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Research Article

Factors Contributing to Safety and Health Performance of Malaysian Low-cost Housing: Partial Least Squares Approach

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Abstract: Sustainable development is fast emerging as one of the main priorities of construction industry in Malaysia. Malaysians of all income levels, particularly the low-income group, would have accessibility to adequate, affordable and quality shelter. As a result, safety and health performance in the low-cost housing has become a rising concern. This study attempts to explore the influence of architecture, building services, external environment, operation and maintenance and management approaches on the building safety and health performance among the construction practitioners in Malaysia and their subsequent personal responsibility. The study used the Partial Least Squares (PLS) and Structural Equation Modelling (SEM) tool to test the hypotheses generated. Findings from the Partial Least Squares analysis revealed that architecture, building services, external environment, operation and maintenance and management approaches are vital determinants contributing to safety and health performance of low-cost housing in the Malaysian context. In turn, this determinant that is formed will largely determine whether the construction practitioners engage in influencing personal responsibility towards building safety and health performance. Implications, limitations as well as suggestions for future research are accordingly discussed in this study.

Keywords: Health, low-cost housing, partial least square, performance, safety

INTRODUCTION

The rate of urbanization in Malaysia has increased rapidly from 25% in 1960 to 72% in 2010 (Zainal *et al*., 2012). An assessment by the Department of Statistics (2010) showed that population density in Kuala Lumpur in 2010 was 7,089 per unit of land area (Department of Statistics, 2010). As a result, demand for affordable housing in the cities has increased, causing an acute shortage of affordable housing. Since the Third Malaysia Plan, the number of completed low-cost housing projects has not achieved its target (Shuid, 2009; Bajunid and Ghazali, 2012). In fact, during the Eighth Malaysia Plan, the total number of low-cost housing completed was 197,649 units compared to 230,000 units needed (Ministry of Housing and Local Government of Malaysia, 2009). Many private developers were engaged to meet the housing need. However, these developers built the low-cost houses purely out of quota requirements as they are unprofitable ventures. Consequently, occupants of low-cost housing are constantly faced with many problems such as sub-standard quality, maintenance, comfort levels, health, safety and security services (Zaid and Graham, 2011; Bajunid and Ghazali, 2012).

A study conducted by Isnin *et al*. (2012) found that residents of low-cost housing in Shah Alam are generally not satisfied with the condition of their homes and the surrounding environment. The construction methods, materials used to build their homes as well as the lack of cleanliness, aesthetic value, safety, privacy and amenities are among the problems and risks affecting their social health and the environment. Another study conducted by Zainal *et al*. (2012) also investigated the relationship between housing conditions and the quality of life in low-cost housing in the Klang Valley. They found that housing for the urban poor lacks in physical qualities such as design, size and materials used and in other qualities such as location, landscape and availability of public amenities and services.

Bringing low-cost housing into the context of sustainable development would be highly beneficial for the country's environment, economy and society. Comprehensive tools and concepts must be developed to determine the safety and health indicators for new and existing building with the focus on the prevention of safety and health problems (Akasah and Alias, 2009; Akasah *et al*., 2011). It is worth investigating further on whether our buildings are sufficiently safe and healthy for their occupants and the general public. Hence this

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study attempts to examine the determinants of safety and health performance of low-cost housing in Malaysia. It also examines how this safety and health performance may predict the construction practitioner's responsibility toward adopting research model.

Research context and research model:

Architecture: Architecture refers to the layout configuration and disposition of a building that are added to the greater surroundings, which include the finest design details (Bokalders and Block, 2010). To achieve building sustainability, a reduction in environmental, safety and health hazards in buildings require broader changes in architecture, construction and spatial planning practices. A vast amount of research was dedicated to the identification of architectural performance and ways to eliminate architectural defects (Ramly *et al*., 2006; Isa, 2011; Chohan *et al*., 2011). Ramly *et al*. (2006), for example, found that 47% of architectural defects are caused by design defects, 17% from materials, 15% from construction, 18% from misuse of facilities, 15% from poor maintenance and 5% from vandalism. Isa (2011) also found that the majority of the defects identified are related to poor architectural works, followed by poor electrical works and civil and structural defects. These findings suggest that defects could have been prevented if consideration is given to the architectural elements. Chohan *et al*. (2011), for example, pointed out that architects need to prevent these defects by using more appropriate materials and a better design and layout. Based on the review of the literature above, the authors hypothesize that:

H1: Architectural factors, such as means of access and escape, structural and finishes integrity, amenities, space functionality and fire resistance have a positive influence on safety and health performance.

