Building Safety Index: Contributing Factor

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Abstract. The safety and health performances aspects of a building should be addressed during their life cycles to improve the occupants' quality of life. However, information concerning the safety and health performance of buildings is not always readily available. This creates a need for building performance assessment tools. The objective of this paper is to propose a Building Safety Index (BSI) framework for building in Malaysia focusing on the factor related to building design and identify the degree of influence of the contribution factor. The research first identified the critical factors through a literature review of current safety and health practices from journals, articles and thesis in order to interpret the factors from a global perspective. A total of fifty questionnaires were then distributed to construction practitioners such as architects, engineers, building surveyor, quantity surveyor, contractor, consultants and developers. In total, 33 completed questionnaires formed a database for descriptive analysis. Statistical analysis results revealed that the highest degree of influence contributing to safety and health performance of building were architecture approach. Collectively, results provide evidence that the instruments are reliable in the Malaysian context. The finding of this study can lead a basis for development of practical assessment scheme to evaluate the safety and health of building in Malaysia.

Introduction

Towards 2020, Malaysia has involves intensive transformation of the economic structure to achieve a high-income status. The most active sector is construction sector as it features prominently in terms of policy formulation and implementations. A comparison of the size of the construction industry with other countries suggests that its contribution has been consistent and stable

The Malaysian construction industry is classified into four sectors namely, residential buildings, none-residential buildings, civil engineering and the special trade sectors. The residential sector involves the construction of houses and condominiums and non-residential construction comprises of all building construction other than residential. Civil engineering pertains to the construction of public infrastructure such as bridges and highways.

According to Department Of Statistic Malaysia, in 2014 Malaysia's economy grew at 4.7 % with construction sector continued a double-digit growth by registering 18.6 % [1]. This figure proved the rapid urbanization and modernization of Malaysia have increased the demand for safe, healthy and comfort living environment [2]. The safety of new and existing buildings must be well planned to ensure that its occupants can live in it safely.

Therefore, laws and regulations related to maintenance and management of stratified buildings needs to be clear, orderly and effective to ensure residents' safety and health [3]. In mid-1990, facilities management was introduced in Malaysia to ensure public facilities well-functioning and satisfy their maximum life span. Facilities management is widely practiced in organizations with real assets, including management bodies of stratified residential buildings, which have common properties as its assets.

However, various issues and problems related to financial, maintenance work and administration [4]. Subsequently, effects of poor maintenance management systems has been identified as a structural deterioration, falling building fragments, deficiencies in fire safety provisions and slope

failures, posed various hazards, respiratory symptoms and mental health problems [5]. Due to these problems, various initiatives have been undertaken by the government to solve the problems.

In Malaysia, unsatisfactory housing conditions and reluctance of property management to carry out safety and health inspections are evidenced by the large number of complaints and reports about the danger and accidents from buildings [6]. A study conducted by Karim [7] to have relevance on low cost housing quality in Shah Alam, Malaysia. He found that the performance of low cost housing is influenced to various issues such as quality and materials of construction, sanitary system, location, maintenance and social problems. A study by Isnin, Ramli, Hashim, and Ali [8], indicates that the residents of low cost terrace housing in Shah Alam, Malaysia were generally not satisfied with their housing conditions and environments. The construction activities, materials used cleanliness, aesthetic value, safety, privacy and amenities caused problems and risk affecting social health and the environment.

In order to ensure a good and orderly provision of management services, Ministry has requested the Board of Values, Appraisers and Estate Agents Malaysia to guide the building managers so that quality control of building can be practiced. Furthermore, new research is conducted to provide a new mechanism to improve the quality of building safety and health, apart from to improve the system of stratified building management in the country. Quality control in building management is important to differentiate high quality buildings from low-quality ones [3].

