UNIVERSITI TEKNOLOGI MARA
Cawangan Perak
Kampus Seri Iskandar

e-Proceeding

v-GOGREEN2020

29 - 30 SEPT

VIRTUAL GO-GREEN: CONFERENCE & PUBLICATION

"SUSTAINABLE ENVIRONMENT, RESILIENCE AND SOCIAL WELL-BEING"

Organiser :
Research, Industrial Linkages, Community & Alumni Network (PJIM&A)

Co-organiser :
Faculty of Architecture, Planning and Surveying (FSPU) & Centre for Post Graduate Studies (CGS)

Publication Date : 22nd February 2021

Virtual Go-Green Conference and Publication 2020

UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH
February 2021

Main Committee

Virtual Go-Green Conference and Publication 2020

Advisor 1	*: Prof Sr Dr Md Yusof Hamid, AMP*
Advisor 2	*: Assoc Prof Dr Nur Hisham Ibrahim*
Chairman	*: Sr Dr Asmalia Che Ahmad*
Co-Chairman	*: 1. Sr Dr Yuhainis Abdul Talib*
	2. Sr Dr Haryati Mohd Isa
Treasurer	*: Mohamad Haizam Mohamed Saraf*
Secretary	*: Noorliza Musa*
Head of v-Conference	*: Sr Dr Nor Suzila Lop*
Head of e-Proceeding	*: Dr Junainah Mohamad*
Head of Scopus Indexed Journal Planning Malaysia Journal (PMJ)	*: Assoc Prof Gs Dr Mohd Fadzil Abdul Rashid*
Head of Scopus Indexed Journal Malaysian Construction Research Journal (MCRJ)	*: Sr Dr Natasha Khalil*
Head of Paper Reviewer	: *Dr Asniza Hamimi Abdul Tharim*

Committee Members

Virtual Go-Green Conference and Publication 2020

E-Proceeding Paper Reviewer

Noraini Md Zain
Shafikah Saharuddin
Nur Fatiha Mohamed Yusof
Farrah Rina Mohd Roshdi

E-Proceeding Formatting

Nurulanis ahmad @ Mohamed
Jannatun Naemah Binti Ismam
Najma Binti Azman

E-Proceeding Language Reviewer

Dr Hjh Shazila Abdullah
Dr Daljeet Singh Sedhu A/L Janah Singh
Zarlina Mohd Zamari
Dr Mary Thomas
Iza Faradiba Mohd Patel
Farahidatul Akmar Awaludin
Wan Faridatul Akma Wan Mohd Rashdi
Jeyamahla Veeravagu
Wan Nurul Fatihah Wan Ismail
Nazirul Mubin Mohd Noor
Noor Aileen Ibrahim
Noraini Johari
Dr Hajah Norakmarwati Ishak

Virtual Conference

Norazlin Mat Salleh	*Registration*
Shahela Mamter	*Auditor*
Mohd Esham Mamat	*Auditor*
Noor Anisah Abdullah @ Dolah	*Auditor*
Mohamad Tajudin Saidin	*Certificate & Conference Kit*
Fairiz Miza Yob Zain	*Logistic*
Mohd Firdaus Zainuddin	*Logistic*
Farah Hanna Ahmad Fuad	*Promotion & Publicity*
Mohamad Shahin Shahdan	*Promotion & Publicity*
Mohd Asrul Hassin	*Liason Officer*

Organiser:
Research, Industrial Linkage Community and Alumni Network Office (PJIM&A)
Universiti Teknologi MARA, Perak Branch, Seri Iskandar.
Malaysia

