Towards Better Housing Management: Service Life Planning In Achieving Sustainability for Affordable Housing

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Abstract

The construction industry has been expected to construct reasonable quality housings that are cheaper, faster to build and most critical to be durable with minimal maintenance required. With the emerging of new technologies and concern for environment, increasing attention in construction industry is given on sustainability. Minimal financial commitment, high standard quality of living and considerations for environment are among the main objectives in assets management. However, anticipated service life of an asset is dependent upon its environment, material properties as well as operations and maintenance. It is generally acknowledged that quality and performance of building components decrease with time and that the imposed loads and the levels of maintenance affect the rate of degradation. However, these issues are normally not being identified earlier during design stage of building construction. By using assessment of building components performance, preventive maintenance, repair and major rehabilitation, decisions can be made based on economic analysis on the life cycle of buildings. Through optimising service life of the building components and its materials, operational and maintenance cost can be reduced. This paper describes a software's concept, assessment process, data collection and potential applications of development in implementing service life planning for local housing.

Keywords: sustainability, service life planning, maintenance.

1 Introduction

As a developing country, an increase in job opportunities in urban areas has resulted in rising demand for housing in three major cities in Malaysia namely Kuala Lumpur, Penang, and Johor Bahru. With the influx of four million foreign workers, shortage for low to medium cost housing has come to critical point in these cities.

Education, housing and other social services continued to be the priority of Malaysia's development programs aimed at providing quality living for lower and middle-income groups. Malaysia has implemented a five yearly programs beginning with the First Malaysian Plan (1966-1970) in distributing the country's wealth among the three major races in the country. In all the Malaysian Plans, priority will continue to be given to the development of low and low medium cost multi-storey houses. In this regard, both the public and the private sectors intensify their efforts in the implementation of the housing development to meet increasing demand.

Under the First Malaysian Plan, an allocation of RM162.5 million was made for the low-cost housing. By the end of the Plan period a total of 22,522 low-cost housing units were built, half of which were flats, costing approximately RM100 million. For the Second Malaysia Plan (1971-1975) nearly RM172 million was allocated for public housing throughout Malaysia. During this period the various Federal and State Agencies constructed a total of 86,000 units of which 13,244 units were low-cost houses constructed under the programme of the Ministry of Housing. In the 3rd Malaysian Plan, prior to the Midterm Review, the Government allocated RM463.7 million as loans to the State Governments and City Hall, Kuala Lumpur to construct about 61,200 units of low-cost houses throughout Malaysia. In addition to public low-cost housing programmes sponsored by the Ministry of Housing, a number of Federal Agencies and regional development authorities are also involved in building about 53,100 low cost housing units [1]. During the 7th Malaysian Plan, the local housing had benefited from the construction activities where 190,600 of low cost, 72,582 of low medium cost and 227,956 of medium cost. During the 8th Malaysian Plan 232,000 low cost, 131,300 low medium cost and 110,700 medium cost were targeted to be built (EPU-Prime Minister's Department, 2001). Level of comfort for the occupants had improved during the subsequent Malaysian Plan where initially the units were provided with only two bedrooms each. With the 8th Malaysian Plan, all units should at least have 3 bedrooms with minimum floor area of 60 m^2. Various construction technologies had been employed to minimize the capital costs in these projects

However, with the multi-million-ringgit investments in providing low cost multi storey housing projects, the maintenance cost of these public housings is of great concern to the decision makers. With little attention paid on what happen during the life span, it is not surprising that most public housing management faces lack of funding for operational, maintenance and replacement of building components [2]. Expenses and care during the life span were not taken into consideration during initial stage because of its non-immediate effect to the client especially if the client is not involved in maintaining these housing.

In an effort to encourage adoption of the public and private sectors, the Ministry of Housing has worked together with researchers at Universiti Teknologi Malaysia in developing software by incorporating local data and environmental factors. The software LICCOMS (Life Cycle Cost for Multi-Storey Housings) is able to estimates the life cycle costing of a housing project through an estimation of its

initial cost, maintenance and replacement cost. LICCOMS is also able to predict the service life of building components by taking into account the environmental condition factors such as sulphur dioxides emission in atmosphere, temperature, relative humidity, yearly precipitation, acidity of rain water from its ion hydrogen in mol/litre.