Building services: Similar to architecture, building services are required for a safe, comfortable and environmentally-friendly operation of buildings. Building services refer to the design, installation, operation and monitoring of the mechanical and electrical systems such as electrical supply, lighting, ventilation, plumbing and sanitary, fire services and lifts (Ho *et al*., 2008). An assessment of building services conditions is important to safeguard the safety, health and well-being of people and to protect the environment (Lai and Yik, 2011). This is important to ensure the maintenance of quality and sustainability of buildings. Lai and Yik (2004) agreed with this view, as they found that building services systems such as fire services, lifts and escalators, electricity, gas and water supplies and ventilating systems tend to be maintained in serviceable condition if they are regularly inspected according to the legal requirements. Therefore, it is hypothesized that:

H2: Building services factors, such as electricity system, lighting, ventilation, plumbing, sanitary services, fire services and lift services have a positive influence on safety and health performance.

External environment: Safety and health measures should include the protection against additional hazards introduced by the external environment. Environmental hazards refer to all potential threats facing human society by events that originate in and are transmitted through, the environment (Smith and Petley, 2008). The study by Hamsa *et al*. (2010), which assessed physical environmental parameters such as noise, air pollution and traffic volume, highlighted several inadequacies of the living environment in the Taman Melati residential area in Kuala Lumpur. In another study, Zainal *et al*. (2012) measured the quality of the surrounding environment by air quality and peace level. They found that the surrounding environment has a significantly positive correlation with the health status and the overall quality of life. Hence, it is hypothesized that:

H3: External environment factors, such as access to emergency services, external hazards, location, air quality, peaceful environment and aesthetics have a positive influence on safety and health performance.

Operation and maintenance: The operation and maintenance of facilities encompass a broad spectrum of services required to ensure that the built environment will perform its originally intended functions (Sapp, 2009). The study conducted by Mohd-Isa *et al*. (2011) found that the cost of maintenance work is rapidly increasing in various countries including Hong Kong, Singapore, the United Kingdom and Malaysia. The Malaysian Government has also increased the maintenance budget for schools and health clinics, housing projects, water tank projects, flood mitigation plans and sports facilities, from RM 2.5 billion for 2012 to RM 6 billion for 2013 (Government of Malaysia, 2012; Government of Malaysia, 2013). In order to mitigate the cost increase, Mohd-Isa *et al*. (2011) proposed a set of criteria for a sustainable building maintenance management. The best practices include:

- A clear maintenance policy
- Systematic maintenance programmes and priorities
- An accurate building condition assessment
- An updated information and data integration system

Therefore, it is hypothesized that:

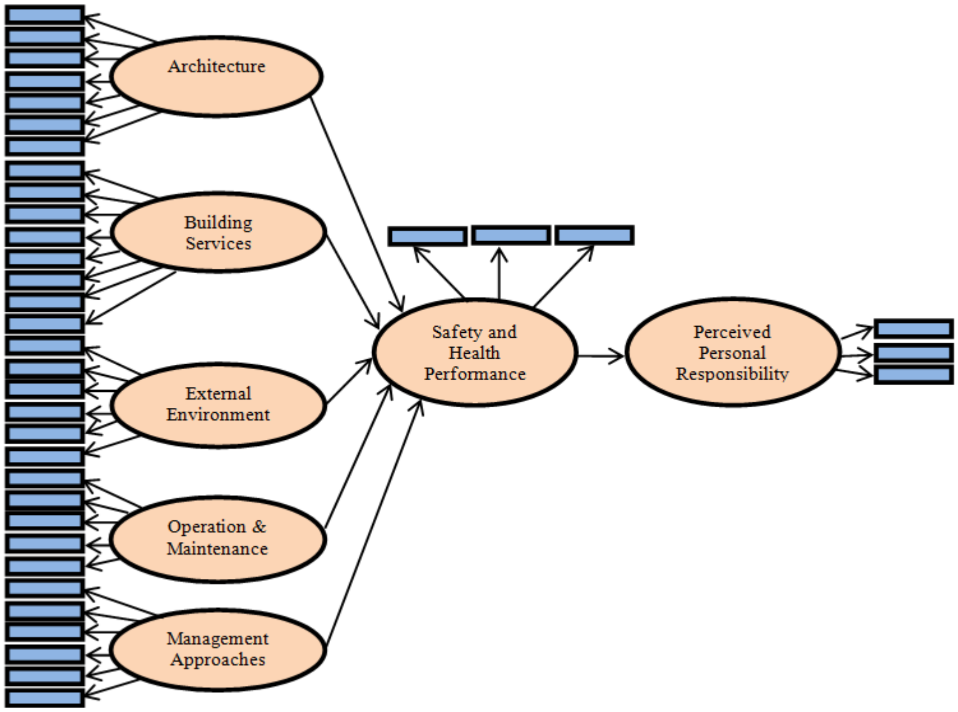

Fig. 1: Research model

H4: Operation and maintenance factors, such as structural and finishes integrity, building services conditions, fire compartment integrity and security maintenance have a positive influence on safety and health performance.

