5
% Nationality	Malaysian	92.4	95.2	73.0
	Foreigner	7.6	4.8	27.0
Average period of occupancy (mths)		12.0		
Average period of stay in workplace per day (hrs)	Retailers (n = 138)	10.38		
Age in years (N = 138)	Mean	27.38		
	SD	8.73		
	Maximum	61.0		
	Minimum	17.0		

RESULTS

DEMOGRAPHIC CHARACTERISTICS

Users' information was investigated to analyse their demographic characteristics. Table 1 represents the characteristics of a total of 138 respondents from all the three case study malls.

Table 1 shows that a sample size of 45, 45, and 48 respondents represented MM1, MM2, and AC mall respectively. Retailers in the two mixed-mode ventilated malls had personal means of control in their workplaces and the two popular means of control amongst the retailers of these two malls were ceiling and portable fans (See Figure 6). In all the three case study malls majority of the respondents are females and also Malaysian citizens. The two main positions held by the retailers in all three case study malls were 'sales assistant' and 'managerial/ supervisor' positions (Figure 7). In all three case study malls, the average period of occupancy for retailers was twelve (12) months and their average period of stay in their workplace per day was 10.38 hours. Furthermore, the minimum age of respondents was 17 years and the maximum age was 61 years.

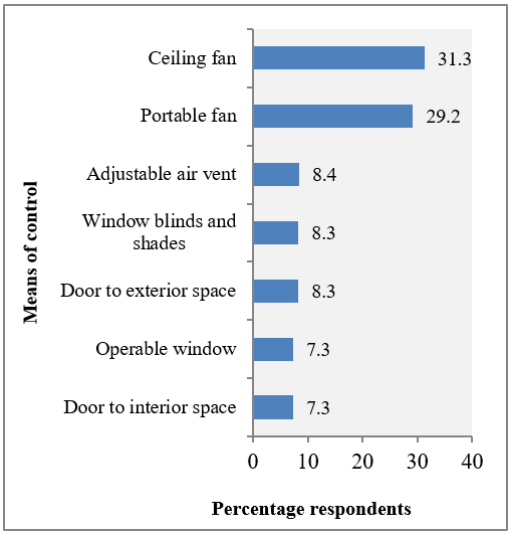

FIGURE 6. Retailers' means of control in both mixed-mode ventilated malls

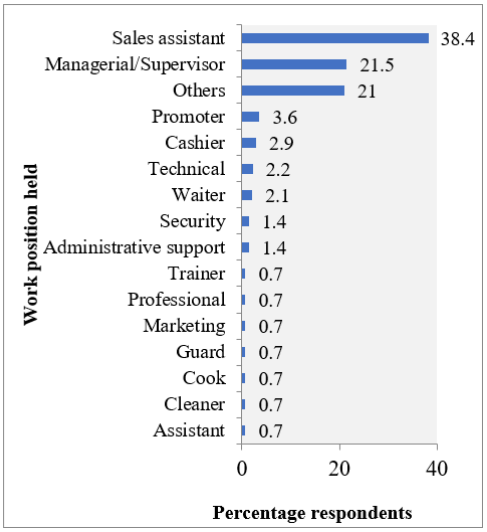

FIGURE 7. Retailers' position held in all three case study malls

GENERAL MEAN SATISFACTION VOTES BETWEEN RETAILERS IN EACH CASE STUDY MALL

Table 2 shows the general mean satisfaction votes between the retailers in all case study malls (N = 138). Generally, retailers are less satisfied with the malls' indoor conditions in both mixed mode ventilated malls whereas retailers in the AC mall were a bit ok with their indoor conditions. However, high satisfaction rates were recorded in MM1 for satisfaction with the 'workplace' and 'overall building performance' (4.33 and 4.24 respectively) where the AC mall recorded the highest mean satisfaction vote (4.44 and 4.35 respectively).