To construct building safety and assessment schemes, empirical investigation must be done to identify factors that affect building safety and health. Through this approach, quality level of any building can be evaluate and classify. These buildings can be rated using star rating system or according to grades. The classification would provide stakeholders with valuable information and signals. For example, house buyers can use the information to determine the quality of the buildings before making a purchase decision

General Background of Building Safety and Health Performance Assessment At present, there are several of building performance assessment have been practice in other countries especially in Hong Kong. These assessment schemes are The Hong Kong Building Environment Assessment Method (HK-BEAM), The Intelligent Building Index (IBI), The Building Quality Index (BQI) and The Comprehensive Environmental Performance Assessment Scheme for Buildings (CEPAS) [9]. However these assessment schemes have been developed based on Hong Kong's unique situation. BQI develop by Faculty of Architecture Hong Kong become a benchmarking tool for classify building in respect of safety and health conditions of buildings. BQI combination of the Building Health and Hygiene Index (BHHI) [10] and the Building Safety and Condition Index (BSCI) [11]. In this regard, building factor are grouped into five categories namely architecture, building services, external environment, operation and maintenance and management.

In Malaysia context, a study was conducted by A.Ramli et al [2] to identify the main factor contributing safety and health performance of low cost house in Malaysia. These studies determined a suitable instrument to be used in Malaysia context according to local design, construction quality, climate environment conditions and the use of existing building. The safety and health framework for this study focuses on two categories namely design and management. Among the two categories, design and management is then further divided into five categories include architecture, building services, external environment, operation and maintenance and management approaches. He found that most influential building design factors were structural and finishes integrity, amenities and fire services installation. The most influential building management factors were documentation and evaluation, building services and structural and finishes integrity. The results of his study are preliminary in nature but are able to provide some insight that can be considered as intervening elements of building safety and health performance factors.

Safety and health factors were not only have been used in building design management but also an essential element in road design [12]. This showed that health and safety factors is very much important element for consideration.

Problem Statement Nowadays, our public is lacked of information on the safety risk related to their living environments. One dilemma identified is that no a uniform standard have been stated for building safety level. Furthermore, there are no unambiguous acceptance criteria to state that the building in serviceable condition.

This kind of information is important for making consumption and investment decision related to property. For example, people want a comfortable, safe and hygienic place to live. However these aspects are not always revealed during pre-transaction property inspection. Some of the information is technical in nature and homebuyers may not fully understand the implications of certain building design and management features. In some cases, the cost of obtaining the information for purposes of comparisons is too high

Hence, comprehensive ways, tools and concept must be develop to determine performance indicators and criteria for safety and health building, focusing in general on the prevention of safety and health problem. It needs a comprehensive understanding of the building factors for built environment hazards and for the purpose of the initial screening to evaluate building safety and health performance.

Objective of study The aim of this study is to develop a Building Safety Index (BSI) framework for building in Malaysia. To achieve the above aim, the following objectives of the study are structured as follows:

I. To study factors related to building design that contribute to BSI.
II. To identify the degree of influence of the contribution factor using SPSS statistic

Scope of Study The scope of the study will concentrate on safety and health aspect based on the design. To fulfil this purpose all construction practitioners in Malaysia has been selected randomly. In this study, research will be conducted by approaching the architects, engineer, building surveyors, developers, contractors, consultants and quantity surveyor to know the guidelines used in their company by obtaining the data needed by questionnaire.

Previous Studies

In the design process, it is very important to implement the safety measures. Therefore, much literature pointed out building design play an important role in building safety. Al-Hamoud and Khan [13] highlighted that unnecessary hazards in buildings design can be reduce much more easily at the drawing board rather than case after the corrective action. They identified that if there are clear rules and are enforced, designers will be aware of such safety requirements in the design process.

It is worth studying the factors of building safety and health performance that have been identified by previous studies. Hierarchical Structure of safety and health building factors is to give preliminary idea on what past researchers had discovered the factors that contributed to the building safety and health performance. A safety and health framework should be comprehensive enough to address all relevant safety and health issues. However, it needs to be concise enough in order to present building safety and health factors in a systematic manner.

In this study, there are 11 scholarly research papers selected and 17 safety factors of building performance were found. Three dimensions are identified as the starting point for setting the boundaries of the safety framework. Therefore, the building safety index modelling in this study focuses on design and is underpinned by three constructs, namely Architecture, Building Services and External Environment.

Therefore, this input is useful for developing the questionnaire to determine the relevancy of these factors according to local design and construction quality, climate, environment conditions

and the use of existing buildings. This following discusses each variable as described in Table 1 and Figure 1.

