

The development of Conceptual Framework of Functional Building Performance Criteria in Historic Government Buildings

Hasnizan Aksah, Adi Irfan Che Ani, SitiHamidah Husain

Abstract: Malaysia has inherited numbers of historic government buildings from the past that have high historical and architectural value. These buildings have important roles in the administration of government matters and should perform as intended to support the organization's goals and enhance building occupant satisfaction. However, these buildings have issues associated with functional building performance criteria, for example, there are inconsistencies in the elements and criteria of building performance evaluation. Some of the other pertinent issues from the previous study were constrained by heritage regulations that effect on several requirements of building occupants such as space arrangement and conflict in balancing energy efficiency and occupants' thermal. A critical review of the literature has been carried out for the purpose of identifying the criteria. Literature review reveals that there is a need to review criteria in building performance evaluation; mainly due to variety of methodologies used in building performance evaluation and an effective and standardized way to quantify criteria of building performance is not sufficiently developed. To sustain the building efficiency, building performance evaluation is important to improve performance issues in historic government buildings. This paper highlights the construct items of functional building performance criteria as the initial framework for the development of an assessment tool. The assessment tool has a significant role to improve functional building performance of historic government buildings.

Keywords: Functional building performance, historic government building, sustainability, conceptual framework

I. INTRODUCTION AND BACKGROUND OF THE RESEARCH

The concept of building performance evaluation has a strong connection with the building occupant comfort and satisfaction. It is viewed as a concept that related to the business environment for organizations in order to meet with their objectives, productivity and increase profit margin by focusing on internal and external customer perception [1]. The main scope of building performance is to assure quality assets that are able to integrate with occupant perceptions to achieve customer satisfaction. This is supported by [2] that emphasized the activities of building performance is also the collaboration of human performance, building and social value.

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Therefore, building performance evaluation is a process that influences the value of a building by assessing how buildings work the effectiveness towards the building occupants [3][4]. The results from the performance evaluations can be used as feedback to improve the evaluated building performance. This is to ensure either the building meets the design, function, capability and technical objectives. The feedback can also highlight the current issues in building operations, including potential risk impact to the building occupants.

Meanwhile, [5] [6] define building performance criteria as an expression and translation of organization's goals and objectives, functions and activities, and environmental conditions that are required. There are various elements and criteria of building performance need to be considered in the different studies that vary depending on the type of facility and the purpose of performance evaluation [7][8]. This study is centered on functional building performance evaluation. Functional performance concerns the relationship of the building with its occupiers and embraces issues such as space, layout, ergonomics, image, ambience, communication, health and safety, and flexibility [9]. Another study mentioned functional performance evaluation addresses on how well the building supports the organization's goals and occupant needs [10]. The functional building elements also covered the ability of occupants to operate efficiently.

According to [11], historic building has architectural, aesthetic, historical, documentary, archaeological, economic, social and even political values. Its represent the ancient building culture and need to be preserved for the country's future generation. Example of historic buildings in Malaysia according to [12] are mosque, churches, palaces, clock towers, prisons, government offices, institutional and commercials, residential, schools, railway stations, hotels, forts and monuments. The term of historic government buildings is defined as the historic building that functioning in the administration of government matters. All government matters are conducted and mostly, the government owns these buildings. However, it is found that most of the historic buildings being left over and in a state of dilapidation and deteriorated [13]. It is still a vital factor to refurbish and maintain historic buildings because these buildings play important roles in becoming landmarks to any town, state or country. Besides, they also generate income from the tourism industry.



Historic government buildings should perform well in order to meet with organization goals and occupants need. However, these building may have issues that regards with functional building performance criteria. To date, there has been issues on constrained by heritage regulations and restrictions that affected judgment and decision in conservation works of any historic building [14][15]. According to the conservation principle, building conservation activities such as refurbishment works should maintain as much as possible the original building structure and fabric. In relation to this, there are several requirements of end user such as the space and room arrangement could not be achieved [16]. [17] agreed that the regulations of conservation refurbishment are far more stringent thus this may limit any conservation works on historic buildings.

Previous study identified a conflict in balancing energy efficiency and occupants' thermal [15]. In relation to this, the cost of operating a historic building is often found rather high due to energy consumption [18]. The installation of new modern services in the historic building also may affect the aesthetic value of historic building [13]. In addition, the costs of refurbishment and maintenance of historic buildings [19] are higher than normal refurbishment for other buildings. Maintaining historic building is difficult due to the deteriorated condition besides conservation regulations that require any building materials or building parts must be replaced with original parts or materials, that make the maintenance cost extremely high. Historic buildings are susceptible to deterioration due to several factors including climatic conditions, dampness and structural failures [13].