Management approaches: A wide range of methods and frameworks for measuring the performance of building facilities management were proposed (Olanrewaju *et al*., 2011). These methods range from a detailed technical assessments of the physical aspects of buildings to surveys of user satisfaction with the quality of facilities in residential buildings. For instance, Lai and Yik (2011) attempted to examine the building users' perceived importance of five aspects of facilities management services, which include security, cleaning, repair and maintenance, landscape and leisure and general management. Nik-Mat *et al*. (2011) examined the relationship between facilities management and customer satisfaction and found that there was a significantly positive relationship between the performance of maintenance management and the type of maintenance management system applied. Thus, we hypothesize that:

H5: Management approaches factors, such as the availability of emergency evacuation plans, documentation and evaluation, security management, occupant safety management and waste and cleaning services have a positive influence on safety and health performance.

The literature also lends support to the formulation of the research framework for examining the relationship architecture, building services, external environment, operation and maintenance and management approaches on the building safety and health performance among the construction practitioners in Malaysia and their subsequent personal responsibility (Fig. 1).

RESEARCH METHODOLOGY

Population and sample: The unit of analysis in this study is all construction practitioners in Malaysia. The construction practitioners involved in low-cost housing projects are mainly architects, engineers, quantity surveyors, building surveyor and developers. Based on the general rule, a sample size of minimum 200 is a good basis to perform a maximum-likelihood based estimation, which is one of the most common Structural Equation Modeling (SEM) estimations (Hair *et al*., 2010). Non-probability cluster sampling was used in this study.

Data collection: Seven hundred self-administered questionnaires were used for gathering data from the respondents. A multiple method of data collection was employed, whereby some questionnaires were mailed to the respondents, some were e-mailed and some were personally administered. The process of distribution and collection of questionnaires was carried out over a period of (3) months. A total of 308 were received and used for this analysis which translates to about 44% response rate.

MEASURES AND ASSESSMENT OF GOODNESS OF MEASURES

The research examines the goodness of measure which is assessed by looking at the validity and reliability of the measures can be carried out using the Partial Least Square (PLS) approach. The two main criteria used for testing goodness of measures are validity and reliability. These two assessments helped to ensure that the scale items are statistically consistent and the constructs measure what they intended to measure before any attempts were taken at drawing conclusions regarding the structural model (Field, 2009).

Construct validity: Establishing validity test assures the researcher that all the measures of the construct fit the theories around which the test is designed. This can be assessed through convergent and discriminant validity. First, the researcher inspects the cross-loadings in order to assess if there are problems with any particular items (Henseler *et al*., 2009). The researcher uses a cut-off value for loadings at 0.5 and considers this as significant (Hair *et al*., 2010). From Table 1, we can observe that all the items measuring a particular construct loaded highly on that construct and loaded lower on the other constructs, thus confirming construct validity.

Convergent validity: Establishing convergent validity assures the researcher that all the measures of the construct do measure the same construct or concept and move in the same conceptual direction. Convergent validity was assessed using indicator reliability, internal consistency reliability and Average Variance Extracted (AVE). The loading values of all items are higher than the required value of 0.6, ranging from 0.611 to 0.864. Composite reliability values (Table 2), which depicts the degree to which the construct indicators indicate the latent (Hair *et al*., 2011), construct ranged from 0.810 to 0.900 which exceeded the recommended value of 0.6 (Fornell and Larcker, 1981; Henseler *et al*., 2009; Hair *et al*., 2011). The value of AVE should be greater than 0.50, indicating an adequate degree of convergent validity, as it can be interpreted as at least 50% of the measurement variance is captured by the construct (Fornell and Larcker, 1981; Gotz *et al*., 2010; Hair *et al*., 2011). The average variance extracted, were in the range of 0.504 and 0.693. However, results of the ARCHI4 (Building Material), BS4 (Air Conditioning) and OM1 (Building Peripherals) constructs has a factor loading and AVE lower than minimum acceptable threshold value, ranging from 0.144-0.355 and 0.432-0.489 respectively. Hence, this construct should be considered for modification and this will be further discussed in the section on iteration one analysis.