2 LICCOMS Version 1.2 Framework and Development

LICCOMS Version 1.2 software was upgraded from previous version with several additional features to add value to its analysis and assessment. LICCOMS Version 1.2 was developed to assist building owners in estimating life cycle costing or ownership cost of buildings throughout its life span. The ownership cost consists of initial cost, operating cost, maintenance cost, replacement cost and other related costs. Alternatives are also offered in choosing different building materials to enable building owners to compare the initial cost, maintenance cost, operating and replacement cost of the building.

LICCOMS Version 1.2 was developed by using Visual Basic 6.0 and integrating some of the features in MapInfo 7.0 software. It enables users to model multi-storey housing either in 2D or 3D by using the modules developed in LICCOMS prior to estimation of initial cost. Database on environmental loads presented as GIS map using MapInfo 7.0 was incorporated in the software to be used in predicting the service life of the building components. Figure 1 shows the conceptual framework of the software.

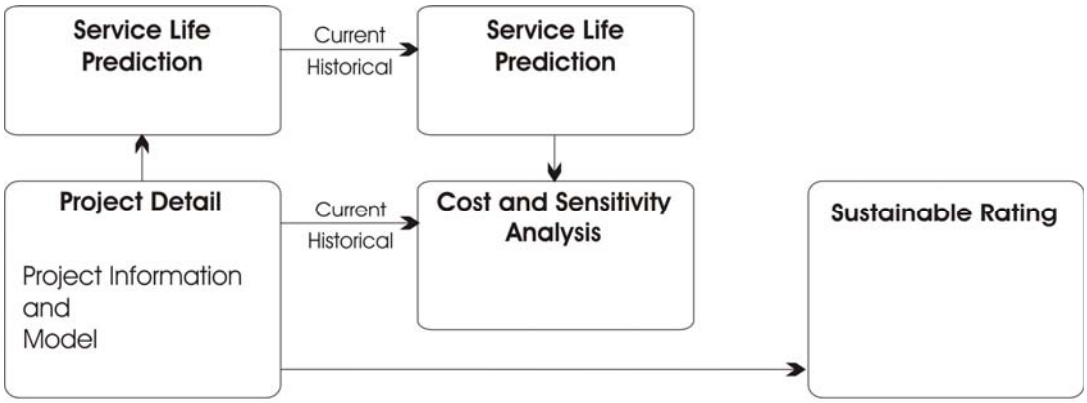

Figure 1: LICCOMS version 1.2 conceptual framework

In LICCOMS Version 1.2, the service life range of building components can be predicted either by using data from the environmental loads or by using analysis of data provided based on performance rating of buildings in regards to its performance degrees [3]. Data for the performance rating is obtained through building assessments of more than 400 buildings around Malaysia and up to 7400 building

components. The service life of building components can also be acquired from the suppliers of the building materials.

The interactions between building materials and pollutants are very complex and many variables are involved. Deposition of pollutants onto surfaces depends on atmospheric concentrations of the pollutants and the climate and microclimate around the surface. Once the pollutants are on the surface, interactions will vary depending on the amount of exposure, the reactivity of different materials and the amount of moisture present. This study characterised the environmental conditions into six zones; rural, urban, industrial, coastal, highland and island.

The components of life cycle cost consist of both present and future expenditure and thus involve elements of uncertainties. For this purpose, the present value concept or the annual equivalent concept is employed to transform all future costs into present value. A complete factual figure may be impossible to construct and certain assumptions will be necessary in order to proceed with the analysis.

The precision of life cycle costing is dependent on several factors such as inflation and cost escalation. LICCOMS Version 1.2 also takes into account the effect of interest rate and escalation rate imposed in the case of financing the purchase or development of the buildings. Data collected during the development of LICCOMS Version 1.2 has shown that the local inflation range is between 2 to 4% and the escalation of cost is about 9% [4].