Co-Organiser:
Faculty of Architecture, Planning and Surveying (FSPU)
and,
Centre for Post Graduate Studies (CGS)
Universiti Teknologi MARA, Perak Branch, Seri Iskandar.
Malaysia

e ISBN 978-967-2920-06-9

AN ANALYSIS ON THE ASSOCIATION BETWEEN THERMAL COMFORT AND VISITORS' SATISFACTION IN SHOPPING COMPLEXES USING SEM-PLS

Asniza Hamimi Abdul Tharim[1], Nursaadatun Nisak Ahmad[2], Mohamad Haizam Mohamed Saraf[3], Asmalia Che Ahmad[4] and Nur Qamarina Raffikhul[5]
[1,3,4]Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus, Seri Iskandar, 32610 Perak, Malaysia
[2]Faculty of Business Management, Universiti Teknologi MARA, Puncak Alam Campus 42300, Selangor, Malaysia

Abstract

This research aims to examine the association between thermal comfort and visitors' satisfaction in shopping complexes. The survey was conducted in selected shopping complexes located at Pulau Pinang, Malaysia. This research was conducted by using a questionnaire survey. It was administered to 176 visitors in the chosen buildings, where respondents were asked to select their preferences based on a five-point Likert scale of agreement and satisfaction. The analysis was conducted using PLS-SEM: SMART PLS Version 3.2 to examine the reliability and validity of the questionnaire. The results indicate that there is a significant relationship between thermal comfort and visitors' satisfaction in shopping complexes, especially with regards to the air movement in the buildings. The results highlight the importance of the thermal comfort condition for visitors' satisfaction in shopping complexes.

Keywords: *thermal comfort, visitors, satisfaction, shopping complexes*

1.0 INTRODUCTION

The effect of the climatic changes based on the increased total annual energy consumption. Based on Kwok and Rajkovich (2010), Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) stated that the global atmospheric concentrations of carbon dioxide have increased due to human activities since 1750. Buildings Energy Data Book published by the U.S. Department of Energy in 2006 found that the building sector consumed 38.9% of the total primary energy used in the United States and 34.8% is used by buildings for space heating, ventilation, and air conditioning. The internal airflow pattern is the result of interaction between the indoor and outdoor environment (Hussain &Oosthuizen, 2012). Subsequently, as outdoor temperature increases, it will increase indoor temperature of the buildings as well, and thus affects the thermal comfort of the visitors. Therefore, in order to achieve the satisfaction of the visitors, enhancing the thermal comfort in shopping complexes is vital. Hence, this research paper intended to identify the relationship between thermal comfort variables with visitors' satisfaction in shopping complex buildings and to determine the main thermal comfort factors that positively influence visitors' satisfaction.

2.0 LITERATURE REVIEW

Ultimate comfort in a built environment is slightly hard to achieve. The term "comfort" means satisfaction to some degree, and it addresses psychological satisfaction as much as physiological satisfaction. Therefore, providing a comfort zone to make everyone satisfied, which depends on a plethora of variations of human psychology differing from one person to the other can be quite a challenge considering that analysing human comfort is also somewhat

tricky and impractical. In that case, architects will create a series of shelters without any facility such as having fenestrations, low ceilings, or small areas to provide certain benefits to the occupants.

Environmental factors have generally influenced human comfort. In other words, occupants feel comfort from the visual, thermal, acoustic, physical and psychological aspects. To be precise, sunlight is one of the determining factors affecting human comfort, which assist people in perceiving their surrounding space (Najafabadi, 2013). Thermal comfort often relates to the condition of an individual's mind, which expresses satisfaction or dissatisfaction within the thermal environment (Esther & Sagada, 2014). Thermal comfort can also be defined as the state of mind, which expresses satisfaction along with the thermal environment. People have strived for centuries to create a thermally comfortable environment not just in shopping malls but also in almost every enclosed building in existence. Thermal comfort can also be defined as a condition that individuals reprocess involving many inputs influenced by physical, physiological, and other factors.

Numerous studies have been conducted on thermal comfort to improve energy consumption in the buildings. However, the difference in diversified space of the buildings creates a different thermal environment and thermal comfort to the fully occupied areas. According to Hou (2016), people spend most of their time indoors, therefore, the indoor environment has a significant impact on occupants, including their productivity and health. Thus, achieving a high-quality internal space is a dominant issue in architectural design.

