

Building Safety Index: Contribution of the Management Factors

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Abstract. Various developments were planned efficiently and rapidly in Malaysia especially related to the sector of building construction in order to meet the status of developed country. Yet, defects and damages in the building are common phenomenon which brings to the degradation of the building safety and its condition. A benchmarking tool called Building Safety Index (BSI) been introduced to this study in order to identify the safety level of the existing building in Malaysia. However, to implement the applicability of Building Safety Index (BSI), identification of the contribution factors should be done earlier so that it can be represented to the influence and hierarchy factors. The objectives of this study are to identify all the management factors that contribute to the Building Safety Index (BSI) and to identify the degree of influence of the contribution factors using SPSS Statistics. Methods of literature review and survey questionnaire were conducted to this study by targeting the government agencies and private sectors which definitely expert in maintenance industry specified in Kuala Lumpur and Johor Bahru. The overall of ten (10) contribution factors from the both of maintenance and building management were successfully identified in this study and it has been found that the maintenance management have contribute slightly two (2) percent higher than the building management which been evaluated based on the factor's attributes.

Introduction

Buildings in Malaysia have been designed for almost minimum of 50 years life span and during that period, a lot of maintenance and post-operation must be monitored by the building management in order to ensure the condition of the building fulfill to the early criteria of the design. Malaysian's government been released a general statement stating that the development plan allocation for repairing and maintenance works increased from RM296 million during the Eight Malaysian Plan to RM1.10 billion in the Ninth Malaysian Plan (Malaysia, 2006) [15]. Building Safety Index (BSI) is defined as a benchmarking tool for classifying apartment buildings in respect of their safety and physical conditions in view of the need to enhance the living environment of a city [1]. This benchmarking tool were first developed by the Faculty of Architecture of the University of Hong Kong [1], and yet there is still none of the building constructed and exist in Malaysia been implemented to this benchmarking for the future development. Building Safety Index (BSI) is commonly used to detect the level of achievement of individual buildings in enhancing the safety of occupants and general public. Major benefits of this implementation are, the government can directly make use of the Building Safety Index (BSI) for its decision-making process and tools as well as budget planning which provide a basis for allocating and directing funding to specific building-related problems.

In order to understand the applicability of Building Safety Index (BSI), studies should be done by considering all the factors that related to the building safety which pose hazards to the occupants and general publics. All the factors must be easily measured and verifiable so that the objectiveness can be fully maintained by the management teams. The assessment of all factors contribute to the safety problems will be simplified into an efficient index for benchmarking work. Basically, there

are few of building factors should be considered and each of that factor owns its own hierarchy. Originally, building factors are grouped into two main categories which are design and management, at the top level. Design factor is common related to the integrity of the building itself while the management factor are considered as form of human's controlling system.

Theoretically, design factor includes with three categories which are architecture, building services and external environment. Meanwhile for management factor, it has been sorted into two categories namely maintenance management and building management. This paper will only focus to the management factor and its attribution to the Building Safety Index (BSI). The problems exist when there are lack of sufficient attention to the contribution factors of the Building Safety Index (BSI) with null of experts and agencies able to publish the guidance or standard criteria to create a new integrating system for the safety checking process of the existing nor constructing buildings entire Malaysia. Malaysian's government declare that there is not yet implementation of any guidelines for the maintenance management of the existing building and also the performance measurement of the system applied. Natasha (2008) mentioned that most of the maintenance agents or companies from both public and private sectors have no systematic guidelines to be followed and no specific compliance to be adhered to in order to deliver the best possible service [8].

The objectives of this study are to identify all the management factors that contribute to the Building Safety Index (BSI) and to identify the degree of influence of the contribution factors using SPSS Statistics. This study will fully access to the existing and high-rise building in Malaysia, by accessing some authorities and agencies such as Department of Public Works (Jabatan Kerja Raya Malaysia), Building & Facilities Management, National Heritage Department, Safety Consultant, Building Surveyor, Architectural Heritage, Quantity Surveyor and Urban Planning & Conservation. Data collection will be conducted by referring to the literature reviews and distribution of questionnaire survey forms to the local authorities, government's agencies and private sector which responsible to monitor the existing buildings in Malaysia. The specific data used for this research is the degree of importance for each of the contribution factors which finally will be interpreted in the form of mean score and standard deviation in order to identify the degree of influence to the Building Safety Index (BSI).

