WCETR 2011

Space Charging Model: Cost analysis on classrooms in higher education institutions

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Abstract

The optimization of space management contributes to efficiency and success to most organizations. Space management is very important not only for optimization but also for cost maintenance of the respected property. The study on space management is vital for an organisation as premises (spaces) expenditure represents the second highest factor of spending resources in organisations. Subsequently, a study on space management, especially in higher educational institutions is highly critical. This study focused on space management particularly on space usage in Universiti Tun Hussein Onn Malaysia with respect to actual cost of space wastage analysed by Space Charging Model. The study specifically took place at the actual lecture room usage against the students’ time table which was made available by the Academic Management Office of the university and also considering on the operation and maintenance cost elements which are used. Noted that the space management in higher education institutions is very critical and therefore, the Space Charging technique will foster attentiveness of the costs of space and eradicate a culture which sees space as free good. It is expected that this study will contribute to greater awareness of an effective and efficient space usage by the users and more importantly this shall be reflected in the operation and maintenance cost reduction.

Keywords: Space management, cost elements, waste of space, Space Charging Model.

1. Introduction

Bernard Williams Associates (1994) explains that the facility management is a process where the organization provides support services and maintains a quality environment by using the appropriate cost to fulfil the needs of an organization. Facilities management is a new field that has a potential growth in Malaysia (Wan Zahari, 2008). Through this field, the existing facilities as the second source of the organization can be managed more efficiently. As the result, the production and quality can be increased in conjunction with the needs of the worker, user and customer of the respective organization. This will help the organisation to achieve their objectives. To achieve the organisation’s objective, space must be managed effectively (Abdul Hakim Mohammed, 2006). Space management are very important for all organisations especially for higher education institution. In fact, the expenses for a building space is the highest expenditure in most organizations or societies. The way of spending is important for the management of properties (NAO, 1996). Efficient and effective space usage will control expenditure cost and level of productivity. According to the National Audit Office (NAO) study, space management in higher educational institutions are more critical compared to other institutions. Therefore, the space and facilities management in an
organization is to be prioritized and have to be managed efficiently. But until now, most of the administrative institutions of higher education and public sector organisations, particularly from other Asian countries have yet to understand the role and contribution of these physical resources to their organisations (Ahmad Fauzi, 2005). Kenny and Foster (1985) stated that the cost which related to the physical sources is the second most important budget after staff salary in higher educational institutions. Marsh and Griffith (1985) stated that the cost of academic space for a student is about USD 2,000.00 per year. This information shows that the cost is equivalent to the cost of space per employee in the corporate organization (Hammer, 1988). The physical resources investment of higher education institutions in 1980s in USA alone was worth as much as U.S. $ 300 billion (Middleton, 1989). However, space wastage happens in all higher educational institutions including University Tun Hussein Onn Malaysia (UTHM). On average, monthly electricity cost for UTHM is RM700,000.00 or RM8.5 million a year and an average use of operating and maintenance costs of buildings for the year 2009 is RM25 million. According to a case study in Universiti Teknologi Malaysia (UTM) Skudai, building’s operational cost accounted for a staggering RM56 million a year for the whole UTM. Space management is considered important not only in terms of optimization, but also related to the cost of maintenance operations. However, operating and maintenance costs will increase if more space is used.

2. Related Works

2.1 Space management concept

In big organisations such as higher education providers, space management plays an important role to control space effectively without space wastage that could occur indirectly, resulting in an adverse impact on the cost of the organisation. Space management is one of the main sources of facility management of the integration of people, premises, process and technology (IFMA, 2005). In other words, the space available within the premises should be well managed for optimum use without wasting the space. According to Archibus (1987), space management is the effective way of managing space and to minimise cost wastage and optimise space usage. There are three important things that need to be emphasized by management. The first one is to develop a management committee members, second is a model or technique of managing the space and the third one is to ensure that employees know and understand the management of space by producing clear guidelines on how the space management is operated (NAO, 1996). The three factors are important in efficient and effective space management.

