

BUILDING MAINTENANCE MANAGEMENT SERVICES FOR INDOOR ENVIRONMENTAL QUALITY AND USER CONTENTMENT; CASE STUDY OF BUS TERMINALS IN MALAYSIA

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Graphical abstract



Abstract

The term maintenance is defined as combination of technical and administration works which includes supervision works that intended to retain item or reestablish it to a state in which it can perform its required function perfectly. Nowadays, with the increasing numbers of users in the public building especially peak season of the year, for the case study a bus terminal, the comfort and user contentment of the indoor environmental quality has become a most important element in maintenance management. In this research, level of current building maintenance management services for indoor environmental quality and user contentment was identified by assessment and checklist. Apart from that, IEQ test was conducted to support the level of contentment in user of the building. However, from the results of data collected, it was known that the latest quality maintenance services level in the bus terminals still not up to the level because user still side to the dissatisfaction range.

Keywords: Building maintenance management, indoor environmental quality, user contentment, bus terminal, Malaysia

Abstrak

Penyelenggaraan didefinisikan sebagai gabungan kerja-kerja teknikal dan pentadbiran yang merangkumi penyeliaan kerja-kerja yang bertujuan untuk mengekalkan fasiliti atau barang dengan mengembalikan kepada keadaan di mana ia boleh melakukan fungsi yang diperlukan dengan sempurna. Pada masa kini, dengan bilangan pengguna yang semakin meningkat dalam penggunaan bangunan awam terutamanya musim cuti tahun ini, untuk kajian kes di terminal bas, keselesaan dan pengguna kepuasan kualiti alam sekitar dalam bangunan telah menjadi satu elemen yang paling penting dalam pengurusan penyelenggaraan. Dalam kajian ini, tahap perkhidmatan pengurusan penyelenggaraan bangunan semasa kualiti persekitaran dalaman dan kepuasan pengguna dikenal pasti oleh penilaian dan senarai semakan. Selain itu, ujian telah dijalankan untuk menyokong tahap kepuasan pengguna dalam bangunan. Walau bagaimanapun, dari hasil data yang dikumpulkan, ia dikenalpasti bahawa kualiti tahap terkini perkhidmatan penyelenggaraan di terminal bas masih tidak mencapai tahap kerana pengguna masih berpihak kepada ketidakpuasan.

Kata kunci: Pengurusan penyelenggaraan bangunan, kualiti persekitaran dalaman, kepuasan pengguna, terminal bas, Malaysia

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1.0 INTRODUCTION

Every human being has their own life expectancy or maximum life span. Human being life's expectancy starts as soon as they were born and ends normally when they reach the maximum's life expectancy. For example, human being at old age. As human ages, their body condition will start to deteriorate. This life concept applies to buildings too. Every building has their particular lifespan to perform its planned purposes and served to the occupants in it. However, the buildings will become progressively worse over time and will not serve its quality main function. A building may look awe-inspiring but with unattended or periodical maintenance management, the buildings will have defects and other failures. According to Suffian, buildings in Malaysia are built in accordance to the British Standard and stern supervision. However, maintenance system in a building is still weak as building maintenance in Malaysia merely focus on the building services technical system. Hence, poor and inappropriate building maintenance will absolutely cause more damages and costly repair [1]. In addition, with poor and irrelevant building maintenance, it will eventually cause danger to the occupants or user's health and safety.

The term building maintenance is defined as combination of all technical and administration works which includes supervision works, intended to retain an item in, or reestablish it to a state in which it can perform its required functions [2]. In detail, maintenance is about work undertaken with purpose to keep, reestablish and promote improvement to every parts of the building, services and surrounding to ongoing standard in maintaining the value of the buildings [3].

Building maintenance practices are frequently related with its building fabric component, building services and facilities. The indoor environment of most public buildings especially the buildings that were selected as case studies in this research which were bus terminals in Malaysia hugely controlled by mechanical services that consume hefty amount of energy to provide comfort to the occupants [4,5].