Previous Studies

Maintenance Management Maintenance management is defined as the continuous care and protection activity done by the specified organization which absolutely involving minor repair works carried out to the building elements in order to keep the building in a good condition whereby can prolonging the life of such element and the entire building for as long as possible [6]. The Ministry of Housing and Local Government has received between 2,400 and 4,500 maintenance complaints each year over the last five years, which centered on wall cracks, roof leakages, plumbing problems, poor plaster, painting, and ground settlement (Chuan, 2008) [4]. In 2006, the Malaysian Government allocated about 1 trillion ringgits towards the maintaining public building facilities (Ninth Malaysia Plan, 2006) [8]. Ahmad (2006) opined that in Malaysia, maintenance problems in buildings are common regardless of the size and owners of the buildings [4]. He concluded that the buildings lacked adequate maintenance despite the enormous resources committed to the maintenance activities. Syamilah (2006) investigated that the buildings of more than 50 schools in Petaling Jaya, and concluded that there was a lack of adequate maintenance [4]. Thirty families have been reported to be living in flats with serious structural problems that were hazardous for residents in Klang Valley (The Star, 2008e, p. M6) [4]. According to the statement released by the former Prime Minister of Malaysia, Dato' Seri Abdullah Ahmad Badawi, Malaysia is losing billions of ringgit due to the poor maintenance of the public buildings and amenities (The Star, 20th February, 2006) [4]. Kayan (2006) outlined that there is a need for proper maintenance management in order to minimize building maintenance [4]. Syamilah (2006) mentioned that more than 90 per cent of the respondents concurred that there is a need for further improvement (which should be broader) in the practice of the maintenance management procedure of buildings in

Malaysia [4]. Ahmad (2006) asserted that a fundamental problem with building maintenance problems in Malaysia is the lack of sufficient attention to the maintenance factor [4]. Ignoring or not paying sufficient attention to the maintenance factor of a building will result in a building that will be expensive to own, since more than 50 per cent of the costs of ownership is attributable to maintenance (Seeley, 1987) [4]. Based on a study determining the problems faced by property managers in managing high-rise condominiums in Malaysia, it was concluded that the most frequent complaints lodged by the tenants were defects not being attended to within the time specified, poor workmanship, and services and facilities not being in good condition even when taking over the building from the developers (Noraziah, 2006) [4]. Good maintenance management should be simple, dynamic, and capable of periodic review as the need arises to accommodate technological advancements and the clients' and users' value systems (Vanier, 2001; Jones and Sharp, 2007) [4]. When implementing a maintenance management system, building's user should be involved and target as main contributing factor to ensure that their satisfaction is proactively taken into account while formulating the maintenance policy.

Budget Allocation for the Building Maintenance. Without any funding or allocation, there would be no maintenance work to be done for the performance of the existing building. Mr. Juhan (Penolong Pegawai Seni Bina Kanan) at Unit Maintenance of Building Department clarify that the budget allocated are the main factor in the maintenance work [7]. The maintenance cost estimation accuracy depends upon the amount of information available on the nature and extent of the work, condition under which will be executed, the mode of execution, and the costs of employing labors and prices of materials (Lee, 1987) [16].

The Existing Material. Practically, the technician's maintenance have to find out and select the exact materials to replace with the damages whether inside and outside of the existing building. That is why searching for the existing materials to conduct replacement method could be the tough factor barrier to the maintenance activity. Materials selection should meet up for the performance requirements expected. Using bad quality of materials will cause failure of the materials, which will require replacement, correction or more maintenance works in the future. One of the major causes of building deterioration and other unsatisfactory features of many buildings is the bad understanding of the nature and behavior of materials. Today the building designer is faced with new materials with little information about their behavior and characteristics.

Maintenance Workers. For the maintenance on the administration existing building, skilled and unskilled workers are highly needed due to the needs of maintaining the value of the building. The skill workers will be the 'planning head' to manage and guide the maintenance workers while the unskilled workers will be the person to do the maintenance work on site. Skill workers will play their role in planning, coordinating, and assigning daily activities, provide on the job trainings and instructions to subordinate staff, provide input for performance evaluations, make recommendations to the supervisor regarding promotion, reassignment, recognition of outstanding performance and personnel needs.

Maintenance Organization Chart. Maintenance management's responsibility needs to formulate long term strategic plans to meet those needs are required (Mahmoud, 1994) [7]. A maintenance services company should have an official organization for a purpose of better and effective plan on managing the maintenance activity. According to Seeley (1987), the functions of maintenance organization include determining maintenance policy, assessing funding requirements, preparing maintenance programs, monitoring maintenance costs and implementing feedbacks [5].

Mechanical and electrical services	Fire control system Lift systems Electrical distribution Generator set Air conditioning and mechanical Ventilation system
Civil and structural	Domestic water Plumbing sewerage Building structure
Custodial services	Landscaping General cleaning Pest control Waste disposal Hygiene Janitorial Housekeeping
Other (related) services	Energy management Event facilitation Engineering consultancy Warranty management Performance management Health safety and environment Quality management

Source: The university document analysis (2010)

Figure 1: Scope of works (services) for the maintenance activities

Procedures of the Maintenance Work. Maintaining the existing building not only to conserve the building integrity, but also to preserve the value of architectural and the historical for both of the building. The objective of the maintenance's manual is to provide all building users with a common system of maintenance information recording and retrieval for the proper guidance of maintenance operatives, building owners, maintenance involving operatives, costing, and general maintenance.

