The importance of space capacity and frequency audit of a Malaysia Public University

Md Yusof Hamid *, Wan Samsul Zamani Wan Hamdan, Mohd Azian Zaidi, Mohd Fadzil Mat Yasin, Nor Amin Mohd Radzuan, Irwan Mohamad Ali

Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus, 32610 Seri Iskandar, Perak, Malaysia

ARTICLE INFO

ABSTRACT

The purpose of this paper is to present the space audit finding of a Malaysia Public University (MPU) by focusing on the capacity and frequency assessment criteria. The common problems faced by MPU regarding the space management are lack of academic office space, postgraduate space, refurbishment and maintenance issues, management unsolved space issues, space territory and others. The space audit exercise promotes a more strategic approach to facilities management in order to support the strategic objectives of the university. The space audit is conducted within three months at a selected public university in Malaysia. Data are collected through fieldwork activities, documentation review and retrieval including archival records review. This paper provides an insight into a better understanding of the application of space audit within a Malaysia public university. The findings of the audit revealed that the space capacity and space frequency rates play an important role in determining the space required by a faculty or an institution. The data have assisted the university management to clarify whether to maximize the use of existing space or to request for a new learning space. The university management needs to respond to the new demands of the stakeholders while maintaining and improving the existing purpose of research, teaching and learning that has become more complicated. Thus, it is important for the university to have a proper space management policy and planning towards future sustainable university.

1. Introduction

This paper focuses on the services related to the demand of accommodation for a university which covers on the strategic space planning and management. In space management context, the first stage in facilities management processes is to identify the range of different types of spaces provided in higher education institution which have to be met to satisfy the strategic goals thus achieving the university objectives. The types of university space can be classified as academic space, administrative office space, commercial area, student support center, library space, residential space and others. Space audit can be conducted to review the current performance or the existing position of the available space within the university.

The opportunities identified will ensure the university ability in achieving the better use of space hence improving its quality. In addition, most universities in the United Kingdom have developed their own university estate strategy. The estate strategy used SWOT analysis technique and followed guidelines provided by the Higher Education Funding Council for England (HEFCE, 2000) or best practices that initiated by the Space Management Group (SMG) for higher education institutions in the UK (SMG, 2006a). Malaysia Public University used the guidelines to determine space norms and approval application as developed in Guidelines and Rules for Building Planning by the Standard and Cost Sub-committee, Economic Planning Unit, (EPU) Malaysia (EPU, 2008; EPU, 2015). Therefore, this paper introduces the space audit assessment to evaluate the current space usage of a public university in Malaysia by referring to the EPU guidelines. This paper is divided into three main sections. First, a literature review of the space audit assessment and method that can be adopted. Second, the methodology consists of the selection of research

strategy and the calculation method to determine the space capacity and frequency audit rates as well as its assumptions. The last part of this paper deals with the summary of findings from the space audit exercises and its interpretation to university management decision making.

2. Literature review on space management audit

Space and infrastructure are parts of the group that were identified under the field of facilities management in EN 15221 (BSI, 2007), 'Facility Management: terms and definitions'. They are grouped around basic client demands. The description of work that belongs under space and infrastructure consists of (a) accommodation; (b) workplace; (c) technical infrastructure; (d) cleaning and (e) other space and infrastructure (BSI, 2007). Space management is the most important aspect of public management of physical resources and not only in terms of optimization, but also related to the cost of maintenance operations (Ibrahim et al., 2011). Therefore, university management needs to analyze the space availability for future planning especially in terms of student enrolment (SMG, 2006b). The increased number of students' enrolment will give the impact to the current and future usage of the academic space including changing the focus of students' intake from undergraduate to postgraduate students. Space audit criteria that have been developed for space audit assessment focusing on space utilization rate as a tool for assessing space needs (SMG, 2006c).

The space utilization assessment model had been developed by the National Office Audit, New Castle, United Kingdom in 1996, where it focused on occupancy rate and frequency rate to determine the percentage of utilization rate. The level of utilization rate that achieved more than 35% is considered good (NAO, 1996). The space utilization assessment model had also been adopted by the Space Management Group in 2006 by using a similar calculation method as published by National Audit Office. There is no requirement for submission of utilization rate for approval of additional new space. The spaces charging were introduced to those higher education institutions that did not reach the target of space utilization (Downie, 2005).