Table 1: Loadings and cross loadings

	ARCHI	BS	BSHP	EX	MA	OM	PR
ARCHI1	0.757	0.322	0.305	0.367	0.350	0.526	0.373
ARCHI2	0.797	0.419	0.444	0.510	0.387	0.446	0.433
ARCHI3	0.618	0.315	0.230	0.364	0.323	0.333	0.348
ARCHI5	0.676	0.254	0.345	0.386	0.289	0.459	0.257
ARCHI6	0.644	0.354	0.297	0.590	0.332	0.426	0.231
ARCHI7	0.743	0.356	0.313	0.356	0.371	0.538	0.377
BS1	0.274	0.757	0.274	0.310	0.455	0.220	0.335
BS2	0.216	0.740	0.260	0.349	0.372	0.210	0.256
BS3	0.345	0.651	0.240	0.277	0.377	0.191	0.315
BS5	0.301	0.733	0.358	0.364	0.487	0.240	0.300
BS6	0.294	0.686	0.267	0.393	0.391	0.257	0.160
BS7	0.347	0.705	0.279	0.376	0.481	0.361	0.299
BS8	0.478	0.695	0.518	0.516	0.481	0.433	0.599
EX1	0.328	0.480	0.211	0.621	0.337	0.370	0.290
EX2	0.538	0.408	0.428	0.753	0.328	0.551	0.469
EX3	0.394	0.323	0.348	0.692	0.248	0.392	0.265
EX4	0.497	0.436	0.341	0.806	0.378	0.487	0.308
EX5	0.478	0.415	0.338	0.759	0.444	0.525	0.182
EX6	0.282	0.295	0.256	0.605	0.382	0.308	0.072
MA1	0.423	0.539	0.407	0.430	0.827	0.392	0.417
MA2	0.413	0.450	0.371	0.349	0.758	0.312	0.243
MA3	0.354	0.517	0.283	0.391	0.759	0.327	0.279
MA4	0.361	0.453	0.293	0.405	0.764	0.363	0.311
MA5	0.246	0.395	0.300	0.262	0.660	0.338	0.335
OM2	0.537	0.275	0.334	0.498	0.281	0.789	0.351
OM3	0.488	0.308	0.377	0.450	0.335	0.844	0.365
OM4	0.369	0.312	0.182	0.407	0.367	0.645	0.351
OM5	0.562	0.386	0.416	0.587	0.452	0.807	0.332
PF1	0.351	0.267	0.758	0.329	0.349	0.408	0.318
PF2	0.340	0.285	0.780	0.309	0.344	0.334	0.382
PF3	0.419	0.531	0.850	0.452	0.374	0.340	0.588
PR1	0.339	0.338	0.401	0.221	0.308	0.324	0.803
PR2	0.359	0.267	0.352	0.226	0.266	0.332	0.803
PR3	0.348	0.370	0.409	0.295	0.314	0.324	0.857
PR4	0.496	0.585	0.623	0.473	0.459	0.449	0.864

Table 2: Results of convergent validity

					Iteration 1				
Construct	Item	Loading	CR	AVE	Construct	Item	Loading	CR	AVE
ARCHI	ARCHI1	0.757	0.828	0.432	ARCHI	ARCHI1	0.757	0.857	0.502
	ARCHI2	0.798				ARCHI2	0.797		
	ARCHI3	0.611				ARCHI3	0.618		
	ARCHI4	0.144				ARCHI4	Omitted		
	ARCHI5	0.673				ARCHI5	0.676		
	ARCHI6	0.644				ARCHI6	0.644		
	ARCHI7	0.747				ARCHI7	0.743		
BS	BS1	0.751	0.866	0.454	BS	BS1	0.757	0.877	0.505
	BS2	0.742				BS2	0.740		
	BS3	0.644				BS3	0.651		
	BS4	0.355				BS4	Omitted		
	BS5	0.741				BS5	0.733		
	BS6	0.688				BS6	0.686		
	BS7	0.699				BS7	0.706		
	BS8	0.684				BS8	0.695		
EX	EX1	0.621	0.858	0.504	EX	EX1	0.621	0.858	0.504
	EX2	0.753				EX2	0.753		
	EX3	0.692				EX3	0.692		
	EX4	0.806				EX4	0.806		
	EX5	0.759				EX5	0.759		
	EX6	0.606				EX6	0.606		
OM	OM1	0.220	0.810	0.489	OM	OM1	Omitted	0.856	0.601
	OM2	0.789				OM2	0.789		
	OM3	0.842				OM3	0.844		
	OM4	0.644				OM4	0.645		
	OM5	0.807				OM5	0.807		
MA	MA1	0.827	0.869	0.571	MA	MA1	0.827	0.869	0.571
	MA2	0.758				MA2	0.758		
	MA3	0.759				MA3	0.759		
	MA4	0.764				MA4	0.764		
	MA5	0.660				MA5	0.660		
PR	PR1	0.803	0.900	0.693	PR	PR1	0.803	0.900	0.693
	PR2	0.803				PR2	0.803		
	PR3	0.857				PR3	0.857		
	PR4	0.864				PR4	0.864		
BSHP	PF1	0.758	0.839	0.635	BSHP	PF1	0.758	0.839	0.635
	PF2	0.780				PF2	0.780		
	PF3	0.850				PF3	0.850		