Table 1: Literature of Building Safety and Health Framework

			[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[5]	[22]
Scope of Assessment	Design	Building Factor											
		Architect											
		Mean of Escape	■					■	■	■		■	
		Mean of Access	■					■	■	■		■	
		Structural & Finishes Integrity											
		Fire resistant Construction	■					■				■	
		Building Material					■						
		Space Functionality	■					■		■			
		Building Service											
		Electricity Installation	■	■	■	■	■	■	■	■		■	
		Lighting	■			■						■	
		Ventilation and Air Conditioning		■		■						■	
		Plumbing & Sanitary Services	■	■		■	■		■			■	
		Fire Services Installation	■	■	■	■		■	■	■		■	
		Lifts				■							
		External Environment											
		Emergency Services						■	■				
		External Hazard						■	■		■		■
		Air Quality & Peaceful Environment							■			■	
		Location							■		■		
		Density						■					

Architecture Architecture refers to the layout configuration and disposition of a building, which are added to provide greater surroundings as well as the finest design details [23]. Issues of architecture have long been and widely addressed by many researchers. In 1984, Banham emphasize human needs and environmental concerns must be considered an integral part of architecture, systematically explored the impact of health and comfort engineering on the design of buildings and the minds of architects. Bokalders and Block [24], highlighted building sustainability must take broader changes in architecture, construction and spatial planning to reduce environmental, safety and health impacts of buildings. Therefore, the focus of architecture is not only on the aesthetic aspects, it should be in combination with a certain structural solution or style and it must enclose space in which certain activities can take place, safely, comfortably and efficiently.

A vast amount of research was dedicated to the identification of architectural performance and ways to eliminate architectural defects. Ramly, Ahmad &Ishak [25] found that 47% of defects were caused by design defects, 17% from materials, 15% from construction, 18% from misuses of facilities, 15% from poor maintenance and 5% from vandalism.

Isa [26] 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.

Furthermore, Chohan et al [27] pointed out the needs for architects to prevent these defects by using more appropriate materials and better design and layout