The modules designed for LICCOMS Version 1.2 are Model Builder, Life Cycle Cost Analysis, Sustainable Rating and Service Life as in the splash screen shown in Figure 2. The Model Builder provides drawing capability and allows users to draw in 2D or 3D model. Determination of initial cost, finance cost, operational cost, maintenance cost and replacement cost of the building can be carried out in the Life Cycle Cost Analysis. Evaluation of sustainability for either new or existing buildings can be achieved by using the Sustainable Rating icon. Finally, the Service Life module enables users to predict service life of any building components under different environments. In this version, the software allows users to perform service life prediction base on location, building material, environmental load factors and degradation factors that affected service life of building components.

Service life prediction allows users to have access to a more reliable costing analysis and thus an effective service life and financial planning can be achieved. Figure 3 shows the service life prediction dialog box where user calculates the service life prediction of typical building components. In certain cases, building components with higher service life that might cost slightly more at initial cost but might require lesser maintenance cost in the long run compared to those components with lower initial cost but might require higher maintenance cost.

Figure 2: Splash screen of LICCOMS version 1.2

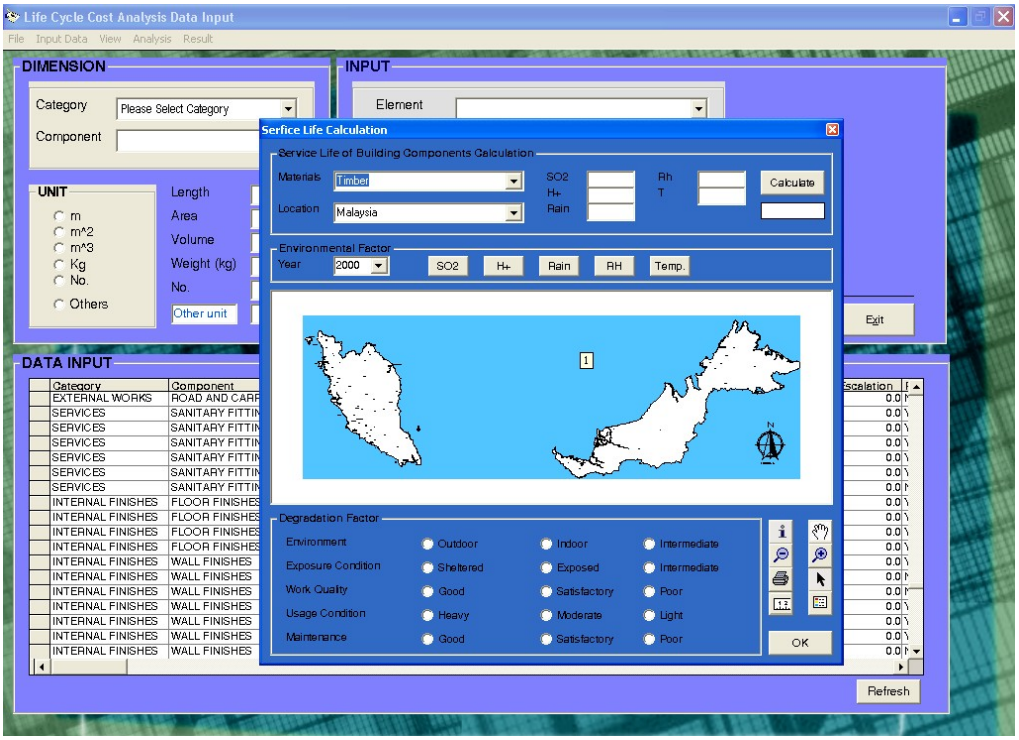

Figure 3: Data input and the service life prediction dialog box

Sensitivity analysis is among the most important features in LICCOMS Version 1.2 because it allows users to select and compare at design stage the life cycle costing of the buildings when different building materials and systems are used during the construction. The software also allows users to compare life cycle cost of buildings when different layout used and land cost per square metre in reducing project cost or maintenance cost as shown in Figure 4.