The Professional Skill. The professional skill in this study actually been interpreted as a human resources which consist special skills and ideas to conduct the whole process of the maintenance work as well as capable to solve the problems that come out from the building [7]. The professional skill will responsible to the maintenance work and give the direction especially to the technician involved in the maintenance activity. He or she will guide the overall process of the maintenance works parallel to the procedure involved in order to ensure a well building's safety to the occupants. Safety factor have to be considered by the professional skill and be a prior secure to the involving employees who maintain the buildings or the public buildings. A systematic and efficient maintenance system have to be an important element so that all the facilities available in the building can give satisfaction and comfort to the public especially when dealing with their safety level and condition. By conducting frequent maintenance works, it is actually able to control the rising costs involved on the activity. This is due to if any damages is left for too long without any improvement, then it is likely allow the damages or deflection on the existing building cumulate until one point it become more serious problem and indirectly need a higher cost to repair the serious damages.

Basic Strategies of Maintenance Management. Management team have to implement some of the basic strategies to meet up for an effective and systematic process. This include for the conservation and the management plan which basically Malaysia still not yet implement to a standard guidelines and monitoring procedure of the building's maintenance. Conducting a regular building inspection also can be consider as one of the basic strategy as it will directly help the management team to evaluate effectiveness of the maintenance process. The basic strategies also have to meet up with the managing of building's maintenance information by storing and sorting the necessary records

and so on. The management team have to record every single damages and accidents occur during the maintenance works in enabling the correct action performed.

Natasha (2008) stated that most of the maintenance agents or companies from both public and private sectors have no systematic guidelines to be followed and no specific compliance to be adhered to, in order to deliver the best possible service [8]. Majority of the maintenance management's manager do not have specific conservation plan for managing the maintenance work of the building in their care. There is lack of standard guidelines and monitoring of maintenance approaches by many 1,000 of maintenance practitioners in Malaysia. In order to produce an efficient and systematic maintenance management, managers should have the requisite specialist qualification as well as appropriate experience. Previous findings showing that the maintenance management's managers of the existing building claim that they do not have special expertise in managing the maintenance of existing buildings in their care.

Conducting regular inspections to the existing building able to help the management teams to evaluate the effectiveness of the maintenance unit which is saddled with the responsibility of protecting the building safety condition and these recorded inspections can be used as a standardized and guideline for long term maintenance planning. From the reviews, interviewees disclosed that general issues regarding to health and safety and checking the building condition are their main purpose of carrying inspections on their buildings. It has been observed that companies using an integrated balanced performance measurement system perform better than those which do not measure their performance (Kennerly and Neely, 2003; Lingle and Schiemann, 1996) [8]. Besides practicing for a good management system, in advance to upgrade the performance of maintenance management, the organizations or parties involved have to store and proper handling the maintenance information in managing the conservation of existing building as the records on which would show the historical development of the building [6]. Majority of the management do not store regular or routine maintenance information; the only information being stored is that of major conservation works carried out by contractors and even those information are not in their custody [6]. Storing maintenance activity's information only would not guarantee the organization efficiency in managing the maintenance of existing buildings unless the information have been sorted in a good format that would allow ease of use for maintenance especially for developing planned preventive maintenance programs. Review shows that, maintenance's managers that keep the information revealed their maintenance's information are being stored in the hard copy format only and not for the softcopy which definitely much more important than the hardcopy [6]. This is due to the inadequacy of their maintenance funds and most of their maintenance personnel lack the requisite skills to use the software to store and retrieve suitable information which finally dragging them not to use maintenance management software and electronic at all.

Building Management Building management can be described as a discipline that comes under the root of facility management which mostly monitor and ensure that the building are in a good condition and the management keep on maintaining. Hard services usually relate to the physical of the building, structural services such as fire alarm systems, lifts and so on. Meanwhile, the soft services indicate to the activity of cleaning, landscaping, security and suchlike human-sourced services. Building management basically related to the facilities present in the existing building. The facilities always referring to the things that be necessary used during the emergency cases. In this context, it is whether be the facilities been well managed by the management team or not to frequent inspect.

Arrangement of Facilities Management. Escape routes play a very important role especially meet up with the emergency cases happen to the applied building. The design of escape routes should allow occupants to move away from the fire across the floor of the compartment containing it and reach a fire-resistant door that leads into a protected escape route (Butcher and Parnell, 1979) [3]. Lathrop (1989) indicated that a reasonable level of life safety in building design for fire safety should

provide the condition of early warning of fire, adequate exits without dependence on any person to permit the prompt escape of occupants in case of fire or other emergency, exits with sufficient capacity for the size, shape and occupancy of the facility, clear, unobstructed and unlocked exits, clearly marked exits and routes of escape to prevent confusion, adequate lighting and alternative exit arrangements [3]. Studies showing that stairways also can be an accident and hazard areas when obstructed. Almost 90 per cent of the building's owner did not have a separate emergency stairway in their buildings as they are using 'bundled' of stairway for the daily purpose and for the emergency situation [3]. Poor lighting system in the building also can contribute to the stairway accidents since there is insufficient lighting system supplied to the building's occupants during the emergency. 80 per cent of the buildings in Malaysia exist with no lifts system. Most of the surveyed buildings do not have special emergency stairs, with the rest having two or more exits. Only 6 per cent of the residential buildings have the central air-conditioning, while the rest is using window or split air-conditioning units [3]. Installing central air-conditioning systems to the building capable to spread the fire's smoke through the other areas just in short of time. Only 30 per cent of the residences have portable fire extinguishers by their own while the rest is using the water as fire-fighting agent [3]. In addition, 82 per cent do not have any special water connection or water supply for fire-fighting in their houses as they will only use water pump pressure from house to fight against the fire existence. Conducting previous survey indicate that 88 per cent do not have smoke detectors or fire alarm systems in their buildings [3]. Only minority of 9 per cent installing smoke detectors in their houses and 2 per cent of the residents have gas detectors functioning well in their buildings [3].