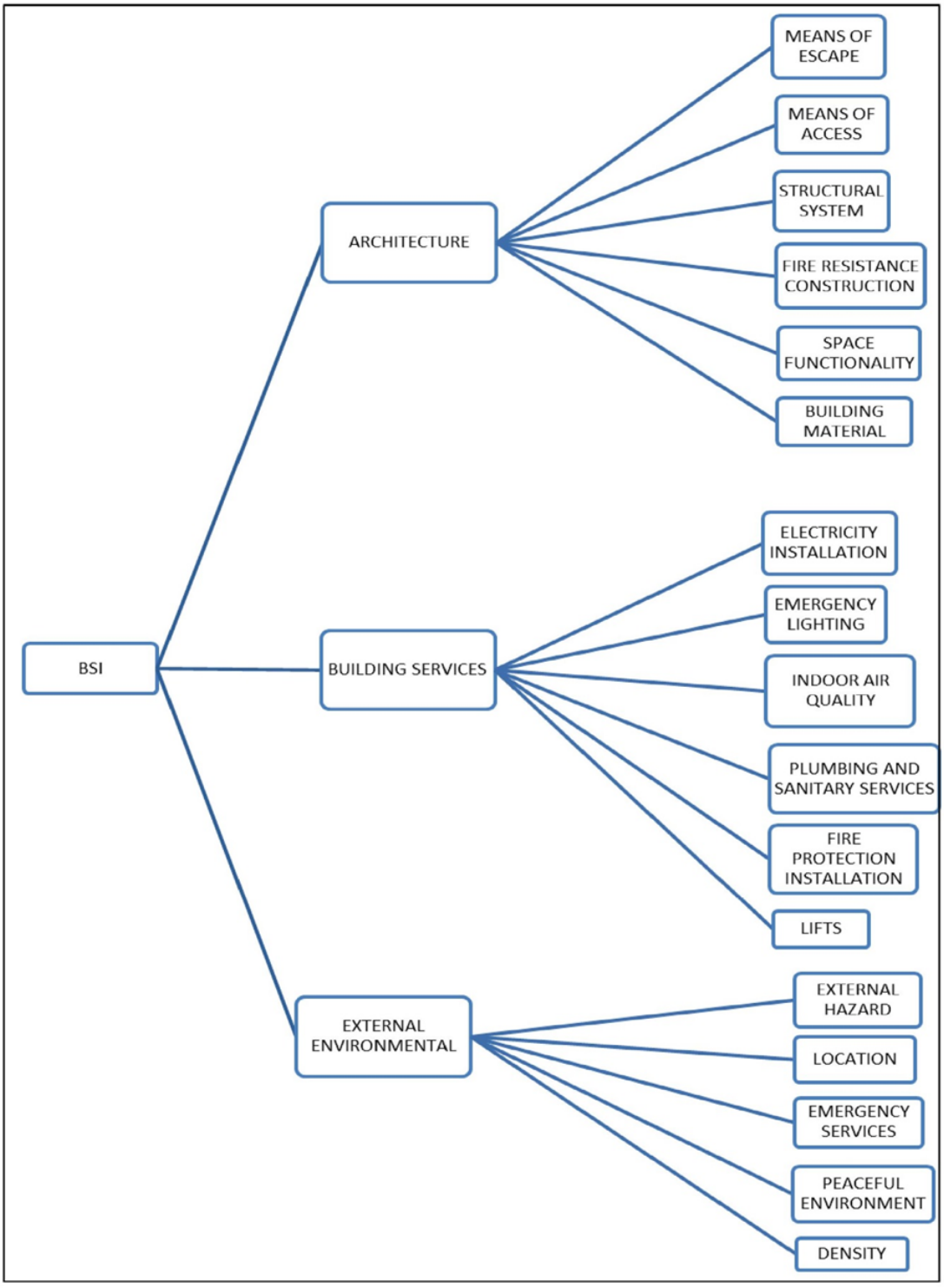

Figure 1: Variables of Building Safety Index Framework

Variables within the architecture category consist of means of escape, means of access, structural system, space functionality, building material and fire resistant construction. For the purpose of effectively architecture process, Al-Hamoud and Khan [13] proposed systematic safety compliance

checklist with the safety requirements includes the design of fire extinguishing systems, smoke detectors, stairways and handrails, minimum width of courts, exterior finishes and number of exists and exit access distances and dimensions.

Building Services Evaluation studies have shown that indoor environment of building is the importance factor that affects the safety, health and comfort of occupants.

A study done by Green, Kouassi, Venkatachalam, and Daniel [28] proved that physical housing condition such as plumbing, heating, cooling and building security contribute to mental health dysfunction such as being depressed, feeling worried, feeling sad, feeling helpless, and feeling emotionally. Hence, it show that housing condition have a significant impact on safety, health, education and behaviour of residents [29].

Thus building services is required for the safe, comfortable and environmentally friendly operation of buildings. Building services refers 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 [30]. However, Lai [31] state that the

installations of building services includes electricity system, lighting, ventilation and air conditioning, water supply, drainage, fire services installation, gas supply, lifts and escalators. He suggested that installations for safety, health and comfort of the building services should work together with the operation and maintenance parties to ensure the designed conditions of the installations be properly delivered and maintained in its life cycle.

Systems of building services which are electricity, fire service, lifts and escalators, gas supply, water supply and ventilating systems tend to be maintained in serviceable condition if they are regularly inspected according to the legal requirements [14]. Building Department of Hong Kong takes rigorous services to facilitate the construction and maintenance of quality and sustainable buildings. It includes conducting regular review of regulations and standards to keep the building control system commensurate with the advancement in technology. Therefore, it is proven that the good building maintenance management practice closely related to the quality of building services that affect the housing performance.

The importance of information available for building services is particular essential to affecting one's decision to purchase the product. The importance of information available for building services is particular important as an indicator to the safety and health performance of the building. Lai and Yik [14] highlighted, an assessment of building services conditions is important in the context of safeguarding the safety, health and wellbeing of people, and protecting the environment. Further evidence in connection to the relationship between overall health and safety and development scale has illustrated by Wong et al [19] in connection with building services. They identified large developments performed better in terms of buildings services because the flexibility in adopting better building services design and adequate funding in building maintenance and management. This has led to the following hypothesis that there is a positive relationship between building services and safety and health performance of building.

External Environment Safety and health measures should include the protection against additional hazards introduced by the external environment. The term environmental hazard refers to all the potential threats facing human society by events that originate in, and are transmitted through, the environment [32]. They identified the major categories of environmental hazard are natural hazards (floods and landslide), technological hazards (hazardous materials, unsafe public buildings and facilities) and context hazards (environmental degradation and air pollution).