REGRESSION ANALYSIS: KANO'S SATISFACTION MODEL

A regression analysis involving retailers' workplace satisfaction (WP_{SAT} as dependent variable) and their satisfaction of three of the measured IEQ factor from occupants' general satisfaction survey ($TEMP_{SAT}$, IAQ_{SAT}, and AM_{SAT} as independent variables) was done on retailers'responses from all the case study malls. The strength each IEQ factor has on the retailers' workplace satisfaction was grouped under two circumstances (Figure 5): 1) when the IEQ factor has a positive impact, and 2) when the IEQ factor has a negative impact. This allows for each IEQ factor to be categorised as either basic, bonus or proportional factors based on their influence on retailers' workplace satisfaction.

The hypothesis tested for this part of the study goes thus: retailers in malls with different modes of ventilation have different IEQ priorities in relation to their overall workplace satisfaction.

Null hypothesis (H_0): No relationships exist between retailers' overall satisfaction with their workplace and the performance of each IEQ factor.

Alternative hypothesis (H_a): Different relationships exist between retailers' overall satisfaction with their workplace and the performance of each IEQ factor and this relationship differs between retailers of malls with different ventilation modes depending on what they expect from their building.

TABLE 2. Mean satisfaction votes of retailers in each case study mall

Factors	MM1(n=45)	MM2 (n=45)	AC mall (n=48)
$Temp_{SAT}$	3.51	3.27	4.23
IAQ_{SAT}	3.78	3.53	4.58
AM_{SAT}	3.98	3.84	4.35
WP_{SAT}	4.33	3.84	4.44
$BuildPerf_{SAT}$	4.24	3.69	4.35

Satisfaction was measured on a scale of 1 to 7 (1 = Very unsatisfied, 4 = ok, and 7 = Very satisfied)

TABLE 3. Impact of IEQ factors on retailers' workspace satisfaction for both satisfied and dissatisfied groups.

	Regression coefficients		Sig. diff.	Group	Regression coefficients		Sig. diff.	Group
	Satisfied group	dissatisfied group			Satisfied group	dissatisfied group		
Temperature	1.86NS (0.23; 3.94)	-1.08 NS (-2.25; -0.08)	-	-	0.53 NS (2.04; 3.09)	-2.57* (-0.34; -4.81)	Yes	Basic
Air quality	1.24NS (3.26; 0.78)	-0.24 NS (-1.21; -1.68)	-	-	2.18 NS (0.17; 4.19)	-3.84NS (-3.92; -23.8)	-	-
Air movement	3.35* (1.39; 5.32)	-4.29* (-6.34; -2.24)	No	Prop.	3.27** (0.83; 5.71)	-2.19NS (-6.26; -1.89)	Yes	Bonus

R^2 = 0.426 (MM malls); R^2 = 0.873 (AC mall).
Significance level of regression coefficients: **P < 0.01, *P < 0.05, NS = Not Significant.
Lower and upper bound of Confidence Intervals (95%) is in parenthesis.
Sig. difference: significant difference in the magnitude of the impact (positive and negative regression coefficients should not overlap)
Basic represents Basic Factor; Prop. represents Proportional Factor, and Bonus represent Bonus Factor

In Table 3, the absolute value of the regression coefficient is interpreted as the strength each factor impacted on retailers' overall satisfaction. The positive coefficients contributing to increased overall satisfaction, while the negative coefficients contributing to decreased overall satisfaction. Also, for the absolute magnitude of the impact of each coefficient to be significant, the 95% confidence intervals of the positive and negative regression coefficients must not overlap (Kim and de Dear 2012a). Therefore the comparison of positive and negative coefficients on each factor was used as a basis for identifying Basic, Bonus and Proportional Factors (Kim and de Dear 2012a).

In the mixed-mode ventilated malls (MM1 and MM2), the impact of temperature (TEMP$_{SAT}$) and air quality (IAQ$_{SAT}$) were not significant while for the AC mall only the impact of air quality was not significant (Table 3). It can be seen in Table 3, in the mixed-mode ventilated malls (MM1 and MM2) malls that for 'air movement' (AM$_{SAT}$) the negative influence has a greater impact (regression coefficient -4.29) on overall satisfaction compared to the positive influence (3.35). However, the absolute magnitude of the impact between satisfied and dissatisfied groups is not significantly different (i.e. the 95% confidence intervals of the positive and negative regression coefficients overlapped). Therefore 'air movement' in the mixed-mode ventilated malls falls into the 'Proportional Factor' category in Kano's satisfaction model which is regarded as a one-dimensional requirement, where retailers' overall satisfaction or dissatisfaction is proportional to the level of the factor's fulfillment/performance. That is, the lower the levels of the factors fulfillment/performance (in this case the air movement), the more dissatisfied customers are and vice versa. These requirements are usually explicitly demanded for by occupants according to the Kano's satisfaction model.