Table 3: Discriminant validity of constructs

Construct	ARCHI	BS	BSHP	EX	MA	OM	PR
ARCHI	0.709						
BS	0.478	0.711					
BSHP	0.468	0.479	0.797				
EX	0.608	0.545	0.467	0.710			
MA	0.482	0.625	0.446	0.488	0.756		
OM	0.642	0.411	0.444	0.632	0.459	0.775	
PR	0.478	0.499	0.563	0.390	0.423	0.441	0.832

The modification involves the elimination of items with poor factor loadings (ARCHI4, BS4, OM1). This follows Henseler *et al*. (2009), where reflective indicators with outer loadings of less than 0.4 are eliminated from the measurement model. Reflective indicators may also be eliminated if by doing so substantially increases CR and/or AVE values. Once the modification process is completed, the factor loading, CR and AVE values are assessed again for convergent validity. The results of the iteration are summarized in Table 2.

These results indicate that the suggested modifications have achieved the intended outcome. The factor loadings of each measurement item on its respective construct are above the suggested 0.60 threshold, ranging from 0.606 to 0.864. The CR values for ARCHI, BS and OM constructs have been increased by 2.9% (0.857), 1.1% (0.877) and 4.6% (0.856), respectively. Likewise, there are increases in AVE values for ARCHI (0.502), BS (0.505) and OM (0.601) constructs, which satisfies the required threshold value of 0.5. Hence, the convergent validity is confirmed and no further modification is required.

Discriminant validity: After establishing convergent validity, the researcher assesses the model's discriminant validity based on the Fornell-Larcker criterion. The assessment is to ensure that the diagonal elements were significantly higher than the off-diagonal values in the corresponding rows and columns. The diagonals represent the square root of AVE while the remaining entries represent the squared correlations. The results in Table 3 show that for all constructs, AVE values were higher than the construct's highest squared

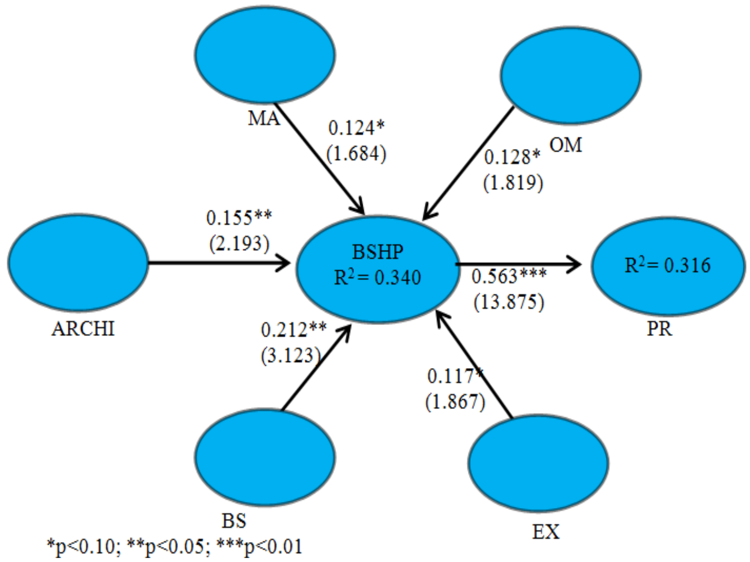

Fig. 2: Results of the path analysis

Table 4: Results of path coefficients

Hypothesis		Beta (β)	Rank order	S.E. (STERR)	t-value	Decision
H1	ARCHI->BSHP	0.155	3	0.071	2.193	Supported
H2	BS->BSHP	0.212	2	0.068	3.123	Supported
H3	EX->BSHP	0.117	6	0.063	1.867	Supported
H4	OM->BSHP	0.128	4	0.070	1.819	Supported
H5	MA->BSHP	0.124	5	0.073	1.684	Supported
H6	BSHP->PR	0.563	1	0.041	13.875	Supported

S.E.: Standard error

correlation with any other latent constructs. The researcher also considers adequate discriminant validity when constructs have AVE loadings of greater than 0.5. In other words, at least 50% of measurement variance is captured by the construct (Hair *et al*., 2011).