The study of Hamsa, Masao, Shuhei and Yosuke [33] highlights the several inadequacies of living environment houses at Taman Melati residential area in Kuala Lumpur. The study addressed the problems of physical environmental parameters such as noise level, air pollution, and level and traffic volume. In another study, Zainal, Kaur, Ahmad, and Khalili [34] 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. Both studies reported that external environmental was a strong factor of safety and health performance of building. Through these studies, it is hoped that the importance of the construct could be extended to safety and health performance context.

Five perspectives in this framework include emergency Services, external hazards, density, location and fresh air quality. Wong et al. [19] proposed an assessment method that identified a building factor of influence the health and safety performance. BQI assessment method are concerned with external environmental change, consists of density, adjacent use, air quality, aural quality, visual obstruction, thermal comfort, proximity to special hazards and proximity to fire station.

Methodology

Research methodology is important to achieve the objectives of a study and to fulfil the scope of study. For this study, a comprehensive approach will be used which include the collection of data from certain resources and methods used in the data analysis.

The aim and objectives of this study were achieved by using two methods which are primary data collection and secondary data collection. The first method was through finding sources of printed materials and electronic media to facilitate the literature review. Literature review is used to gather all information about the background of study topic. Secondly, was through questionnaire and brief discussion with the targeted respondent to facilitate the study empirically. Then the raw data obtained will be analysed by established methods to give some conclusions and further suggestions about research.

Literature review A literature review was carried out to obtain and established some knowledge of the study topic. Literature review carried out by collecting all relevant information carried by reading journals, previous thesis, articles, especially from newspaper, internet and books which are appropriate with the topic of study. All reference involved are identified in advance in order to help in completing this study. Literature review is made to collect relevant information as possible to facilitate the course of the study and also to increase understanding of the study.

Questionnaire A total of 50 sets of questionnaire were distributed to construction practitioners which are mainly architects, engineers, quantity surveyors, building surveyor and developers that involved in building construction. The questionnaires were delivered personally and mailed to all construction practitioners in Malaysia

The research questionnaire developed had two sections. First section included the demographic information such as name, organization address, type and category of organizations. Respondents were also asked to provide job related information including years in services and type of projects undertaken. This was mainly composed of closed-ended questions. Nevertheless, comment boxes were included throughout the questionnaire enabling the generation of additional information by participants. The second section of the questionnaire was consists of respondent perceptions to identify the most significant factors contributing to safety and health performance of building in Malaysia. The respondents were asked to indicate their opinion on a five-point scale in terms of not significant to extremely significant.

Analysis of data The data collected was analysed using Statistical Package for Social Science (SPSS) Version 23.0. Basically, to determine the mean and standard deviation of each sub-factor. Ranking analysis was used by ranking the key variables. The mean score (with 1 - not significant to 5 extremely significant) was used to rank the variables of factors contributing to safety and health performance. The main purpose of ranking analysis is to indicate the differences in the level of significant factors on safety and health among the variables.

Data Analysis

Data analysed were based on studies that have been made around the state of Johor, Negeri Sembilan, Selangor and the Wilayah Persekutuan Kuala Lumpur. The study involved a construction practitioners which are mainly architects, engineers, building surveyor, quantity surveyor, contractor, consultants and developers. From fifty (50) set of questionnaire distributed, a total of thirty-three (33) set of questionnaire was returned with complete answer. The percentage of responses received was 66%. The response rate is considered sufficient based on the fact proposed by Roscoe (1975) as noted by Sekaran [35]. Sekaran noted Roscoe as suggesting that a sample size larger than 30 and less than 500 is appropriate for most research.