Other studies have revealed that there are inconsistencies in the elements and criteria for building performance evaluation [20]. This is supported by [21][22] that mentioned an effective and standardized way to quantify criteria of building performance from an occupant perspective is not sufficiently develop and variety of methodological and approach used in building performance evaluation. Therefore, this paper provides the initial establishment of the relevant criteria for functional building performance evaluation for historic government buildings.

II. LITERATURE REVIEW

The Concepts of Building Performance

Numerous studies have revealed that building performance has a strong integration with building occupants because their comfort and satisfaction are empowered as the indicator of a well-performed building. This is supported by [2] that emphasized the activities of building performance is also a collaboration of human performance, building and social value. Other studies have considered building performance is also related to the business environment for organizations to meet their objectives, productivity and increase their profit by focusing on the internal and external user perceptions. Through building performance evaluation, it can facilitate building benchmarking and action required at all phases of the building life cycle [21].

There are various methods used to evaluate the building performance in fulfills building occupants' requirements and satisfaction that include balanced scorecard approach, Post

Occupancy Evaluation (POE), and measurement through metrics of key performance indicators (KPIs). POE is the common method used in evaluating the building that can be tailored to a specific purpose and available[23]. Historically, building performance was evaluated in an informal manner and based on the results, it will apply in the next building of similar facility type. But, the increasing in the construction industry and technical and regulatory requirements and also the demand of clients on facilities has changed the situation. Therefore, the performance of the facilities needs to be well articulated and documented since all these requirements have to be comply and balance with the demand of clients[5].

Building Performance Elements

Organizations need to develop a clear statement about the achievement needed in evaluating building performance. The resources available to the available time and budget should be identified. The various building performance elements and criteria that will be selected for evaluation either quantitative or qualitative method should be determined by the organization. Examples of building performance elements involved are functional performance, technical performance, process performance, building services, environment etc.

However, different buildings require different performance elements and criteria. It depends on the types of buildings and the purpose of conducting a building evaluation. Results obtained can be used as feedback in improving building performance to ensure occupant comfort and satisfaction. It is important to assess building performance to ensure the building meets design, function, capability and technical objectives and also to obtain the current issues in building operations that can lead to potential risk to building occupants [23]. Lessons learned are generally obtained from mistakes, issues arising and problems that appear in buildings, so that those mistakes are not repeated by current management or in future developments [1].

Functional Building Performance Criteria

Numerous studies have shown that there are various performance criteria available in the scientific literature and included in standards and legislation that should be complied in order to achieve good building performance that addressed various elements in building performance. Existing building performance cover criteria for example energy performance, equipment performance, indoor environmental quality, space, lighting, aesthetics, noise, thermal comfort, safety, life cycle cost etc [2][5][6][7][9][10][23][24].

Data from several studies have identified that functional building performance is one of relevant element to be used because majority of the researchers agreed and applied functional performance in their research as an element that concerns on occupant satisfaction.

This is supported by [10][23] that stated functional building performance supports the occupant needs in building and addresses how well the building supports the organisation's goals and objectives. The functional requirements should focus on the business requirement that important for the organization [25].

III. TOWARDS A CONCEPTUAL FRAMEWORK

The identification of assessment areas or building performance elements that should be assessed is the initial step in establishing a framework for the development of an assessment tool. Next step is to determine the specified criteria or sub-criteria that should be involved in evaluating the functional building performance. Criteria need to be established by organization that including determining the occupant comfort and satisfaction. Therefore, all participants in the building delivery process should

understand on type and level of performance that should be achieved in a facility. Facility managers can play an important role to determine building performance criteria that need to be specified. Building performance criteria are an expression and translation of client's goals and objectives, functions and activities, and environmental condition that are required [5].

Therefore, the criteria involved in functional building performance are focused to thirteen (13) criteria, i.e. space, comfort, aesthetics, amenities, safety, orientation, circulation area, operational management, strategic value, life cycle cost, building related illness/Sick Building Syndrome and codes and regulations compliance . The constructed criteria are compiled from previous established rating tools and standard and also from precedent research.