In Malaysia, the space utilization analysis has been used to evaluate the existing assets to accommodate current and future needs of the space within the organization (Abdul Rahman et al., 2009). The recent research conducted for the Ministry of Higher Education in Malaysia introduced five space audit criteria namely space capacity, space frequency, space occupancy, space utilization and space condition (MOHE, 2012). These criteria determine the importance of the space audit assessment and relevant for Ministry and university management decision making process. The data obtained from a space audit is used to update the university's building and academic space inventory. As example, the space capacity assessment can measure the rate of academic space usage thus determine the maximum capacity of space and density population of space usage (Hamdan et al., 2016). The space capacity audit includes room-specific tours to confirm that the space is occupied and used as designed, as well as to assess the quality of the space and physical conditions of each academic space. The result can be used in identifying space with low and high usage, estimating and forecasting future space need and for making decision related to the space allocation or space planning (Hamdan et al., 2016). The space frequency assessment criteria however are more accurate compared to the space capacity measurement. The Space frequency audit criteria identify the usage rate of the academic spaces based on the actual usage of the spaces and frequently determine the space availability for future planning (MOE, 2013). The result of space frequency creates an opportunity for the university management to efficiently and productively utilize a space such as renting out available space to other organization. In addition, the space audits provide information for the assessment of space allocations, prospective planning to accommodate changing situations and realignment of program priorities. Furthermore, the space management issues faced by the MPU contributed to the constraints of the effective facilities management decision making process. Therefore, there is a need for the development of good space management practice for MPU to overcome these constraints.

3. Methodology

The case study involved 986 nos. of learning space or academic rooms with equivalent of gross floor area of 87,428 square meters and usable floor area of 52,433 square meters at University A. The academic building comprises of main lecture hall, classrooms for teaching and learning activities, studio for architecture and art and design students, computer room, laboratory for science and engineering students, workshop for architecture and engineering students and postgraduate room. The first phase of space audit was conducted by six Researchers and 39 Research Assistants on the 6th to 11th December 2016. The second was conducted on the 19th to 20th January 2017. The summary of space audit for academic building is shown in Table 1.

3.1. Space capacity maximum measurement

Several guidelines and requirements in measuring the maximum capacity of a space building are as follows:

- Determine which categories of the population load will be adopted. The load of this population may refer to the standard planning by the government or the body of the relevant professional agencies in the construction industry. The estimation of capacity for academic room depends on the types

of spaces including equipment that been used in the room as in Table 2 (EPU, 2015).

- Determine the usable floor area (UFA) space and allocate 60% from gross floor area. The calculation is taking into accounts the whole area deduction or reduced by the space that cannot be occupied and used as walls, columns, stairs, utility room and so on. Here are the types of the calculated area based on the requirements:

- Gross Floor Area (GFA) - Total gross floor area encompasses an area of the floor is the main floor and the floor area ancillary.

- Main Floor Area (MFA) - The total area enclosed spaces only measured in wall to wall including M and E (Room motor elevator, water tank, AHU etc.) but does not include space ancillary.
- Ancillary Floor Area (AFA) - The total area covered and open space, measured from wall to wall, including sidewalks, air space, open veranda and parking.
- Usable Floor Area (UFA) - Total floor area that can accommodate users by taking into account the suitability of the related.

- Determine the space capacity score and index (Hamdan et al., 2016) as shown in Table 3.

Table 1: Summary of space audit

No	Type of Spaces	No of Spaces (unit)	Gross Floor Area (GFA) m2	Usable Floor Area (UFA) m2	Percentage (%)
1	Classroom	562	35,007	20,980	64.0
2	Studio	79	7595	4557	5.0
3	Laboratory	129	20,056	12,034	4.0
4	Computer Room	128	12,060	7236	11.0
5	Workshop	16	2388	1433	1.0
6	Lecture Hall	41	7498	4499	13.0
7	Postgraduate Room	31	2824	1694	2.0
	Total	986	87,428	52,433	100.0

Table 2: Estimate minimum capacity of academic spaces

No	Type of Spaces	Estimate Minimum Spaces (m2)	Equipment
1	Classroom	0.95	Table and chair
2	Studio	2.5–7.5	Studio table and studio chair
3	Laboratory	0.95-7.9	Laboratory work bench and chair
4	Computer Room	0.95-1.9	Computer table and chair
5	Workshop	11.0 or depend on purpose and usage	Workshop work bench, chair and equipment/ machines
6	Lecture Hall	1.0 or depend on design	Flip chair
7	Postgraduate Room	2.5	Workstation (desk and chair)