Thermal comfort is influenced by the personality of a person, such as a mood, culture, organisation, and social factors. According to Hou (2016) and Najafabadi (2013), thermal comfort is not a state of condition, but rather a state of mind which affects human performance and their health, and involves many inputs influenced by the physical and physiological state on what they feel.

Subsequently, visitors' satisfaction is a critical issue for both occupants and shopping mall management. It is an essential concept within general retail, marketing, and consumer research. The marketing concept, for instance, the long-dominant credo of marketing literature says; 'the key to achieving organisational goals consists in determining the needs and wants of target markets and delivering the desired satisfactions more effectively and efficiently than competitors' (Anselmsson, 2006). Meanwhile, visitors' satisfaction in a shopping complex may be viewed as their individual emotional reaction to the personal evaluation of the complete set of experiences encountered at the shopping complex. Hence, this research paper aims to identify the association between thermal comfort conditions in shopping complexes with visitors'' satisfaction.

2.1 Research Framework and Hypothesis

Figure 1 displays the conceptual framework and research hypothesis of the association between thermal comfort variables and visitors' satisfaction in shopping complexes.

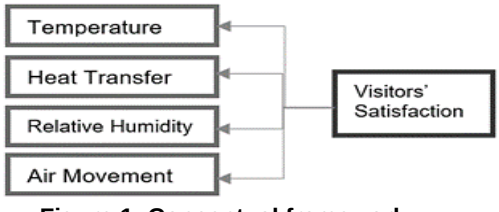

Figure 1: Conceptual framework

(Source: Authors' Research, 2020)

Main hypothesis: There is a significant association between thermal comfort and visitors' satisfaction in shopping complexes

H1: There is a significant association between air temperature and visitors' satisfaction in shopping complexes

H2: There is a significant association between heat transfer and visitors' satisfaction in shopping complexes.

H3: There is a significant association between relative humidity and visitors' satisfaction in shopping complexes
H4: There is a significant association between air movement and visitors' satisfaction in shopping complexes

3.0 METHODOLOGY

For this study, the researcher used a questionnaire for the data collection purpose. The questionnaire was produced in a formatted form which needs to be filled by the respondents of this research. The unit analysis of this research is the visitors in shopping complexes in Penang Malaysia. The population of these studies are the visitors within the two (2) selected shopping complexes at Penang Island. The sampling method used for this research to determine the sample size is by using the formula by Krejcie and Morgan (1970). The population size of the study is N=50,000. Therefore, based on the formula by Krejcie and Morgan (1970), the total sample is S=381, and the respondents were randomly selected as the sample for questionnaire distribution.

Table 1: Questionnaire distribution sample size

Sample Size (Distributed)	Percentage (%)	Expected Return	Respondents Returns for the Research
381	20	77	176

(Source: Krejcie & Morgan, 1970)

According to Nulty (2008), the acceptable response rate is 20%. Based on Table 1 above, 176 questionnaire sets were returned by the respondents, exceeding the minimum of 20% respondent rate. Thus, the number of samples is adequate for data collection. The survey questionnaires used in this study consist of three (3) sections. The first section of the questionnaire focuses on the independent variable (IV) of the study which is the thermal comfort that consists of four dimensions; air temperature, heat transfer, relative humidity, and air movement. The second part of the questionnaire inquires on the perception of the visitors towards their satisfaction in shopping complexes as the dependent variable (DV) of the research. The items in the first and second section were measured using a 5 item scale. The last section of the survey focuses on the demographic variables of the respondent.

4.0 ANALYSIS

SPSS 24 and SmartPLS 3.2 were employed to assess the reliability and validity of the survey questionnaires data, and to do the preliminary testing for the research hypothesis. The demographic profile of the respondents was analysed using SPSS version 24, while the measurement and structural model of the research framework were analysed using SmartPLS 3.2. The significant benefit of using SmartPLS 3.0 in determining the reliability and validity of a study is that this method delivers latent variable score thus avoiding the problem of small sample size and handling complex models with many variables efficiently (Henseler et al., 2009).