In contrast, 'air movement' fits Kano's definition of 'Bonus Factor' (usually referred to as 'surprise' or 'delight' attribute) in the AC mall as its negative impact on overall satisfaction was not statistically significant. Attributes within the bonus factor categories (in this case the 'air movement') are not expected by occupants so when fulfilled, occupants are extremely satisfied but dissatisfaction is not shown when these attributes are not fulfilled.

Furthermore, in the AC mall, the positive impact of 'temperature' on overall satisfaction was not statistically significant, thus in this case 'temperature' fits Kano's definition of 'Basic Factor'. Indicating that the impact of 'temperature' on overall satisfaction is bigger only when the thermal performance of the building is perceived to be unsatisfactory and below expectation (Negative coefficient -2.57). Thus, the overall satisfaction score was decreased by 2.57. Therefore, for the AC mall, temperature falls into the Basic factor category in Kano's satisfaction model and can be regarded as a minimum requirement (expected requirement) which causes extremely dissatisfaction if not fulfilled, but will not in any way cause increase satisfaction when fulfilled or meets expectation.

In summary, retailers in the mixed-mode ventilated malls considered air movement within their workplace as a necessity since attributes within the proportional factors are usually explicitly demanded by occupants. Whereas, retailers in the AC mall consider satisfactory air movement within their workplace a bonus and something not actually expected. On the other hand, retailers in the AC mall believe that their thermal environment should be comfortable (i.e. their indoor temperature should be within the satisfactory limit) because controlled environments like an air-conditioned space is expected to thermally satisfy its occupants.

DISCUSSION

This study conducted on shopping malls operating on different modes of ventilation (two mixed-mode ventilated malls and a fully air conditioned mall) aims at determining: 1) retailers' perception of some IEQ factors in each mall, and 2) developing a pattern of the impact of retailers' perception of some IEQ factors on their overall workplace satisfaction using the Kano satisfaction model. The two mixed-mode ventilated case study malls operate under 'zoned' mixed-mode ventilation strategy and data were collected from retailers that are located within the naturally ventilated space of both mixed-mode ventilated malls. To fulfill the study's objectives, a subjective IEQ measurement was carried out using a modified version of the questionnaire developed by the Center for the Built Environment (CBE) at the University of California, Berkeley. Descriptive analysis was done on retailers' responses to reveal their level of satisfaction after which a regression analysis was carried out on their perception of some IEQ factors in relation to their workplace. The hypothesis tested was "retailers in malls with different modes of ventilation have different IEQ priorities in relation to their overall workplace satisfaction".

Null hypothesis (H_0): No relationships exists between retailers' overall satisfaction with their workplace and the performance of each IEQ factor.

Alternative hypothesis (H_a): Different relationships exist between retailers' overall satisfaction with their workplace and the performance of each IEQ factor and this relationship differs between retailers of malls with different ventilation modes depending on what they expect from their building.

Results revealed that the two mixed-mode ventilated malls were provided with means of personal control for the retailers and the two most popular means of control were the ceiling and portable fans. This indicates that retailers are free to adjust their environmental conditions whenever their thermal condition is deemed unsatisfactory. On average retailers stay 10.38 hours each day in their workplace.

Generally, retailers in both mixed-mode ventilated malls found their indoor conditions unsatisfactory compared to retailers in the AC mall, with thermal satisfaction having the least mean score. This is understandable, considering that the spaces studied are naturally ventilated spaces with no operating cooling mechanism. In addition, results show that retailers in all three case study malls have different priorities in relation to those factors that influence their workplace satisfaction. These different priorities became evident as the Kano's satisfaction model revealed that retailers in the mixed-mode ventilated malls viewed satisfactory air movement within their workplace as a necessity and it is something they always explicitly demand for. Whereas in the AC mall, satisfactory air movement as far as retailers are concerned is a bonus and something not actually expected. However, they (retailers in the AC mall) expect their thermal environment to be comfortable and within the satisfactory limit as expected of a controlled environment like an air-conditioned space, and if it is not, they are extremely dissatisfied.