Table 3: Space capacity score and index

No	Category Score	Capacity (%)	Category Score	Description
1	Crowded	More than 100	Not Comply	Space crowded and more than maximum capacity
2	High	76-100	Comply	Optimum and efficient space usage
3	Medium	60-75	Partial Comply	Partial optimum and efficient usage
4	Low	0-59	Not Comply	Space not optimum and inefficient usage

3.2. Space frequency measurement

The space frequency measurement is using a concept of maximum hours (MH) per week that can be allocated in the academic time table and estimated between five days in a week with maximum of 8 hours per day. Total maximum time that has been allocated for this audit exercise is 40 hours a week considering that classes or activities start from 8.00am until 5.00pm.

The actual time table is referring to the existing hours (EH) that has been allocated in the time table for each of the academic rooms and endorsed by the Academic Affairs Division or the Faculty itself. For the purpose of this audit, the actual time table is based on Semester September 2016 to February 2017 session. Table 4 shows the space frequency score and index guidelines adopted from the Space Management Best Practices in Malaysian Higher Education Institutions (MOE, 2013). Formula to measure space frequency as follows:

$$Space\ Frequency\ =\ Existing\ Hours/Maximum\ Hours \times 100$$

4. Data analysis, results, and discussions

4.1. Space capacity audit

The usable floor area (UFA) for academic spaces is 52,433 square meters with a maximum capacity of 34,596 students at one time. However, the existing capacity is around 30,951 which are based on current student enrolment and the availability of furniture available on site. This capacity can accommodate up to 40,000 students in year 2020 as projected by the Strategic Planning Division of University A. The overall 986 nos. of academic space with a capacity rate of 90% are met and complied with the index developed for this study. The 562 unit of classroom capacity rate achieved 88% and complied with the index for the whole campus. The other academic spaces are recorded between 75% to 100 % of the capacity rate which is considered as compliant to the index.

The capacity rate for studio space achieved 99 % which indicates that the spaces are been equipped with adequate table and studio chairs. However, for postgraduate room, the capacity rate is more than

100% and considered as very high (108%) and crowded to the postgraduate students. This can be expected as University A is moving towards to increase the postgraduate students and to excel in research and consultation. The summary of space capacity audit for academic building is shown in Table 5.

Table 4: Space frequency score and index

No	Category Score	Frequency (%)	Description
1	Crowded	More than 100	High frequency with usage more than maximum hours allocated.
2	High	76-100	Optimum frequency and space usage
3	Medium	60-75	Partial optimum and space available
4	Low	0-59	Low frequency and space available

Table 5: Summary of academic spaces capacity audit

Type of Spaces	No of Space	Gross Floor Area (GFA) m2	Usable Floor Area	Max. Cap. (MC)	Actual Cap. (AC)	Cap. rate %
Classroom	562	35007	20980	22084	19529	88
Studio	79	7595	4557	1823	1809	99
Laboratory	129	20056	12,034	1523	1377	90
Computer Room	128	12060	7236	3808	2865	75
Workshop	16	2388	1433	181	142	78
Lecture Hall	41	7498	4499	4499	4499	100
PG Room	31	2824	1694	678	730	108
Total	986	87428	52433	34596	30951	90

4.2. Space frequency audit

The overall of 986 nos. of academic space with a frequency rate of 28% is low and does not comply with the index developed for this study. The data show that out of 35,920 maximum hours available for the whole academic spaces, only 9977 hours been utilized by program and faculties. This indicates that even when the capacity rate is higher and complies with the guidelines, the frequency criteria is still important in determining the real usage of the available space within the faculties or campus. The space frequency for 562 nos. of classrooms is low with 34% of frequency rate due to 194 nos. of classrooms which are not equipped with proper time table and have not been used during the term audit. The audit reveals that the situation occurs due to the factors of some faculties being moved out to a new campus. The space frequency for the majority of 128 nos. of computer room is recorded below than 40% with an average frequency of 27%. This shows that the computer room is not fully utilized and university management need to relook on this situation as majority of the computers are under hired basis scheme. The space frequency for studio recorded only 6% and is the lowest rate compared to other spaces.