Other than health issue, other researcher also justify indoor environment research by pointing that occupants or user who are contented with total environmental quality of their workplace perform better in their work [6, 7, 8] Besides, user in a building should be treated like consumers of a product in which of this case study is a bus terminals and so, they are deserved to be contented with the indoor environmental quality [9]. Bus terminals in Malaysia (Kuala Lumpur, Malacca and Johore) is chosen as case study in this research mainly because the express buses had become one of the popular choices way of travel and the arising attention of the government and public to the bus terminals issues. This can be read in the newspaper or seen in the mass media nowadays. In The Malay Mail online 3rd March 2015, with headlines; "Johore's Larkin Central

to Get RM10m new look". From the articles, it states that the transportation hub will be upgraded to provide comfort and convenience for about 30,000 daily commuters as well as changes of an air conditioned waiting lounge for 1,000 people. So, this clearly reflects the objective of the researcher in conducting this research with the purpose to highlight the past level of user contentment is not on a satisfactory level and therefore the management will be taking action in improving the facilities in the terminals to increase the user's comfort and satisfaction. Other than that, in another newspaper article published in The Borneo Post with the headline of "Southern Integrated Bus Terminal Achieves 75 Percent Score for Disabled Friendliness" in 28th September 2011. However, the lift for the disabled to travel from the bus terminal lobby to the Express Rail Link (ERL) and Keretapi Tanah Melayu terminals is not functioned and there were no special staffs in charge on duty in assisting the disabled. Besides, from the researcher's visual investigation, there were no disabled friendly facilities prepared for the disabled in all three bus stations. This can be supported by the user contentment's questionnaire feedback where most participants agreed with the disabled friendly facilities to be added in the bus terminals.

2.0 LITERATURE REVIEW

2.1 Indoor Environmental Quality and User Contentment

According to British Standard BS 3811, the phrase Maintenance is the merger of all technical and associated works planned to maintain an item or restore it to the state where it is able to perform its required function. Maintenance, which is the common issue that is not less mentioned by many scholars in the literature is about concerning with the action in preserving the building so that it is suitable for its main function [10]. Besides, by maintenance management, it also extends the life of building elements through daily work [11]. Most importantly, for safety and security purpose, a suitable operation is needed to prevent condition of a building from deteriorate continuously [12, 13]. Basically, maintenance management's objective is to enhance and increase productivity, the service provided by the management and the level of user contentment. Based on Lateef, maintenance management in Malaysia's building is on the rise regardless of size, type, location and ownership of the building. Currently, the maintenance management procedures in Malaysia are still on condition and reactive based. This eventually weaken the current procedures which is the primary problems because maintenance team in Malaysia do not link maintenance needs with building performance with respect to the users [14].

Based on Derek Miles [15] the function of maintenance management practices contained three main components which are cleaning and servicing, rectification and repair and replacement. These three component are usually classify into planned maintenance such as, where cleaning and servicing are to be carried out often and to be combined with faults report so that remedial works can be conducted after the faults become apparent.

In order to have good maintenance management system, a maintenance strategy is needed. Dunn [16] defines maintenance strategy as "a long-term plan, covering all aspects of maintenance management which sets the direction for maintenance management, and contains firm action plans for achieving a desired future state for maintenance function" [17].

3.0 METHODOLOGY

Research methodology gives a detailed explanation of research methods which are used throughout the study to obtained relevant data for analysis of results later on. This includes the description of the population or target group of the users in bus terminal's questionnaire participation as well as its reason and fieldwork done. Besides, it also discusses about the steps and chronological order of this research in order to achieve the establishment of aim and objectives in this study. Basically, a mixing of qualitative and quantitative methodology was used in this research. This includes interview, questionnaire survey and visual inspection.

3.1 Investigated Bus Terminals

Three bus terminals located in three different states in Malaysia were investigated in this study. General information about the three bus terminals are summarized in Table 1.