4.1 Demographic Profile of the Respondent

Based on the demographic analysis using SPSS, there is quite a balanced percentage between female and male respondents. The respondents consist of 55 percent females and 45 percent male respondents. The majority of the respondents' age is below 21 years old (43%). The analysis also indicates that the frequency of visiting the shopping complexes by the respondents was a few times per month (34%) followed closely by a few times per week (24%). Lastly, the majority of the respondents (86%) indicated that they stay in the shopping complexes for two to four hours per visit.

4.2 Measurement Model Analysis

Table 2 summarises the results of the measurement model of the conceptual study framework after a few adjustments were made. The results of the model were presented as the following:

Table 2: Measurement model

Construct	Item	Convergent Validity		Internal Consistency Reliability		Discriminant Validity	
		Cross Loading	**AVE**	**Cronbach Alpha**	**Composite Reliability**	**HTMT**	**VIF**
		>0.50	***>0.50***	***0.60-0.90***	***0.60-0.90***	***Confidence Interval Does Not Include 1***	***<5.00***
Air Temperature (AT)	2	0.902-0.923	0.833	0.800	0.909	Yes	2.325
Heat Transfer (HT)	2	0.877-0.907	0.726	0.746	0.887	Yes	2.699
Relative Humidity (RH)	2	0.856-0.914	0.784	0.729	0.879	Yes	3.305
Air Movement (AM)	2	0.918-0.934	0.858	0.835	0.924	Yes	2.306
Occupant's Satisfaction (OS)	3	0.858-0.906	0.789	0.865	0.865	Yes	

AVE: Average Variance Extracted; HTMT: Heterotrait-Monotrait Ratio; VIF: Collinearity Statistic

(Source: *Table adapted from Hair et al. 2016)*

To test the effectiveness of the proposed conceptual model and further rectify its validity as an instrument for real study data collection, there are a few tests and figures that need to be finalised within its acceptable range of measurement. Two of the most important tests that need to be taken into consideration in determining the effectiveness of measure for a model are the reliability and validity test. According to Sekaran and Bougie (2010) reliability test is a test to measure the consistency of the instruments while validity test is a test that indicates the effectiveness of the developed instrument in measuring a particular concept of a study.

4.3 Reliability

Reliability of the measurement model can be assessed using two values which are the Cronbach's alpha coefficient of above 0.6 in assessing the inter-item consistency, and through the composite reliability which is considered as acceptable if the value ranges from 0.7 or greater (Fornell & Larcker 1981). As for this study, Table 2 indicates that the composite reliability of the measurement model values ranged from 0.729-0.865 for Cronbach's Alpha value, and ranged from 0.879-0.924 for composite reliability as portrayed in Table 2. Thus, the measurement model of this research is acceptable to consistently measure the instruments.

4.4 Validity

The main purpose of the validity test is to measure the theories fitness of the designed test (Sekaran & Bougie 2010). It can be divided into two tests which are the convergent validity and discriminant validity. Convergent validity can be assessed by looking at the results of the

measurement model's factor loading, composite reliability, and also its average variance extracted (AVE) (Hair et al., 2014). Table 2 shows that the factor loading of each item in the construct exceeded the endorsed value of 0.5, as stated by Hair et al. (2014). Subsequently, Table 2 also further confirms on the validity of the model by indicating the value of composite reliability of the model that ranges from 0.879-0.924, which surpasses the recommended value of 0.7 (Hair et al., 2014). In addition, the model's average variance extracted (AVE) values also exceeds the expected value of 0.5 (Fornell & Larcker 1981, Barclay et al. 1995, Hair et al., 2014) with the range of 0.726-0.858 that reflects the overall amount of variance in the items for the latent construct. Thus, the result for convergent validity is acceptable for this model.