Emergency Plan and Preparedness. Fire drill session have to be carry out frequently as it is the only way to alert and spread simple message of preparedness to the occupants in the existing building in case there is an occurrence of fire. Almost 83 per cent of the commercial building respondents reported by participated in a fire drill within last year, compared to the only 19 per cent of residential building respondents [13]. 89 per cent of commercial building respondents and 80 per cent of the residential building respondents agreed to carry out the fire drill session as it is beneficial for a certain situation [13]. Emergency preparedness can be assessed on a number of factors including knowledge and awareness of a building's notification systems, evacuation routes, and familiarity with the emergency evacuation plans or procedures [13]. Majority of the building's occupants know where the location of the fire exits is and notify whether or not the building has alternative exits or stairs [13].

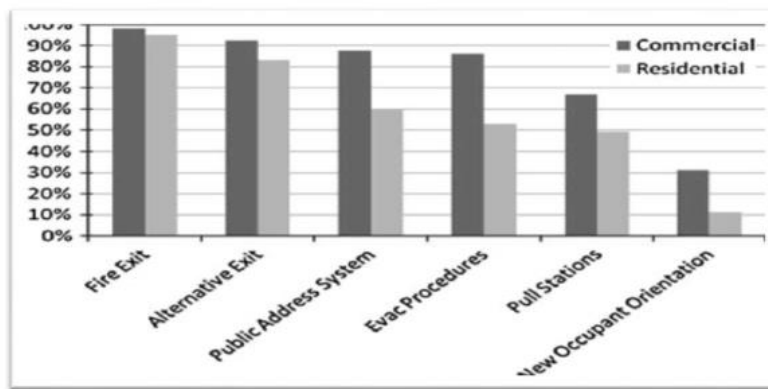


Figure 2: Percentage knowledge of emergency preparedness system among commercial and residential occupants

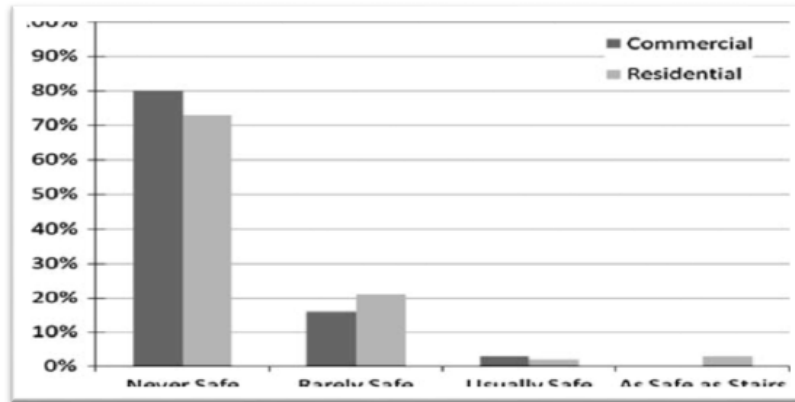


Figure 3: Percentage of occupant's belief that elevators are safe to use during an emergency situation.

For this opinion, respondents have to be questioned about how they might behave during an emergency evacuation. This is important in order to understand the real situation during the emergency as well as to carry out a proper preparation for the future. 35 per cent of commercial and 31 per cent of the residential building occupants reported they would stop and let one or two persons go ahead of them [13]. Only about 10 per cent would stop and let everyone go ahead of them or just continue exiting [13].

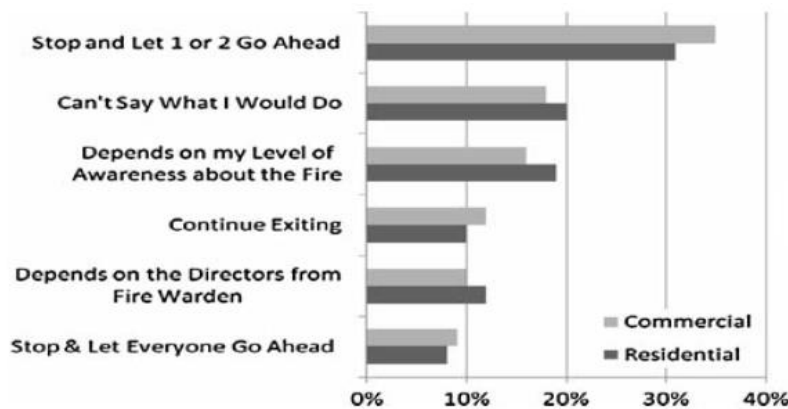


Figure 4: Percentage of likely behaviour of the commercial and residential occupants during an evacuation in a stairwell.