Path coefficients and hypothesis testing: In PLS, the strength and the significance (or insignificance) of each structural path or hypothesis can be examined. PLS calculates a path coefficient, or a beta value (β), which indicates the strength of the path and signifies the unique contribution that the independent variable makes in explaining the variance of the dependent variable. Fig. 2 presents the results of the path analysis.

The first criterion that was examined is the coefficient of determination (R^2) of endogenous latent variables. The results show that for the BSHP construct, R^2 values (0.340) were above the substantial level of 0.26 (Cohen, 1988). In other words, 34.0% of the variance in the BSHP model is explained by architecture, building services, external environment, operation and maintenance and management approaches. Using various significance levels ($p<0.10$, $p<0.05$, $p<0.01$), the results show that all path coefficients from the focal construct to the six hypothesized outcomes were significant. Table 4 presents the path coefficients, beta value (β) and *t*-statistics. In addition to determining which single factor makes the strongest unique contribution toward predicting or explaining the variance in the endogenous latent variable, the beta values (β) were also determined. The results show that Perceived Responsibility (PR) is best predicted by Building Safety and Health Performance (BSHP). In contrast, the best predictor of BSHP factor is Building Services (BS), followed by Architecture (ARCHI), Operation and Maintenance (OM), Management Approaches (MA) and lastly, External Environment (EX). In other words, BS contributes the most towards explaining the variance in BSHP, exceeding the impact of other factors in the model.

With regard to H1-H5, the results provide an evidence for a significant relationship between Building Safety and Health Performance (BSHP) and all of the five proposed outcomes of the conceptual framework. There is evidence for a significant relationship between Building Safety and Health Performance (BSHP) and Architecture (ARCHI) (H1, $\beta = 0.155$; $p<0.05$), Building Services (BS) (H2, $\beta = 0.212$; $p<0.01$), External Environment (EX) (H3, $\beta = 0.117$; $p<0.1$), Operation and Maintenance (OM) (H4, $\beta = 0.128$; $p<0.1$) and Management Approaches (MA) (H5, $\beta = 0.124$; $p<0.1$). The PLS results also show that the Building Safety and Health Performance (BSHP) factors strongly and significantly influence a construction Practitioners Responsibility (PR) towards building safety and health performance (H6, $\beta = 0.563$, $p<0.01$).

DISCUSSION AND CONCLUSION

The findings of this study indicate that architecture, building services, external environment, operation and maintenance and management approaches impact on building safety and health performance with building services having the strongest impact in BSHM. It implies that the more and better the building services ($\beta = 0.212$) in building, the higher the extent of safety and health performance is observed, which can then lead to improved building performance in the construction industry. This corroborates with findings from Ho *et al*. (2008), Lai and Yik (2011) and Green *et al*. (2011). Continuous monitoring of the building services performance according to the legal requirement results in better to safeguard the safety, health and well-being of people and to protect the environment.

Architecture too has an influence on the extent of safety and health performance for low-cost housing in Malaysia. This makes sense as construction practitioners must be committed to forging good long term architecture design to achieve success for the construction industry in general and for low-cost housing in particular. As an example, the focus of safety and healthy building architecture need to be incorporated better design detail as well as aesthetic aspects. The findings support the recommendation made earlier by researchers Isa (2011) and Chohan *et al*. (2011) who suggested that in order to have successful architecture building performance, structural design, architectural building elements, space accessibility and amenities are necessary factors which occupants can live safely, healthy, comfortably and efficiently.

Moreover, external environment also had a significant relationship with safety and health performance of low-cost housing in Malaysia. This signifies that external environment is a critical situation that allows information flow between different parties during different stages of building life cycle (Zainal *et al*., 2012). In essence, consideration to the external environment factor will assist the organizations to communicate their wants and needs accurately to ensure the safety and health of the occupants which allow things to be done right at the design stage of a building construction. This practice will prevent loss of time, life and wastage of resources thus leading to a better low-cost housing performance.