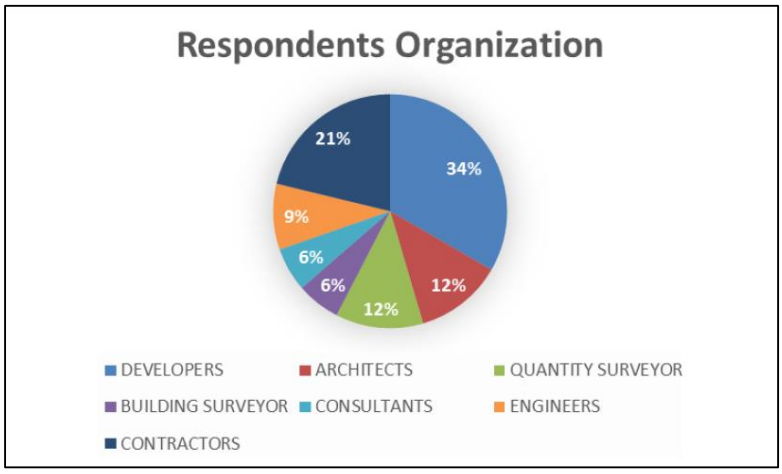

Figure 2: Composition of the respondent organization

Respondent background Based on data shown in Figure 2, the highest number of respondents was developers at 34%. Contractors which were the second largest respondents brought in 21% of overall respondent organization and this was followed by architects and quantity surveyor at 12% respectively. Only 9% of the respondent were from engineers and the lowest number of respondents were consultants and building surveyor accounting only 6% respectively.

Next area examined was the type of projects that had been handled among the respondents. Figure 3 shows that most of the respondents had been handled terrace project at 34% and this was followed by industry at 24%. Only 18% of the respondent had been handled high rise building project and 12% from overall respondents had been handled government office. On the contrary, respondents been handled 5 storey building and auditing was 6% respectively.

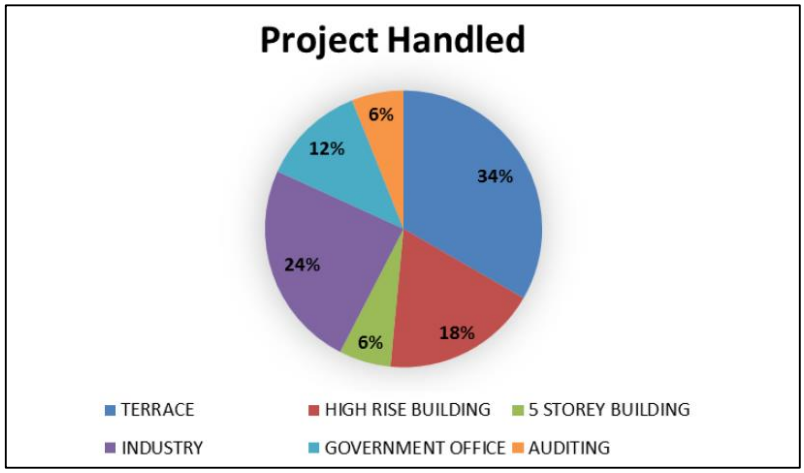

Figure 3: Project Handled

Then, area examined was year of services in construction sector among the respondents. The area has been broken down into five categories which are less than five years, between 5-10 years, between 10-15 years, between 15-20 years and more than 20 years. Referring to the information in figure 4, the highest number of number respondent was for the respondents that have been working less than five years with 14 respondents. Next, the second highest was seven out of 33 respondents have been working in the range 5-10 years followed by six of them been working for 10-15 years. Only five of the respondents have been working between 15-20 years and only one respondent have been working for more than 20 years.