This result is in line with Kim and de Dear, 2012a where it was revealed that provision of thermal comfort is clearly a minimum requirement for people working in centrally air-conditioned spaces. In other words, users of air-conditioned spaces will be satisfied whenever the building provides them with a comfortable thermal environment (i.e. satisfaction with their workplace increases). Whereas, they will display dissatisfaction with their workplace when the building fail to deliver satisfactory thermal comfort (i.e. satisfaction with their workplace decreases). This was also iterated by de Dear and Brager (2002) when they argued that due to the high expectations of thermal uniformity developed by occupants in air-conditioned spaces, they unconsciously become critical even of a slight deviation in their usual thermal conditions.

Air movement was not evaluated as part of the IEQ factors included in Kim and de Dear, 2012a's study. So, to explain users in the natural ventilated zone of the mixed-mode ventilated mall's expectation towards air movement, a critical look into their condition is vital. As explained by de Dear and Brager (2002) occupants/users in naturally ventilated spaces are more closely connected to the outdoor climate, hence become used to varying thermal conditions in their indoor environments. Therefore, their expectation of the indoor thermal condition in their location is not high as explained by Kim and de Dear, 2012a, occupants of naturally ventilated spaces are forgiving towards their indoor thermal condition. Hence the plight felt by retailers in the mixed-mode ventilated mall is justified as the only channel for achieving comfort is the air movement. As a result, retailers in the mixed-mode ventilated mall have very high expectation of the air movement in their spaces and as such are not satisfied when this expectation is not fulfilled. In summary, the different level of expectation developed by users' experience in building spaces with different ventilation mode probably led to their different classification of the IEQ factors. This strengthens Zosia and Raymond (2009)'s argument that expectations play a crucial part in dictating occupants'/users' comfort and their indoor environmental behaviour.

CONCLUSION

This study reveals the retailers' perception of some IEQ factors in three malls operating on different ventilation modes (two mixed-mode ventilated and one air-conditioned). A subjective IEQ measurement of the retailers in the three malls was carried out through a paper-based IEQ assessment survey. Furthermore, a regression analysis was done on responses from the survey in other to fulfill the study's objectives The two mixed-mode ventilated malls used in this study operates on zoned mixed-mode ventilation strategy, therefore retailers located within the naturally ventilated zones are used for the study. Retailers' satisfaction votes of thermal, air quality, air movement, workplace, and overall building performance were revealed. And the air-conditioned ventilated mall recorded the highest mean satisfaction votes compared to the two mixed-mode ventilated malls with regards to all factors.

The results from the regression analysis revealed that the major priority for retailers in the mixed-mode ventilated malls is the indoor air movement (regression coefficient 3.35*, -4.29*). Satisfactory air movement is highly important to retailers in mixed-mode ventilated malls and it is something they usually explicitly demand for within their workplace. So much so that retailers in these malls are blinded to other indoor factors. From this observation, it is therefore, sensible to argue that when the air movement reaches a satisfactory level in a naturally ventilated space, workers give less attention to all other factors. Equally, satisfactory indoor thermal condition is essential for workers in an air-conditioned mall (0.53 NS, -2.57*), and it is expected of an air-conditioned mall to thermally satisfy its users. Even, if satisfactory air movement is achieved

by workers in this space (air conditioned space) in place of thermal satisfaction, this satisfactory air movement will be considered a bonus, something just to be delighted about. These findings have shown that for naturally ventilated spaces, the air movement is very essential in elevating users' thermal condition. Findings from this study were able to prove that: Retailers/Workers in malls with different modes of ventilation have different IEQ priorities in relation to their overall workplace satisfaction as the results indicated that users of the mixed-mode ventilated malls placed high priority on indoor air movement while those in the air-conditioned mall prioritised the indoor temperature.

Findings from this study provide a better understanding of workers' expectations and concerns with regard to their indoor environmental conditions. The results can potentially be used to help designers in creating malls that are more efficient in resources and also safer and healthier for people and the environment.

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DECLARATION OF COMPETING INTEREST

None

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