Operation and maintenance was found to be related to building safety and health performance success. This indicates that mutual dependencies between safety and health performance will increase when the level of operation and maintenance improved. Additionally, operation and maintenance is an important factor for future sustainable building maintenance management works because of the shared responsibility, information, policy, technology, benefits and risks involved in the process (Mohd-Isa *et al*., 2011; Lai and Yik, 2004).

As predicted, management approaches was significantly positively related to safety and health performance of low-cost housing in Malaysia. Management can create effective management systems through emergency evacuation plan, documentation and evaluation, security management, occupant safety management and waste and cleaning services that address staff at all levels of the firm. A bad management performance can lead to accidents (safety issue) and pollutions (health hazard and environmental issues) besides encouraging an unhealthy work culture and environment (Pati *et al*., 2009; Olanrewaju *et al*., 2011; Lai and Yik, 2011; Nik-Mat *et al*., 2011).

Extent of safety and health performance has a significant impact on their responsibility towards BSHP among the construction practitioners. The result also concurs with Ho *et al*. (2008) study conducted in Hong Kong that safety and health significantly predicted both design and management factors. However Hashim *et al*. (2012) study on the factors influencing performance of Malaysian low-cost public housing found that a better safety and health performance could not adequately explain such factors unless the respondents' past experience and their perception of its responsibility towards safety and health performance were also incorporated in the model. Responsibility were found to have the greatest impact in order to accomplish the main purpose of the construction industry which is to build sustainable construction to both, the client and the end users (Hussin and Omran, 2009) consistent with earlier findings from studies by Keall *et al*. (2010) and Lee *et al*. (2011).

REFERENCES

Akasah, Z.A. and M. Alias, 2009. Application of the Generic Process Modelling in the Preservation of Heritage School Building. Structural Studies, Repairs and Maintenance of Heritage Architecture XI. WIT Transaction on The Built Environment, Vol. 109 @ 2009; ISSN: 1743-3509 (0n-line), DOI: 10.2495/STR090291.

Akasah, Z.A., R.M.A. Abdul and S.N.F. Zuraidi, 2011. Maintenance management success factors for heritage building: A framework. Structural Studies, Repairs and Maintenance of Heritage Architecture XII. WIT Transaction on the Built Environment, Vol. 118 @ 2011. ISBN: 978-1-84564-526-7; ISSN: 1743-3509 (0n-line).

Bajunid, A.F.I. and M. Ghazali, 2012. Affordable mosaic housing: Rethinking low-cost housing. Procedia Soc. Behav. Sci., 49: 245-256.

Bokalders, V. and M. Block, 2010. The Whole Building Handbook. Earthscan, United Kingdom.

Chohan, A.H., M.M. Tahir, N.A.G. Abdullah and N.M. Tawil, 2011. Housing and analysis of design defects. Post Occupat. Evaluat. Private Housing Malaysia, 6(2): 193-203.

Cohen, J., 1988. Statistical Power Analysis for the Behavioral Sciences, 2nd Edn., Lawrence Erlbaum Associates, Hillsdale, NJ.

Department of Statistics, 2010. Basic Population Characteristics by Administrative Districts. Department of Statistics, Putra Jaya.

Field, A., 2009. Discovering Statistics Using SPSS. 3rd Edn., Singapore SAGE Publications, Asia-Pacific Pte Ltd.

Fornell, C. and D.F. Larcker, 1981. Evaluating structural equation models with unobservable variables and measurement errors. J. Marketing Res., 18: 39-50.

Gotz, O., K. Liehr-Gobbers and M. Krafft, 2010. Evaluation of Structural Equation Models Using the Partial Least Squares (PLS) Approach. In: Vinzi, V.E., W.W. Chin, J. Henseler and H. Wang (Eds.), Springer Handbooks of Partial Least Squares. Computational Statistics, pp: 691-711, DOI:10.1007/978-3-540-32827-8 30.

Government of Malaysia, 2012. National Budget. Economic Planning Unit Minister's Department.

Government of Malaysia, 2013. National Budget. Economic Planning Unit Minister's Department.

Green, R.D., M. Kouassi, P. Venkatachalam and J. Daniel, 2011. The impact of housing stressors on the mental health of a low-income African-American population. Rev. Black Polit. Econ. DOI: 10 1007/s12114-011-9109-z.

Hair, J.F., W.C. Black, B.J. Babin and R.E. Anderson, 2010. Multivariate Data Analysis. 7th Edn., Upper Saddle River, Prentice Hall, NJ.