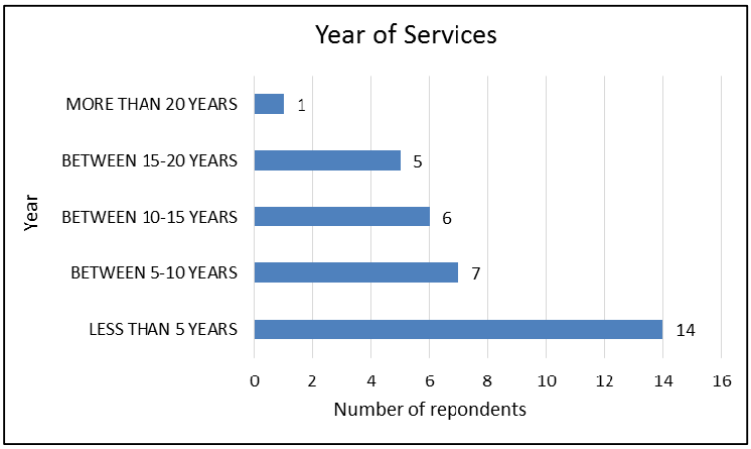

Figure 4: Year of Services

Statistical Analysis To clarify the most dominant factors among those three (3) categories related to building design, SPSS Statistic was used. Hence, from the data obtained, an analysis have been conducted using SPSS Statistics software to identify the most dominant factors. The most dominant factor has tendency to give a higher ranking to the applicability of the Building Safety Index (BSI). This analysis can be run by calculating the mean score and the standard deviation for each of the sub-factors involved. The highest value of the mean score will indicates as the highest ranking in each categories. Then, the average mean score and average standard deviation for each factor will be compared. The high average mean value has tendency to contribute more in the safety index.

Table 2: Descriptive Analysis for architecture approach

Variables	Mean	Std. Deviation	Rank
Mean of Escape	4.6667	0.54006	1
Structural System	4.6364	0.48850	2
Space Functionality	4.5758	0.66287	3
Material	4.5455	0.66572	4
Mean of access	4.5455	0.50565	5
Fire resistant construction	4.4545	0.66572	6
AVERAGE	4.5707	0.58808	

Table 2 shows the mean score and the standard deviation for each of the sub-factors in the architecture approach. It shows that the provision of emergency escape indicates as the highest value with mean score of 4.6667 and standard deviation of 0.54006. The average mean score of architecture approach is 4.5707 and the average standard deviation is 0.58808.

The provision mean of escape is categorized as the most influence factor in the architecture approach due to people reaction when fire occurs. People tend to follow the routes which they are

most familiar when fire occurs. Our respondents believe than rather than waiting for emergency rescue it should be possible for people to travel away from the fire and find a place of relative safety or place of ultimate safety. Hence, a well-designed means of escape that provide an efficient circulation pattern for the building is important especially in during fire incident.

Table 3: Descriptive Analysis for building service approach

Variables	Mean	Std. Deviation	Rank
Fire Protection System	4.7576	0.43519	1
Electricity Installation	4.6970	0.46669	2
Lifts	4.3939	0.86384	3
Emergency Lighting	4.3333	0.81650	4
Indoor Air Quality	4.2727	0.83937	5
Plumbing & Sanitary services	4.1515	0.83371	6
AVERAGE	4.4343	0.70921	

Table 3 shows the mean score and the standard deviation for each of the sub-factors in the building service approach. It shows that the provision of fire protection system indicates as the highest value with mean score of 4.7576 and standard deviation of 0.43519. The average mean score of building service approach is 3.9272 and the average standard deviation is 0.77151

Fire and Rescue Department Malaysia (FDRM) reported that seven years fire statistics in Malaysia show that there are 27387 fire building cases in Malaysia, in fact it was gradually increased from 2005-2011 [6]. Among the type of building, residential buildings are the highest fire cases in year 2010 and 2011. This statement is verified by this finding, whereby the provision of fire protection system are the highest ranked factor under building service approach with mean score 4.7576. Hence, for the purpose of effectively architecture process, Al-Hamoud and Khan [13] proposed systematic safety compliance checklist with the safety requirements includes the design of fire extinguishing system, smoke detectors, stairways and handrails, minimum width of courts, exterior finishes and number of exits and exit access distances and dimensions.

Table 4: Descriptive Analysis for external environment approach

Variables	Mean	Std. Deviation	Rank
Location	4.0606	0.70442	1
Emergency Service Area	4.0000	0.82916	2
Density	3.8788	0.85723	3
External Hazard	3.8788	0.73983	4
Fresh Air Quality	3.8182	0.72692	5
AVERAGE	3.9272	0.77151	

Table 4 shows the mean score and the standard deviation for each of the sub-factors in the external environment approach. Meanwhile the bar chart above visualized the highest and the lowest ranking of the contribution sub-factors. It shows that the location of building far from hazardous area indicates as the highest value with mean score of 4.0606 and standard deviation of 0.70442. Meanwhile the lowest value of the mean score is represented by the fresh air quality and peaceful environment with mean score of 3.8182 and the standard deviation of 0.72692. The average mean score of building service approach is 3.9272 and the average standard deviation is 0.77151.