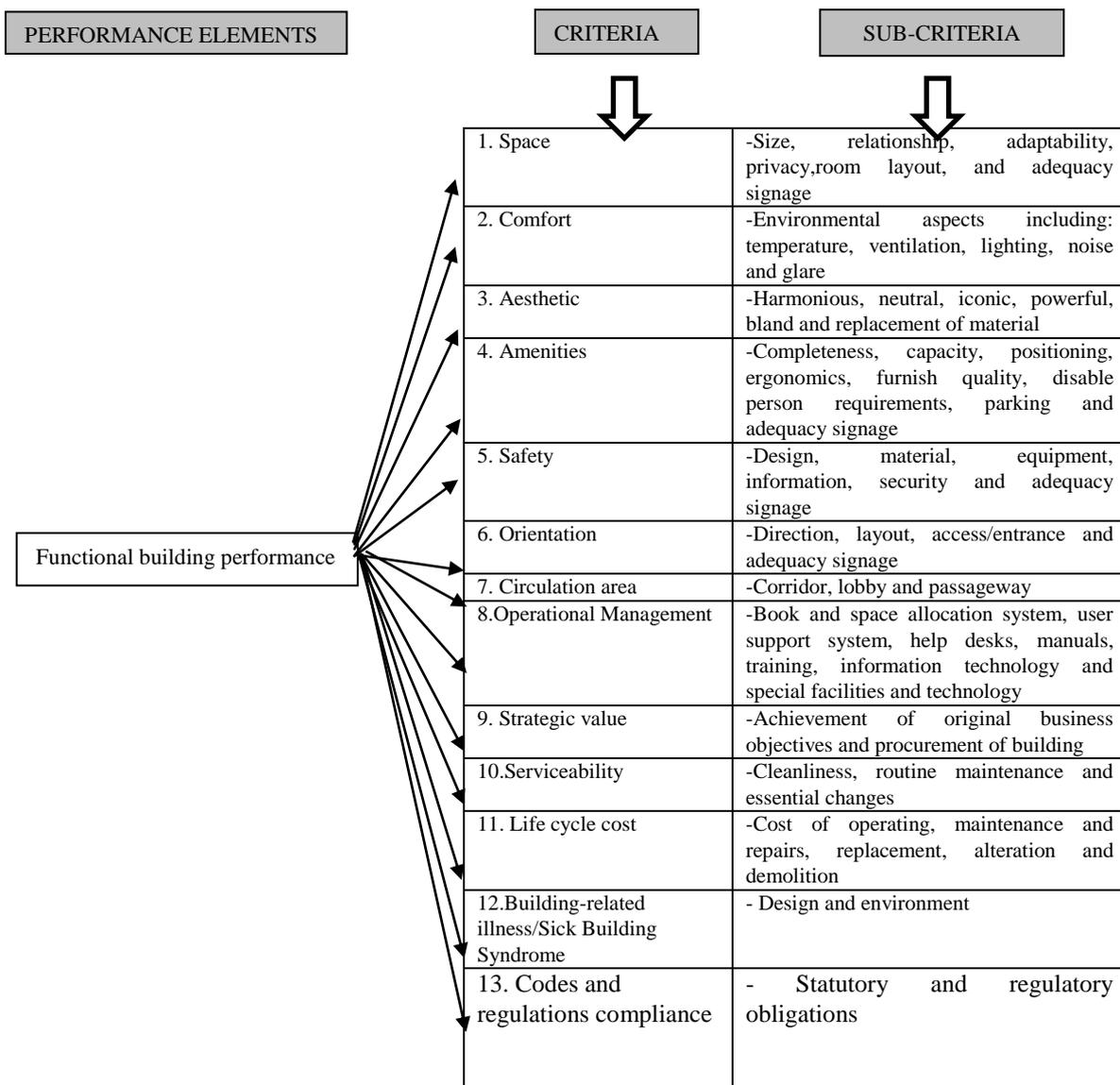


Fig. 1 The construct items of functional building performance criteria and sub-criteria as the initial framework

IV. CONCLUSION

The determinants of the criteria as indicators for functional building performance are significant in four (4) aspects: i) extend and improve on design requirements consideration for functional building performance evaluation criteria, ii) create awareness to designer and building management team on the relevant criteria may enhance occupants' satisfaction iii) contribute to the establishment of design guidelines and best practices in improving functional performance in buildings and iv) improve steps and processes to optimize functional building performance aspects and requirements in buildings. It will give benefit to related professionals, public agencies, local municipality and relevant interested parties in historic building management. It is concluded that functional building performance criteria are related to the concept of sustainable building facilities that will ensure efficient use of resources, improved environmental quality and the life cycle cost that will consequently result in sustainable building facilities. This research was limited in functional building performance element that comprises thirteen (13) criteria and fifty-nine (59) sub-criteria has made it possible to concentrate on the development of a standardized, well documented and validated method. At this stage, the framework needs to be validated in terms of suitability with local context as the survey is currently still ongoing.