The next test that needs to be taken into consideration is the discriminant validity test that explores the degree to which a definite measure of one variable is not a reflection of another variable in the model. According to Cheung and Lee (2010), a discriminant validity test can be indicated by a low correlation between items in different constructs. This test identifies that by looking at the collinearity statistic (VIF) value of the construct. Table 2 shows that all constructs in the model obtain VIF values of less than 5. Therefore, it can be concluded that there are no collinearity issues between constructs in the proposed conceptual model. To further examine the status of model discriminant validity, it is best to assess the discriminant validity in PLS-SEM by looking at the Fornell-Larcker Criterion value to further confirm that the items across the constructs measure different constructs in the model. This can be identified by looking at the fact that the confidence interval value of statistic must not comprise the value of 1 for entire combination of construct which indicates the lack of discriminant validity for the model as tabulated in Table 3:

Table 3: Fornell-Larcker Criterion

Dimension	AT	HT	RH	AM	OS
Air Temperature (AT)	0.912				
Heat Transfer (HT)	0.687	0.892			
Relative Humidity (RH)	0.716	0.753	0.886		
Air Movement (AM)	0.707	0.730	0.745	0.888	
Occupant's Satisfaction (OS)	0.613	0.664	0.727	0.800	0.926

(Source: Authors' Research, 2020)

Based on the above discussion of the measurement model findings, it can be concluded that all four constructs of the thermal comfort which are air temperature, heat transfer, relative humidity, and air movement are all valid measures of their constructs based on their factor estimates and statistical significance. It can also be summarised that the measurement model established adequate reliability and validity standard that can be used in the entire data collection.

4.5 Structural Model Analysis

In order to test the hypotheses of the study, a structural model was tested and analysed. As shown in Table 4, out of four variables hypothesised to influence visitors' satisfaction in shopping complexes, only three were significant. Results indicate that air temperature, heat transfer, and air movement were positively related to visitors' satisfaction where p-value was less than 0.05. However, one of the independent variables; the relative humidity, was found to be insignificant to the visitors' satisfaction.

Table 4: Structural model

Hypothesis	Relationship	Coefficient	p-value/ t-value	Result
H1	Air Temperature Visitors' Satisfaction	0.212	0.004/2.927	Supported
H2	Heat Transfer Visitors' Satisfaction	0.195	0.011/2.553	Supported
H3	Relative Humidity Visitors' Satisfaction	0.113	0.152/1.436	Not Supported
H4	Air Movement Visitors' Satisfaction	0.458	0.000/7.626	Supported

(Source: Authors' Research, 2020)

5.0 CONCLUSION

This study emphasises the importance of thermal comfort in providing shopping complexes with an environment that could increase the visitors' satisfaction. The study attempted to highlight the interaction between the five main variables of the research; air temperature, heat transfer, relative humidity, air movement, and visitors' satisfaction. The findings of this research showed that the air temperature, heat transfer, and air movement contributed to visitors' satisfaction. However, there is no significant relationship between relative humidity with visitors' satisfaction. The result may be due to the small number of respondents. This study tested a conceptual framework based on thermal comfort satisfaction literature. The instrument used in this study fulfilled the acceptable requirements for reliability and validity analyses. The outcome of the path model analysis confirmed that thermal comfort is significantly correlated with visitors' satisfaction.

REFERENCE

Anselmsson, J. (2006). 'Sources of customer satisfaction with shopping malls: A comparative study of different customer segments', The International Review of Retail, Distribution and Consumer Research, 16(1), pp. 115– 138.

Barclay, D., Higgins, C., & Thompson, R. (1995). The Partial Least Squares (PLS) approach to causal modelling: Personal computer adoption and use as an illustration. Technology Study, 2 (2), 285-309.

Cheung, C. M., & Lee, M. K. (2010). A Theoretical Model of intentional Social Action in Online Social Networks. Decision support systems, 49(1), 24-30.

Esther, M. M., and Sagada, M. L. (2014). 'An Evaluation of Thermal Comfort Conditions in an Urban Entertainment Centre In Hot-Dry Climate Of Nigeria', International Journal of Energy and Environmental Research (IJEER), 2(1), pp. 55–74.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18, 39-50.