Post Occupancy Evaluation (POE). Evaluation after occupancy in the existing building is vitally needed to ensure that the building's performance is sustained for a few decades. Post Occupancy Evaluation (POE) of buildings is the most importance in building performance evaluation as it comprises the technique that is used to evaluate whether a building meets the user's requirement or not [17]. This evaluation is by using the occupants as a benchmark. Zimring and Reizenstein (1980) defined POE as an examination of the effectiveness of occupied design environments for human users [17]. While Vischer (2002) finds that POE is used not only to determine client's or user's satisfaction, but it is also used to fulfill other objectives which include determining building defects, supporting design and construction criteria, supporting performance measures for asset and facility management, lowering facility life cycle costs by identifying design errors that could lead to increased maintenance and operating costs, clarify design objectives and improve building performance [17]. Post Occupancy Evaluation functions as a systematic way in data collection and information on a particular building but unfortunately it has not yet been undertaken for government

and public buildings in Malaysia [17]. Among the benefits gathered from POE is it helps to identify successful design features to repeat, identify problems to mitigate or reduce, improve building environment and performance., fine tune completed buildings, identify redundant or unnecessary building features, empower users to negotiate building issues and others [17].

Methodology

The objectives of this study can be achieved by using two (2) methods. First method was going through the literature review which been conducted at the early stage of this study in purpose to gather information about the study topic. Second method was proposing the survey questionnaire which practically distribute to the targeted respondents such as the government agencies, private sectors in maintenance industry and also lecturers from the related faculty and professionalisms.

Survey Questionnaire A set of questionnaire have been developed in order to investigate the contribution level of management factors to the building safety index of the existing building, which basically evaluate based on the attribution of each factors involved. In the questionnaire form, there are two (2) sections been construct. The respondent background have been designed in section A of the questionnaire form which include the name of the respondent, contact number, company or organization name and address, types of company or organization involved, current position in the industry, period in safety services and types of building maintained in the period. Meanwhile, for the section B, there are two (2) segments have been designed which are the contribution factors of maintenance management and the building management. Both of the segments designed according to the sub-factors which basically conceptual from the previous literature review in Chapter 2. To answer the questions in section B, the scaling method applied in the questionnaire survey to identify the degree of importance for each of the sub-factors involved in the maintenance and building management. Scaling of 5 indicates as very important, 4 as important, 3 as moderate important, 2 for less important and scaling 1 indicates as not important. There are thirteen (13) parts been developed in the segment of maintenance management which are the budget allocation for the building maintenance, the existing material (replacement), maintenance workers, management organization chart, procedures of the maintenance work, the professional skill, factor of safety, comfort of occupants, control the increased maintenance costs, basic strategies of maintenance management, maintenance staff training and expertise, regular building inspections and information management. For the segment of building management, eight (8) parts been constructed which are the exit route condition, stairway condition, building condition, fire-fighting appearances, fire drill session, knowledge of emergency preparedness, opinions on the emergency evacuation behaviors and post occupancy evaluation (POE).

This study have targeted 80 respondents in answering the questionnaire forms. There are three (3) methods been used in order to get the information of the targeted respondents. One of the methods is recommendation assisted by the lecturers and supervisor to approach certain company and individual, second is by searching respondent's information on the website and internet regarding on the safety services' company and government agencies and third is by extracting various examples of respondents from the previous literature review and journals. Mostly, the targeted respondents are in the circumference of Peninsular Malaysia which are in Kuala Lumpur and Johor Bahru. Practically, there are three (3) methods been used to carry out this task which are the submission of questionnaire through the delivering method (posting), passing directly to the office of the company or organization involved and distribution of questionnaire forms by email and contact number from the obtained information. The selected respondents have been given for almost one (1) month to completely answering the questionnaire form and giving back to the researcher as a collected data for the further purpose.

Analysis Software For the process of analysis, the data collected have been transformed and inserted into the software of SPSS Statistics. By applying the descriptive statistics in SPSS software, mean score and standard deviation for each of the factors in maintenance and building management can be achieved. In order to fulfill the second objectives of this research study, mean score have to be considered in the data analysis. After analyzing, the mean values have to be sorted in descending form which is the highest value at the top and lowest value at the bottom. Highest value of mean score will be labelled as the most influence factors in both maintenance and building management. Standard deviation is the average degree to which scores deviate from the mean score. Finding the standard deviation is the only accurate method to identify the degree of influence factors for the maintenance and building management, in case there are similar or exact values of mean score for the sub-factors involved.

Data Analysis

Physical Results of Data Collection About 30 hardcopy of the questionnaire sets have been distributed by hands to the specified company and organization involved in this study and the rest of 50 online survey forms (Google form) have been created in order to conduct the distribution process by using email as a hub. From the overall of 80 questionnaire sets, only 48 sets was obtained back by hardcopy and online feedback. There were 5 questionnaire sets have been default. Therefore, only 43 sets of questionnaire have been taken into the consideration of data analysis where 38 sets been collected from the online survey forms while the rest are getting back from the company involved by hardcopy.