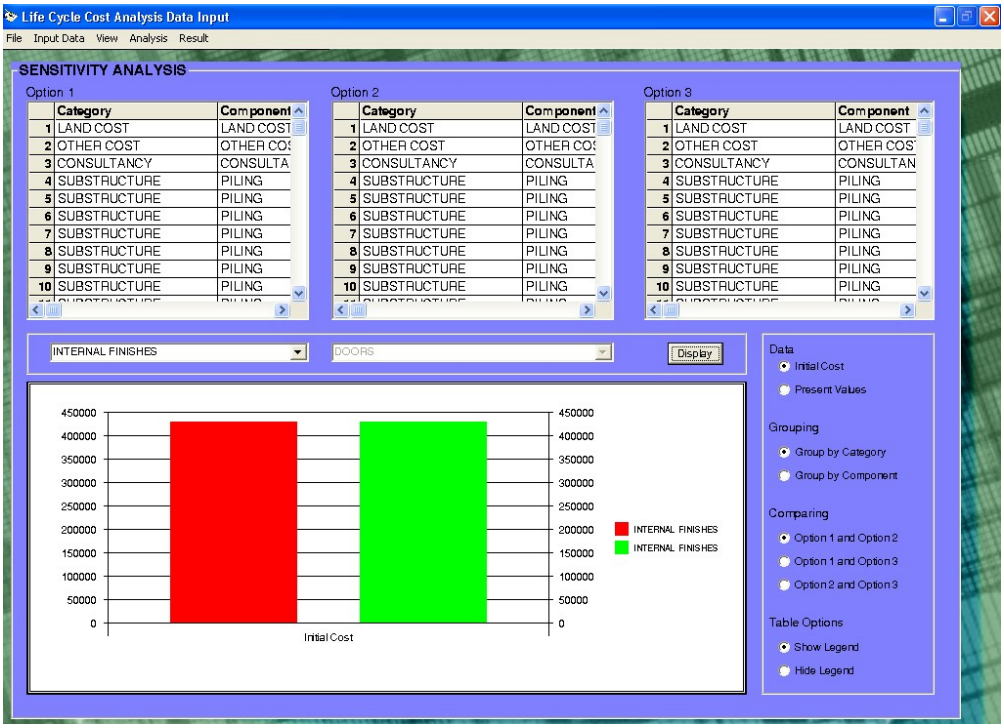

Figure 4: Sensitivity analysis

3 Strategy for Implementation

The construction industry is continuously seeking new ways in optimising the construction process as to effectively conserve energy and fuel and thus working towards sustainable buildings. Concerted efforts from the government and industry are necessary if service life planning is to be the main agenda imposed to the construction industry. Encouragement alone for the inclusion of the service life planning at design stage for any construction project will not suffice unless levies waiver are offered as a recognition from the policy makers.

Awareness among the industry players is vital to the success of implementation of service life planning in the construction industry. Dissemination of information to the players has to be carried out in ensuring awareness and willingness in inclusion of service life planning in the design of a project.

The policy makers could further play a role by ensuring developers to deliver buildings that provide greater satisfaction, comfort and value for money to the clients while maintaining standard quality of workmanship. As to respond to the global issue, sustainability in projects could be achieved by creating competitiveness among the industry players. Policy makers have to promote awareness and understanding of sustainability in protecting the environment by imposing sustainability rating to all projects in the country and awards must based the sustainability merits.

4 Conclusion

In working towards sustainable development in the local residential affordable housing, LICCOMS Version 1.2 was developed to cater for the inclusion of life cycle costing for Malaysian construction industry. LICCOMS Version 1.2 enables building owners to estimate and compare financial commitments at design stage when different materials and systems are chosen for the construction. This is to ensure that sufficient funding is provided in maintaining the buildings without compromising on the quality buildings and comfort of the occupants. In achieving effective financial planning, analysis of data on service life prediction of building components was incorporated in LICCOMS Version 1.2. Implementation of service life planning is necessary in the construction industry so as to ensure the construction industry continuously work towards sustainable buildings.

5 Acknowledgement

Researchers at Universiti Teknologi Malaysia wish to express their gratitude to Kementerian Perumahan dan Kerajaan Tempatan Malaysia in financing this project.

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