Table 1 General information of Puduraya Central, Melaka Central and Larkin Central

Location	Completion Date	Number of Floors	Management	Type of Bus Service Provided
Puduraya, Kuala Lumpur	2011	6	UDA Holdings	Bus Terminal for Express Bus
Melaka Central, Malacca	2004	1	Melaka Central	Bus Terminal for express buses and intercity bus
Larkin Central, Johor Bahru	2004	3	Larkin Central Property	Bus terminal for express bus, cross border bus from Singapore and intercity bus

3.2 Interview

An Interview was carried out to each maintenance officer of the bus terminals. Throughout the interview, the interviewee was asked to answer to the Evaluation Index of Maintenance Management Service Quality, created by Research Institute of Environmental Management, Administration and Maintenance of JAPAN, which is also known as Takakusagi checklist. Basically, this index composing of eight parts as shown in Table 2.

3.3 Questionnaire Survey

The questionnaire was derived from comprehensive literature review and scanning of past questionnaire by past researcher. The questions were set to collect relevant data and to fulfill the aim and objective of this research. The main objective of conducting this survey is to determine the level of user contentment in correlation to the level of maintenance services of the three bus terminal. The target population is 750 respondents of occupants, including the passenger and the tenants (staff) in the building. Basically, the questionnaire consists of mainly four indoor environment parameters, thermal comfort, lighting condition, air quality and cleanliness with three questions each to be sub-divided according to the different area of the bus terminal.

Table 2 Eight parts of the Takakusagi checklist

Parts	Survey Contents
Part 1	Reliability, defect avoidance
Part 2	Deal regarding aging elimination
Part 3	Management for water usage, energy and waste
Part 4	Indoor air quality-maintenance and improvement of thermal comfort
Part 5	Indoor air quality, cleanliness maintenance and improvement of the environment
Part 6	Maintenance work management
Part 7	Plan for improvement (remodeling)
Part 8	Risk management

The type of questions used is closed ended questions with five-point psychometric scale to get a detailed results respecting to the level of user contentment. In the last section of the questionnaire, the respondents are allowed to provide their comment and suggestion which will increase the value of this questionnaire survey. Meanwhile, the questionnaire was distributed manually, which means the researcher will go to the studied bus terminal and approach the occupants to answer the questionnaire directly in person. This can minimize the error of misinterpretation of the questionnaires and making the explanation task to the respondents easier.

4.0 RESULTS AND DISCUSSION

4.1 Interview

By using the Takakusagi tool, the interview of responses in the survey evaluates the maintenance service levels of both the bus terminals. Thus, the interview result were been interpreted by the researcher based on the three bus terminals. From the Takakusagi checklist, two of the bus terminals in this research are being managed by own management department, except for Puduraya Central however still not yet reaching the contentment level. This can prove that even though the Larkin central and Melaka Central has their own management organization, they are still lacking in maintenance management service and there is room of improvement as compared to Puduraya central. Although Puduraya Central's maintenance management was outsource management, they have a better level of maintenance service.

4.2 Questionnaire

250 survey questions were distributed for each bus terminal and 250 respondents were received for each bus terminal.

Basically, the questionnaire consists of mainly four indoor environment parameters, thermal comfort, lighting condition, air quality and cleanliness with three questions each to be sub-divided according to the different area of the bus terminal. The type of questions used is closed ended questions with five-point psychometric scale to get a detailed results respecting to the level of user contentment. In the last section of the questionnaire, the respondents are allowed to provide their comment and suggestion which will increase the value of this questionnaire survey.

The target participants of the questionnaires are users from Pudu Central, Melaka Central and Larkin Central. Out of the 250 respondents in Pudu Central terminal, 60.4% is female and 39.6% is male. The highest respondents come from the age between 40-49 years old in which 32% was recorded and the least respondent's age group which is greater than 50 years old with only 12.4% of the overall responses. For Melaka Central, the highest respondent's gender is also female which records 52.4% and the least is male which records 47.6%. The highest age group respondents are between ages 20-29 in which 30% was recorded. The least age group was also age more than 50 which records only 16%. For Larkin Central, female records the highest percentage in participating in the questionnaire which records 68% and the least is still male respondents with only 32% respondents. For the age group, the ages between 40-49 records highest percentage which is 30% and the lowest is 14% for age above 50.

4.3 Visual Inspection

This section explains the data collected based on the observations made from visual inspection by the research within the studied areas inside the investigated bus terminals. For visual inspection, the researcher has use the visual inspection and instrument test on four parameters which are lighting, sound, temperature and humidity.