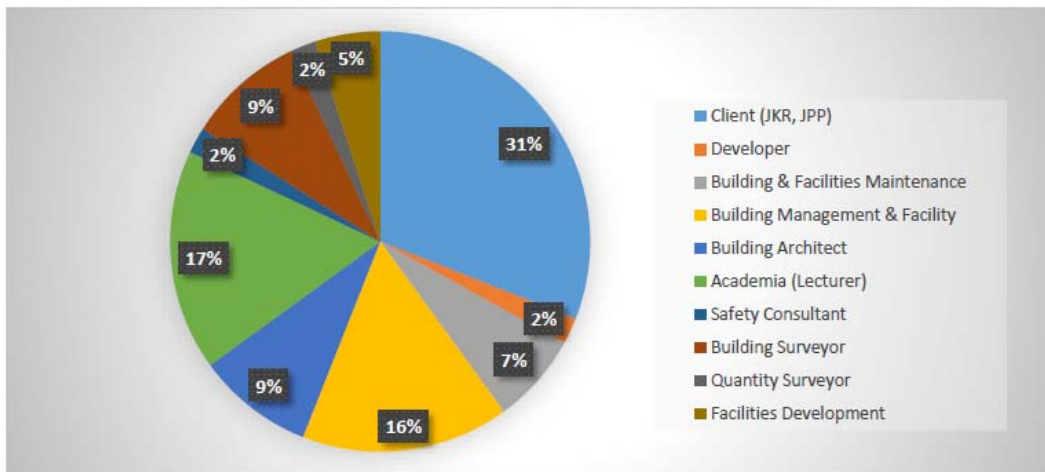


Figure 5: Percentage types of company or organization involved in this study

Background of Respondents From the total of 43 respondents, thirteen (13), 31% of them are from the client which mostly come from the government agencies such as Jabatan Kerja Raya Malaysia (JKR), Dewan Bandaraya Kuala Lumpur and Jabatan Pembangunan & Pengurusan Fasilitas (Kampus Universiti Awam Malaysia). Seven (7), 17% of the respondents are from the building management & facility and also the academia (lecturers from the faculties) respectively. Four (4) which indicate 9% of the total respondents come from the building architect and building surveyor respectively while three (3), 7% are the building & facilities maintenance. Two (2), 5% of the respondents claimed as they are the facilities development and the rest of 2% of respondents come from the developer, safety consultant and quantity surveyor.

Table 1: Types and percentage of job position among respondents in this study

Job Position	Frequency	Percentage (%)
Advisor	1	2%
Manager / Director	17	40%
Assistant Director	2	5%
Head of Department	2	5%
Architect	3	7%
Civil Engineer	1	2%
Assistant Engineer	3	7%
Head of Operation	2	5%
Procurement Manager	1	2%
Coordinator	1	2%
Academician (Lecturer)	4	9%
Safety Director	1	2%
Building Surveyor	5	12%
Total	43	100%

From the Table 1, most of the respondents positioned as the manager or director of the company or organization which are 40% from the total of 43 respondents. Five (5), 12% of the respondents are the building surveyor and four (4), 9% are from the academician (lecturers of the faculties). Both architect and assistant engineer contribute to 7% of the total respondents which are three (3) respondents respectively. Two (2), 5% of the total respondents come from the assistant director, head of department and head of operation respectively. Last but not least, only one (1), 2% of the total respondents indicate as an advisor, a civil engineer, a procurement manager, a coordinator and a safety director, respectively.

To identify all the management factors that contributes to the Building Safety Index (BSI) All the finding factors have been successfully identified and discussed by detailed in Chapter 2. Theoretically, factor of management can be divided into two major factors which are:

1. Maintenance Management
2. Building Management

For the factor of maintenance management, there are seven (7) sub-factors been considered in these researches which are:

1. Budget Allocation for the Building Maintenance
2. The Existing Material (Replacement)
3. Maintenance Workers
4. Management Organization Chart
5. Procedures of the Maintenance Work
6. The Professional Skill
 - Factor of Safety
 - Comfort of Occupants
 - Control the Increased Maintenance Costs
7. Basic Strategies of Maintenance Management
 - Conservation Plan and Management Plan
 - Maintenance Staff Training and Expertise
 - Regular Building Inspections
 - Information Management

Meanwhile, for the factor of building management, there are three (3) sub-factors that tendency to contribute to the Building Safety Index (BSI) which are:

1. Arrangements of Facilities Management
 - Exit Route Condition
 - Stairway Condition
 - Building Condition
 - Fire-fighting Appearances
2. Emergency Plan and Preparedness
 - Fire Drill Session
 - Knowledge of Emergency Preparedness
 - Opinions on the Emergency Evacuation Behaviors
3. Post Occupancy Evaluation (POE)

To identify the degree of influence of the contribution factors using SPSS Statistics The second objective of this research is to identify the degree of influence of the contribution factors using SPSS Statistics. This objective can be achieved by identifying the average mean score and the average standard deviation for each of the sub-factors involved in the maintenance management and the building management. The highest value of the average mean score will indicates as the highest ranking to the safety index contribution. Meanwhile, the purpose of standard deviation value is to identify the degree of influence for the contribution factors that consist of exact values of the average mean score.