Hair, J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2010). A primer on partial least squares structural equation modeling (PLS-SEM). 126- 145.

Hair, J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2014). A primer on partial least squares structural equation modelling (PLS-SEM), 60-78

Henseler, J., Ringle, C. M., & Sarstrdt. M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43, 115-135.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of the partial least square path modeling in international marketing. New Challenges to International Marketing Advances in International Marketing, 20, 277-319.

Hou, G. (2016). An investigation of Thermal Comfort and the use of Indoor Transitional Space, Thesis for the degree of Doctor of Philosophy, pp. 1–275

Hussain, S. & Oosthuizen, P. H. (2012). Numerical Investigations of Buoyancy- Driven Natural Ventilation in a Simple Atrium Building and its Effect on the Thermal Comfort Conditions. Applied Thermal Engineering. Elsevier Ltd, 40, pp. 358–372.

Krejcie, R.V., & Morgan, D.W., (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement.

Kwok, A. G. & Rajkovich, N. B. (2010), Addressing Climate Change in Comfort Standards. Building and Environment. Elsevier Ltd, 45(1), pp. 18–22.

Lazrak, F., Rietveld, P., & Rouwendal, J. (2014). The Market Value of Cultural Heritage in Urban Areas: An Application of Spatial Hedonic Pricing. Journal of Geographical System, 16(1):89-114.

Najafabadi, F. A. (2013). Effect of Atrium on Thermal Comfort (July), pp. 1–165.

Nulty, D. D. (2008). The adequacy of response rates to online and paper surveys: What can be done?', Assessment and Evaluation in Higher Education, 33(3), pp. 301–314.

Sekaran, U. & Bougie, R. (2013). Research Methods for Business: A Skill- Building Approach. New York: John Wiley & Sons, Inc. The Center for the Built Environment (CBE), Available at: http://cbe.berkeley.edu/

Pejabat Perpustakaan
Librarian Office

Universiti Teknologi MARA
Cawangan Perak
Kampus Seri Iskandar
32610 Bandar Baru Seri Iskandar,
Perak Darul Ridzuan, MALAYSIA
Tel: (+605) 374 2093/2453 Faks: (+605) 374 2299

UNIVERSITI TEKNOLOGI MARA

Surat kami : 700-KPK (PRP.UP.1/20/1)
Tarikh : 20 Januari 2023

UNIVERSITI TEKNOLOGI MARA PERAK
TERIMA
25 JAN 2023
Tindakan
Universiti Teknologi MARA Perak
PEJABAT REKTOR

Prof. Madya Dr. Nur Hisham Ibrahim
Rektor
Universiti Teknologi MARA
Cawangan Perak

Tuan,

PERMOHONAN KELULUSAN MEMUAT NAIK PENERBITAN UiTM CAWANGAN PERAK MELALUI REPOSITORI INSTITUSI UiTM (IR)

Perkara di atas adalah dirujuk.

2. Adalah dimaklumkan bahawa pihak kami ingin memohon kelulusan tuan untuk mengimbas (*digitize*) dan memuat naik semua jenis penerbitan di bawah UiTM Cawangan Perak melalui Repositori Institusi UiTM, PTAR.

3. Tujuan permohonan ini adalah bagi membolehkan akses yang lebih meluas oleh pengguna perpustakaan terhadap semua maklumat yang terkandung di dalam penerbitan melalui laman Web PTAR UiTM Cawangan Perak.

Kelulusan daripada pihak tuan dalam perkara ini amat dihargai.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

SITI BASRIYAH SHAIK BAHARUDIN
Timbalan Ketua Pustakawan

nar

Setuju.

27.1.2023

PROF. MADYA DR. NUR HISHAM IBRAHIM
REKTOR
UNIVERSITI TEKNOLOGI MARA
CAWANGAN PERAK
KAMPUS SERI ISKANDAR