4.4 Discussion

Based on the results, the maintenance management service level in the three bus terminals by using the Takakusagi tool shows the level of maintenance management system managed by the managers. From the Takakusagi checklist, two of the bus terminals in this research are being managed by own management department, except for Puduraya Central however still not yet reaching the satisfaction level. This can prove that even though the Larkin central and Melaka central has their own management organization, they are still lacking in maintenance management service and there is room of improvement as compared to Puduraya central. Although Puduraya central's maintenance management was outsource management, they have a better level of maintenance service.

All three bus terminals was indicated at neither satisfied nor dissatisfied range. In comparing Melaka central, Puduraya central and Larkin central bus terminal, it shows that Larkin Central and Puduraya Central terminal has better implementation work of management maintenance services based on the interpretation of the Takakusagi checklist. However in the results of questionnaire survey, Larkin central had the lowest mean index for the indoor environmental quality as compared to the other two terminals. According to the visual inspection result, from the average reading interpreted, all the three bus terminal lighting lux reading result is in a range less than 50 lux which is the standard lighting lux standard for light. For the temperature, the law does not state a minimum temperature, but the temperature in workplace should normally be at least 23 degree Celsius to 28 degree Celsius if the work involve more physical work as stated by the [18] Ashrae Standard 55-2010. Hence in the average reading for temperature of all three bus station, it exceeds the temperature guidelines which are between 22.6 degree Celsius to 32 degree Celsius. This can be concluded that the temperature at Larkin central needs to be improved as it exceed the standard. For humidity, the range should be between 30-60% as suggested in ASHRAE Standard 55-2010. However, from average reading taken from all the places in bus terminals, Puduraya central has the highest humidity level which is 62.3% which mean their humidity level has exceeded the range given. Last parameters were sound level. For the sound level, according [19] Glowatz, that the sound level in a building for public use should be between 49-58 dBA.

However, for all the three terminals, average reading results shows that the sound level has exceeded the standard. In addition to the survey of occupant satisfaction regarding the indoor environmental quality, respondents were also asked about their satisfaction level regarding the facilities. The result shows the respondents were also dissatisfied with the amenities provided in both the bus terminals. They are facing the problems of proper locker in the bus terminals. They suggested that the management to provide lockers with charge of a reasonable rate because with the lockers the users can leave their belongings in the locker without worrying of their belongings being stolen when they are away. This can be crucial because occupant satisfaction is not merely about comfort issue, but also the level of convenience and productivity of a building. Apart from that, facilities for the disabled were also suggested by the users in the building to be provided by the management. This is because the management needs to know the users in the terminals they will be different group of users using the building's facilities. Besides, the results also showing the management department of the bus terminals has seldom act and response on the complaints made from occupants. Hence, in order to improve the satisfaction level of occupants, the most important method is by improving the maintenance management services quality in the buildings that has the greatest direct impact. A well planned preventive maintenance involving periodic inspection and servicing will contribute to the rising in number of the occupant satisfaction, as compared to rectification and replacement of corrective and breakdown maintenance. Furthermore, the management department of both the bus terminals may need to take extra care about air quality issue. This is important as all the studied indoor environmental parameters, the lowest contentment level of users investigated is air quality. It has the lowest rating level, where the total air quality rating of mean value for Puduraya central, Melaka central and Larkin central are 3.44, 2.90 and 2.92 respectively. From the mean value, it can be assumed that the users using three of the bus terminals are neither satisfied nor dissatisfied with the performance of building in overall air quality, siding towards discontentment level.

5.0 CONCLUSION

The purposes of this study were to study the Building maintenance management services in related to indoor environmental quality and the user contentment level. The conclusions drawn from this research are as follows:

1) All investigated bus terminals are still not up to the satisfaction level. Occupant's range of contentment level is still in neither dissatisfied nor satisfied.

2) The level of maintenance management services and occupant satisfactions are higher in Puduraya Central and Melaka Central than in Larkin Central.

3) Thermal comfort and lighting problems is the major issue that require extra maintenance management service care from the management in the terminal buildings.

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