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REFERENCES

1. M. Abdul and N. Khalil, "Building performance and evaluation methods: A preliminary review", *The Malaysian Surveyor*, Vol.51, No.4, pp. 18-29, 2016.
2. J.C.Vischer, "Towards an environmental psychology of workspace: How people are affected by environments for work", *Architectural Science Review*, Vol.51, pp97-108, 2008.
3. W.F.E Preiser and U. Schramm, "Intelligent office building performance evaluation" *Facilities*, Vol.20, No. 7/8, pp 279-287, 2002.
4. J.C.Vischer, "Applying knowledge on building performance: From evidence to intelligence" *Intelligent Buildings International* Vol.1, No.4, pp.239-248, 2009.
5. W.F.E Preiser, "Post Occupancy Evaluation: How to make buildings work better," *Facilities* Vol.13, No.11, pp. 19-28, 1995.
6. N. Khalil and A.H. Nawawi, "Performance analysis of government and public buildings via Post Occupancy Evaluation," *Asian Social Science*, Vol.4, No.9, pp. 103-112, 2008.
7. S. Gopikrishnan and V.M. Topkar, "Attributes and descriptors for building performance evaluation," *HBRC Journal*, 2015, pp.1-5.
8. S. Lavy, J. Garcia and M.K.Dixit, "Establishment of KPIs for facility performance measurement: review of literature," *Facilities*, Vol.28, No.9/10, pp. 440-464, 2010.
9. M.F.M Yasin and C.O. Egbu, "Harnessing knowledge management in the process of performance evaluation of facilities in Malaysia: A critical success factor" World Congress 2010, 2010.
10. A. Blyth, A. Gilby and M. Barlex, Guide to Post Occupancy Evaluation. Higher Education Funding Council for England, 2006.
11. B.M. Feilden, Conservation of historic building. Architectural Press 3rd Edition, 1995.

12. A.G. Ahmad, "Conservation of British colonial buildings built between 1800 and 1930 in Malaysia," PhD Thesis, University of Sheffield, 1993.
13. A.G. Ahmad, "Why Building Decay," Paper presented at the E&O Hotel, Penang. 1994.
14. S.N Harun, "Heritage Building Conservation in Malaysia: Experience and challenges" *Procedia Engineering* Vol. 20, pp.41-53, 2011.
15. M.A. Martines, A.I. Tort, S. Cho and J.L. Vivancos, "Energy efficiency and thermal comfort in historic buildings: A review" *Renewable and Sustainable Energy Reviews*, Vol.61, pp. 70-85, 2016.
16. A.E. Hashim, H. Aksah, S.Y. Said, "Functional assessment through Post Occupancy Review on Refurbished Historical Public Building in Kuala Lumpur" *Procedia Social and Behavioral Science* Vol. 68, pp. 330-340, 2012.
17. A. Ali and R. Zakaria, "Complexity of statutory requirements: case study of refurbishment projects in Malaysia" *Journal of Building Performance*, Vol. 3, No. 1, pp. 49-54, 2012.
18. S.N.Kamaruzzaman, E.M.A.Zawawi, A. Omar, "Preliminary evaluation of problems involved in maintaining heritage buildings in Malaysia", *The Malaysian Surveyor* Vol. 46, No.1, pp.30-38, 2011.
19. S.N Kamaruzzaman, E.M.A. Zawawi, M. Pitt, Z.M.Don, "Occupant feedback on indoor environmental quality in refurbished historic building," in *International Journal of Physical Sciences* 5(3), 2010, pp 192-199
20. I.S. Mohamad, "Performance Criteria and Parameters for Post Occupancy Evaluation of Building Performance", PhD Thesis, Universiti Teknologi Malaysia, 2010.
21. W.O.Brien, I. Gaetani, S. Carlucci, P. J. Hoes, J.L.M. Hensen, "On occupant centric building performance metrics", *Building and Environment*, Vol. 122, pp.373-385, 2017.
22. T. Sharpe, "Innovation for sustainable building design and refurbishment in Scotland", *Architectural Science Review*, pp. 127-146, 2013.
23. W.F.E. Preiser, "The evolution of Post Occupancy Evaluation", Federal Facilities Council, pp.9-22, 2001.
24. H. Aksah, A.E. Hashim, E.D. Ismail, Z. Ithnin, "Criteria overview for functional performance evaluation pertaining to refurbished historical building," *Proceedings of the Colloquium on the Administrative Science and Technology*, pp.99-106, 2013.
25. F. Szigeti, G. Davis, L.A. West and O.N.K.R. Canada, "Using the ASTM/ANSI Standards for Whole Building for most asset and portfolio decisions", ASTM/ANSI Standard, pp.507-521, 2002.