Hair, J.F., C.M. Ringle and M. Sarstedt, 2011. PLS-SEM: Indeed a silver bullet. J. Market. Theor. Practice, 19(2): 139-152.

Hamsa, A.A.K., M. Masao, I. Shuhei and N. Yosuke, 2010. Perception analysis of living environment at Taman Melati residential area. J. Des. Built Environ., 7: 1-13.

Hashim, A.E., S.A. Samikon, N.M. Nasir and N. Ismail, 2012. Assessing factors influencing performance of Malaysian low-cost public housing in sustainable environment. Procedia Soc. Behav. Sci., 50: 920-927.

Henseler, J., C.M. Ringle and R.R. Sinkovics, 2009. The use of partial least squares path modeling in international marketing. Adv. Int. Market. 20: 277-319.

Ho, D.C.W., K.W. Chau, A. King-Chung Cheung, Y. Yau, S.K. Wong, H.F. Leung, S. Siu-Yu Lau, *et al*., 2008. A survey of the health and safety conditions of apatment buildings in Hong Kong. Build. Environ., 43(5): 764-775.

Hussin, A.A. and A. Omran, 2009. Roles of professionals in construction industry. Proceeding of the International Conference on Economics and Administration. Faculty of Administration and Business, University of Bucharest, Romania, pp: 248-256.

Isa, H.M., 2011. Learning from defects in design and build hospital projects in Malaysia. Proceeding of International Conference on Social Science and Humanity, 5: 238-242.

Isnin, Z., R. Ramli, A.E. Hashim and I.M. Ali, 2012. Sustainable issues in low cost housing alteration projects. Procedia Soc. Behav. Sci., 36: 393-401.

Keall, M., M.G. Baker, P. Howden-Chapman, M. Cunningham and D. Ormandy, 2010. Assessing housing quality and its impact on health, safety and sustainability. J. Epidemiol. Commun. H., 64: 765-771.

Lai, J.H.K. and F.W.H. Yik, 2004. Law and building services maintenance in Hong Kong. HKIE Trans., 11(1): 7-14.

Lai, J.H.K. and F.W.H. Yik, 2011. An analytical method to evaluate facility management services for residential buildings. Build. Environ., 46: 165-175.

Lee, J., H. Je and J. Byun, 2011. Well-being index of super tall residential buildings in Korea. Build. Environ., 46: 1184-1194.

Ministry of Housing and Local Government of Malaysia, 2009. Housing for Urban Squatters Resettlement and the Low Income Group. Retrieve from: http://www.Earoph.Info/Pdf/2009papers/P5.Pdf.

Mohd-Isa, A.F., Z. Zainal-Abidin and A.E. Hashim, 2011. Built heritage maintenance: A Malaysian perspectives. Procedia Eng., 20: 213-221.

Nik-Mat, N.E.M., S.N. Kamaruzzaman and M. Pitt, 2011. Assessing the maintenance aspect of facilities management through a performance measurement system: A Malaysian case study. Procedia. Eng., 20: 329-338.

Olanrewaju, A.A., M.F. Khamidi and A. Idrus, 2011. Validation of building maintenance performance model for Malaysian universities. World Acad. Sci. Eng. Technol. Int. J. Soc. Hum. Sci. Eng., 5(8): 159-163.

Pati, D., C.S. Park and G. Augenbroe, 2009. Roles of quantified expressions of building performance assessment in facility procurement and management. Build. Environ., 44(4): 773-784.

Ramly, A., N.A. Ahmad and N.H. Ishak, 2006. The effects of design on the maintenance of public housing buildings in Malaysia-Part two. Build. Eng., pp: 34-36.

Sapp, D., 2009. Facilities Operation and Maintenance. Whole Building Design Guide, National Institute of Building Services, Washington, DC, USA.

Shuid, S., 2009. Changing structure of low income housing provision in Malaysia: Housing allocation under the computerized Open Registration System (ORS) for low cost house buyer. Proceeding of HSA Conference. Cardiff, pp: 1-20.

Smith, K. and D.N. Petley, 2008. Environmental Hazards. 5th Edn., Taylor and Francis e-Library, New York.

Zaid, N.S.M. and P. Graham, 2011. Low-cost housing in Malaysia: A contribution to sustainable development? eddBE2011 Proceedings, pp: 82-87.

Zainal, N.R., G. Kaur, Ahmad, N. 'Aisah and J.M. Khalili, 2012. Housing conditions and quality of life of the urban poor in Malaysia. Procedia Soc. Behav. Sci., 50: 827-838.