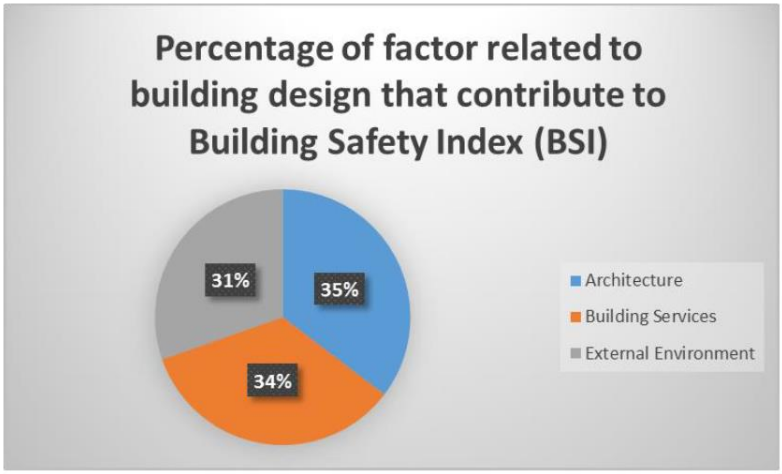

Figure 5: Percentage of factor related to building design that contribute to BSI

Figure 5 indicates the percentage value of factors related to building design that contribute to BSI. Previously, the design dimension been divided into three (3) parts which are architecture approach, building services approach and external environment approach. These factors consist of their own sub-factors which obtained from literature review. From the average mean score and the average standard deviation of those three (3) factors, we have to be identified the contribution percentage. Pie chart above stated that architecture approach have contribute higher percentage than building services and external environment approach. The architecture approach percentage is up to 35 percent with the highest value of an average mean score by 4.5707 and average standard deviation by 0.58808.

This high percentage makes sense as construction professionals must be committed to forging good long-term architecture design to achieve success for the construction industry in general. As an example, the focus of safety and healthy building architecture needs to incorporate better design detail as well as aesthetic aspects. The findings support the recommendation made earlier by researcher such as Das, and Isa, H.M [36]. In their journal they suggested structural design, architectural building elements, space accessibility, and amenities are necessary factors to have successful architecture building performance so that occupants can live safely, healthily, comfortably, and efficiently.

Meanwhile, the building services contribute slightly lesser than the architecture approach with 34 percent and consists of average mean score of 4.4343 and the average standard deviation of 0.70921. This finding implied that with a better building services in building it will extent the safety and health performance. Good building services can lead to improved building performance in the construction industry. This finding corroborates with the findings from Ho etc [30] and Daniel J [28]. Continuous monitoring of the building services performance according to the legal requirement results in better building safety and health condition to safeguard the safety, health, and well-being of people and to protect the environment.

The lowest percentage is external environment approach with only 31 percent with the average mean score of 3.9272 and average standard deviation of 0.77151. External environment is a critical situation that allows information flow between different parties during different stages of building life cycle. In essence, consideration to the external environment factor assists the organisations to communicate their wants and needs accurately to ensure the safety and health of the occupants. Therefore, organised planning can 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 building performance.

Conclusion

This study set out to develop a Building Safety Index (BSI) framework for building in Malaysia, as a lack of comprehensive ways and tools to determine performance and criteria of safety and health building. Basically in this research, the method is by using questionnaire and analysed using Statistical Package for Social Science (SPSS) Version 23.0. The two objectives in this research are to study factors related to building design that contribute to BSI and to identify the degree of influence of the contribution factor.

After the data was analysed, the objectives of this study were already fulfilled. The first objective was already fulfilled by identified the critical factors through a literature review of current safety and health practices from journals, articles and thesis. The literature review identified 17 variables of factors contributing to safety and health performance of building in Malaysia. These 17 safety factors are underpinned by three constructs, namely Architecture, Building Services and External Environment. This include 6 sub-factor for architecture, 6 sub-factor for building services, and 5 sub-factor for external environment. By analysing the results from the questionnaire, the second objective which is to identify degree of influence of the contribution factor was already fulfilled.

In addition, after analysing all the results, it was found that the highest degree of influence contributing to safety and health performance of building design were architecture approach. The results of this study are preliminary in nature but are able to provide some initial insights in developing a building performance framework that would encourage better assessment practices. These data will be useful for developing a quantitative evaluation methodology of Building Safety Index (BSI).

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