1.2 Space charging in higher education institutions

Space Charging Model is a method of managing the space. According to Griffit.G and David.H (1999), Space Charging Model is a method in which the costs will be imposed on the space in a building that is not fully utilised. Some institutions believe that effective methods of space charging can minimise the demand for the use of space and can be used in the best way without a valid waste. Cock and Frech (2001) have identified two charges based on operational asset and financial asset. The main purpose of this charge was made to remind the user that space is not free. This is essential to educate consumers not to waste space to optimize the usage of the given spaces. In addition, Weatherhead (1997) pointed out that Space Charging can also be used as a basis to determine the internal rent space to ensure that the users can understand the overall costs of operations and facilities. He suggested that all parts of the occupied space should be charged. The benefits of Space Charging Model are: it makes the cost of space more transparent, helps overcome a culture of seeing space as a free good, encourages close examination of how much space is actually needed, enables faculties and departments to take responsibility and make their own decisions regarding how much space is needed and affordable and enables rooms realised to be used for other purposes. There are four elements in space charging concept which is space to be charged, amount to be charged, mechanism for cost and the source of payment for the charge. All of these elements are subjected to the procedures and university law.
3. Conceptual Framework

According to IFMA (2005), facilities management is a profession that includes the integration of activities of different disciplines to ensure functionality of the environment with the integration of people, places, processes and technology. The dimension and scope of facilities management form a conducive and productive workplace. This study is referring only one aspect it is premises. This is because space management is located under premises. The usage of space must be identified whether it optimized or not. If space usage is under utilization, charge will be taken under Space Charging Model.

4. Space Charging Model

Figure 2 presents the Space Charging Model of the appropriate use of space for UTHM. There are three main components of cost elements for UTHM, there are civil maintenance, electrical maintenance and mechanical maintenance. The electrical maintenance cost such as telecommunication system, PA system, and electric system (not including High Tension system), mechanical maintenance cost such as fire fighting system, air-conditioning system, cool water pump system and sewerage and air compressor system, civil maintenance cost such as building cleaning, building maintenance, hygiene maintenance, and pest control maintenance. Other related costs are landscape maintenance and utility such as water, electricity and telephone. According to Frank (2006), there are two types of maintenance: first is planned (programmed, preventative and cyclical) and second is unplanned (reactive, normal response and emergency response (breakdown). All the elements above are included in the category of planned and unplanned maintenance. All components will be divided into an area for each classroom. Formula below is used to generate the cost of each class. For classrooms that do not have the optimum level of utilization, charges will be imposed on that class.
5. Research Methodology

To identify the usage level of studying space, researcher had used two methods of research. The first method is by using field study to examine the lecture room and hall and to audit the usage compare to the time table provided by the Academic Management Office and compare it with the real usage of the lecture room. The second method is to analyze the cost elements for each classroom. Charges are based on the booked room not used. Formula used by Massey University (2007) as stated below is used to analyze the cost. Block G at UTHM was selected as the study case area because there is lot of lectures being conducted in this particular building and this building can accommodate about 3180 students. Nevertheless, this research focuses only on how to develop a Space Charging Model without considering who to be charged. Therefore, it depends on the higher education management to decide this matter.

\[
\text{Total Cost} = \frac{\text{Floor Area Used} \times \text{Total Cost} \text{ per m}^2}{\text{Floor Area Used}}
\]

5.1 Indicator

The indicators below are used to measure the effectiveness of lecture room that is booked but not used. This formula was adapted from Washington State University, (2008).

\[
\frac{\text{Hours Book not Used}}{\text{Book Hours}} \times 100\%
\]

6. Analysis

6.1 Booked but not used

The graph shows an analysis of the use of the booked lecture rooms, but not use. The classroom consists of 26 classes. Based on the graph, only the E6 classroom is in optimum usage. Booked but not use is to measure the usage of booked lecture rooms as in time table but not in use. The overall time is 43 hours for a week usage from Monday to Friday and starts from 8 am until 6 pm. The highest percentage for booked but not used is the Lecture Room of E9 with 42 percent. While the lowest percentage is lecture hall D and lecture room of B7 with 2 percent. Penalties will be imposed on these factors. The details on the number of space booked but not used shown in table 1.