Figure 6: Contribution factors of maintenance management

Factors of Maintenance Management. Figure 6 shows that the factor of the professional skill indicates as the highest value of an average mean score 4.607 with the standard deviation of 0.652. While the lowest value of the average mean score represented by the factor of budget allocation for the building maintenance with an average mean score of 4.333 and the average standard deviation of 0.732. Therefore, the professional skill is categorized as the highest degree of influence factor in the maintenance management due to the management and the professional skill have been stressed deeply during conducting the maintenance work. Moreover, the special skills and ideas could be the key of success when conducting the whole process of the maintenance activity. The manager or the director of the organization have to be a decision maker in order to ensure that the maintenance work done perfectly as planned. Sufficient budget allocation by the Malaysian’s government and proper distribution of budget to the maintenance works in Malaysia be the main reason why the

factor of budget allocation indicates as lowest degree of influence to the Building Safety Index (BSI). Plus, the budget allocation not be the main issue or problem to conduct any maintenance activity in Malaysia. Malaysian's government have released a general statement stating that the development plan allocation for repairing and maintenance works increased from RM 296 million during the Eighth Malaysian Plan to RM1.10 billion in the Ninth Malaysian Plan (Malaysia, 2006) [15].

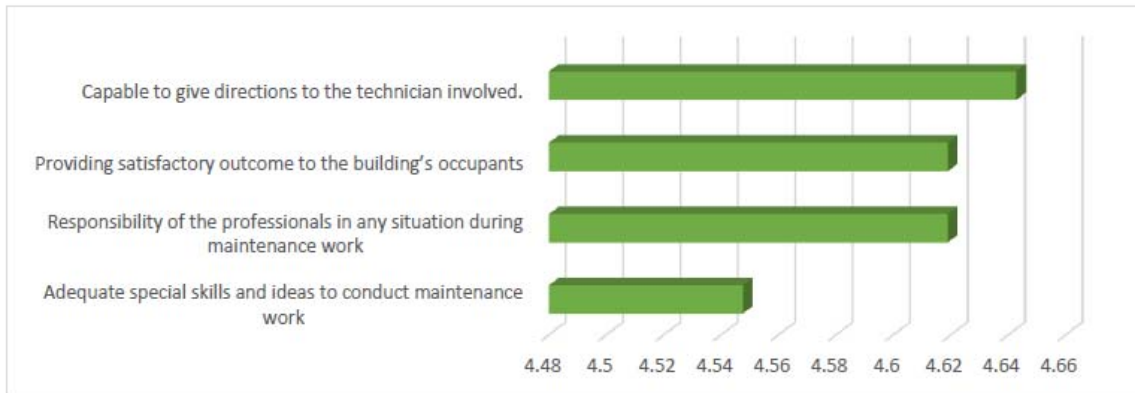


Figure 7: Attribution level of the professional skill

Figure 7, indicates the attribution level for the factor of the professional skill. It shows that capable to give directions to the technician involved in the maintenance work accounted as the highest ranking in that factor which contribute 4.6429 of the mean score and the standard deviation of 0.61768. This result proof that the role of the professional skill or the head of the operation for the maintenance work is the most important thing in order to ensure the operational process done perfectly as planned.

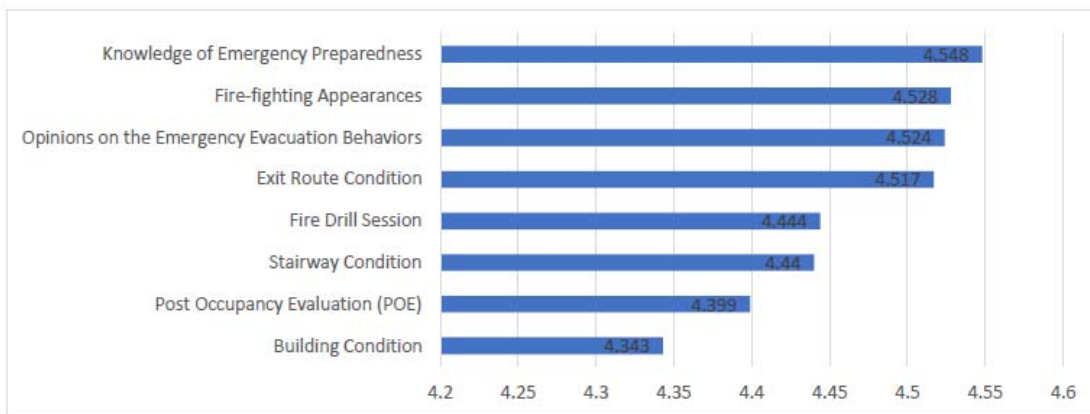


Figure 8: Contribution factors of building management

Factors of Building Management. Figure 8 shows that the factor of knowledge of emergency preparedness indicates as the highest value of an average mean score 4.548 with the standard deviation of 0.668. While the lowest value of the average mean score represented by the factor of building condition with an average mean score of 4.343 and the average standard deviation of 0.729. Therefore, the knowledge of emergency preparedness is categorized as the highest degree of influence factor in the building management due to the respondents really stresses on the safety of the building's occupants during the emergency cases happen to the existing building.