The space frequency for 41 nos. of lecture hall recorded an average of 22% due to the changing of the student populations and the changing level of study from undergraduate to postgraduate students that creates a situation of teaching and learning with a small number of groups. Based on this situation, the university management needs to decide for the best suitable approach for space allocation. With the low frequency rate for a laboratory, computer room, workshop and studio, it creates an opportunity to the management to think of the current usage and prepare for the intervention action that can improve the situation. The summary of space frequency audit for academic building is shown in Table 6.

Table 6: Summary of academic spaces frequency audit

Type of Spaces	No of Space	Gross Floor Area (GFA) m2	Usable Floor Area	Max. Hours per weeks (MH)	Actual Hours per weeks (AH)	Fre. rate %
Classroom	562	35007	20980	22480	7730	34
Studio	79	7595	4557	3080	185	6
Laboratory	129	20056	12,034	5160	814	16
Computer Room	128	12060	7236	2960	786	27
Workshop	16	2388	1433	600	99	17
Lecture Hall	41	7498	4499	1640	363	22
PG Room	31	2824	1694	NA	NA	NA
Total	986	87428	52433	35920	9977	28

5. Conclusion

All academic spaces in a public university must be managed efficiently and effectively by the university organization. To obtain space capacity index, every university needs to conduct the space audit in stages or when it is deemed necessary by the top management. The ability to measure every learning space capacity in relation to the total number of students and standard of space planning will produce result of density for every space. The density will highlight the current space availability and also to be used for future space planning. The space capacity index is one of the significant indicators to measure space usage besides frequency rate, condition rate, and occupancy rate. Based on the above case study, it is indicated that, most of the learning spaces have achieved high density with the average capacity index of 90%. However, the space frequency rate shows the usage below than 28%

which indicates that the available space has yet to be fully utilized by the program and faculty. The result of the capacity index needs to be read together with frequency, occupancy, utilization and condition rates before any decision made for space strategic planning either to maximize existing space or to propose new requirement space by new building construction.

References

Abdul Rahman MS, Abdullah S, and Mohd Ali H (2009). Space utilisation survey (SUS) in Malaysia HEIs: Towards sustainabale usage of existing building assets. In the International Conference on Building Science and Engineering, The Puteri Pacific Hotel Johor Bahru, Penerbit UTHM, Johor, Malaysia.

BSI (2007). BS EN 15221-1:2006: Facility management. British Standard Institution. London, UK.

Downie ML (2005). Efficiency outcomes from space charging in UK higher education estates. Property Management, 23(1): 33-42.

EPU (2008). Rules and guidelines for building planning 2008. Standard and Cost Committee, Economic Planning Unit, Prime Minister Department, Malaysia.

EPU (2015). Rules and guidelines for building planning 2015. Standard and Cost Committee, Economic Planning Unit, Prime Minister Department, Malaysia.

Hamdan WSZW, Hamid MY, Radzuan NAM, and Shah AMA (2016). Study on space audit assessment criteria for public higher education institution in Malaysia: Space capacity assessment. In the 4th International Building Control Conference 2016 (IBCC 2016), EDP Sciences, 66: 00078. https://doi.org/10.1051/matecconf/20166600078

HEFCE (2000). Facilities management: Improving the management of support services in higher education. Higher Education Funding Council for England, London, UK.

Ibrahim I, Zahari W, Martin D, Sharipah N, and Sidi S (2011). Space changing model: A comparative study on cost elements in institutions of higher education. In the International Conference on Management and Artificial Intelligence, IACSIT Press, Bali, Indonesia, 6: 23-27.

MOE (2013). Space management best practices in Malaysian higher education institutions. Ministry of Education, Universiti Putra Malaysia (UPM), Kuala Lumpur, Malaysia.

MOHE (2012). Space audit report on optimization usage in public higher education in Malaysia. Ministry of Higher Education, Putrajaya, Malaysia.

NAO (1996). Space management in higher education: Good practice guides (NAO Report). National Audit Office, London, UK.

SMG (2006a). UK higher education space management project, space utilization: Practice, performance and guidelines. Department for Employment and Learning UK and UCL UK, London, UK.

SMG (2006b). UK higher education space management project, impact on space of future changes in higher education. Department for Employment and Learning UK and UCL UK, London, UK.

SMG (2006c). UK higher education space management project, case studies. Department for Employment and Learning UK and UCL UK, London, UK.