Lack of general knowledge among building's occupants during the emergency situation will definitely contribute higher level of unsafe condition to the Building Safety Index (BSI). Therefore, the occupants must have sufficient knowledge of the emergency preparedness so that when there is something happen, the knowledge can be applied as well. Factor of building condition contribute less to the Building Safety Index (BSI) due to there is adequate proper requirement of building condition after and before being maintained by the maintenance teams. Besides, the previous review mentioned that there is adequate lift systems in the existing building which make the building in a safety condition to the occupants or building's users.

Table 2: Mean score and standard deviation values for the attributions of knowledge of emergency preparedness

Attributes	Mean Score	Standard Deviation	Ranking
Sufficient knowledge of emergency preparedness by the building's occupants	4.5952	0.62701	1
Adequate knowledge of the fire exits' location and alternative exits	4.5476	0.70546	2
Sufficient evacuation procedures and location of pull stations	4.5000	0.67173	3
Total (Average)	4.548	0.668	

As we can see from the Table 2, above, the attribution of sufficient knowledge of emergency preparedness by the building's occupants accounted as the highest contribution to the main factor with value mean score of 4.5952 and the standard deviation of 0.6270, compare to the rest of the factor's attributions. This result proof that there should be a sufficient knowledge of the emergency preparedness by the building's occupants since the level of the occupant's knowledge on the safety will figure out the outcome and active actions of the occupants during the emergency of the existing building.

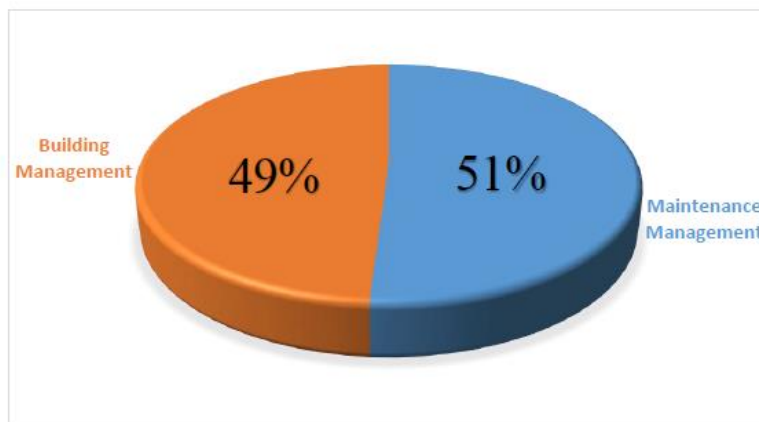


Figure 9: Percentage of the management factors contribute to BSI

Percentage of the Management Factors Contribute to the BSI. The Pie chart states that the maintenance management have contribute higher percentage of the Building Safety Index (BSI) compare to the building management which is up to 51 percent of the highest value with an average mean score by 4.473 and average standard deviation by 0.676. Meanwhile, the building management contribute slightly lesser than the maintenance management with 49 percent to the Building Safety Index (BSI) which basically consists of the average mean score by 4.468 and the average standard deviation of 0.696.

Conclusion

Roughly mentioned that all the objectives of this study have been successfully achieved and the analysis of data also have been completely discussed in the Chapter 4 previously. After conducting this research, some recommendations have been proposed for the improvement of the construction industry in Malaysia especially related to the management and conserving the existing building and facilities. The proposed recommendations are as follow:-

1. The maintenance organizations of the existing building have to focus more on the importance of the professional skill especially during conducting the maintenance activity. The manager or the director of the organization have to take part as a decision maker and capable to give directions to the technician involved in the maintenance work in order to ensure that the operational process done perfectly as planned.
2. The building's owners and the government have to play important role to ensure there is sufficient knowledge of emergency preparedness by the building's occupants in order to encounter any problems during the emergency.
3. Building Safety Index (BSI) have to be initiated and implemented to the construction industry in Malaysia from now on. This is due to there is not yet implementation of any guidelines for the maintenance management of the existing building and also the performance measurement of the system applied.
4. Construction industries in Malaysia have to stress more on the importance of contribution factors that tendency to degrade the safety level of the existing building as well as to the new construction of building by maintaining the grade of Building Safety Index (BSI).
5. Malaysian's government have to study further on the application of Building Safety Index (BSI) by identifying more detailed on the contribution's factors. More experts and agencies need to study the variety and possibility of the contribution's factor and finally publish the guidance or standard criteria to create new integrating system for the safety checking process of the existing building entire Malaysia.

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