![Figure 3. Booked But Not Used Graph](image)

6.2 Space Charging Calculation
Calculation usage of lecture hall (Discussion Room 1)
Overall cost in UTHM = RM 19,364,133.12
Number of students in UTHM = 7336
Number of students in block G3 = 3180
Total area block G3 = 8716.250 m²
Total area lecture Discussion Room 1 = 111.755 m²
Hours session lecture conducted= 9 hours
Calculation (use the formula above):

RM 19,364,133.12/7336 = RM 2639.60
3180 X RM 2639.60 = RM 8,393,928
RM 963.02 X 111.755 m² = RM 107,622.30
RM 294.86 / 9 = RM 32.76 per hour

6.3 Charge for each classrooms and number of space booked but not used.

<table>
<thead>
<tr>
<th>Classrooms</th>
<th>Area (m²)</th>
<th>Charge Per Hour (RM)</th>
<th>Number of Space Boooked But Not Used (A Weeks)</th>
<th>Space Charge (A Weeks) (RM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion Room 1</td>
<td>111.755</td>
<td>32.76</td>
<td>2</td>
<td>65.52</td>
</tr>
<tr>
<td>Lecture Room B1</td>
<td>112.413</td>
<td>32.95</td>
<td>1</td>
<td>362.45</td>
</tr>
<tr>
<td>Lecture Room B2</td>
<td>113.377</td>
<td>32.94</td>
<td>4</td>
<td>131.76</td>
</tr>
<tr>
<td>Discussion Room 2</td>
<td>111.807</td>
<td>32.78</td>
<td>9</td>
<td>295.02</td>
</tr>
<tr>
<td>Lecture Room E3</td>
<td>112.499</td>
<td>32.98</td>
<td>8</td>
<td>263.84</td>
</tr>
<tr>
<td>Lecture Room B3</td>
<td>111.239</td>
<td>32.93</td>
<td>7</td>
<td>230.51</td>
</tr>
<tr>
<td>Lecture Room B4</td>
<td>111.800</td>
<td>32.77</td>
<td>6</td>
<td>196.52</td>
</tr>
<tr>
<td>Lecture Room E5</td>
<td>111.795</td>
<td>32.77</td>
<td>1</td>
<td>32.77</td>
</tr>
<tr>
<td>Lecture Room E6</td>
<td>112.481</td>
<td>32.77</td>
<td>6</td>
<td>197.82</td>
</tr>
<tr>
<td>Lecture Room E7</td>
<td>112.566</td>
<td>32.89</td>
<td>12</td>
<td>394.68</td>
</tr>
<tr>
<td>Lecture Room E8</td>
<td>111.779</td>
<td>32.77</td>
<td>5</td>
<td>163.85</td>
</tr>
<tr>
<td>Lecture Hall C</td>
<td>241.613</td>
<td>70.83</td>
<td>2</td>
<td>141.66</td>
</tr>
<tr>
<td>Lecture Room E1</td>
<td>111.755</td>
<td>32.76</td>
<td>7</td>
<td>229.52</td>
</tr>
<tr>
<td>Lecture Room E2</td>
<td>112.397</td>
<td>32.95</td>
<td>6</td>
<td>197.70</td>
</tr>
<tr>
<td>Lecture Room E3</td>
<td>112.375</td>
<td>32.94</td>
<td>8</td>
<td>263.52</td>
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<tr>
<td>Lecture Room E4</td>
<td>111.806</td>
<td>32.67</td>
<td>16</td>
<td>223.72</td>
</tr>
<tr>
<td>Lecture Room E5</td>
<td>111.739</td>
<td>32.76</td>
<td>5</td>
<td>163.80</td>
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<tr>
<td>Lecture Room E6</td>
<td>111.718</td>
<td>32.75</td>
<td>0</td>
<td>0</td>
</tr>
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<td>Lecture Room E7</td>
<td>111.750</td>
<td>32.76</td>
<td>4</td>
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</tr>
<tr>
<td>Lecture Room E8</td>
<td>112.463</td>
<td>32.97</td>
<td>10</td>
<td>329.70</td>
</tr>
<tr>
<td>Lecture Room E9</td>
<td>112.342</td>
<td>32.93</td>
<td>18</td>
<td>392.74</td>
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<tr>
<td>Lecture Room E10</td>
<td>111.767</td>
<td>32.77</td>
<td>9</td>
<td>294.93</td>
</tr>
<tr>
<td>Lecture Hall F</td>
<td>241.613</td>
<td>70.83</td>
<td>5</td>
<td>354.15</td>
</tr>
<tr>
<td>Lecture Hall G</td>
<td>157.679</td>
<td>46.22</td>
<td>6</td>
<td>277.32</td>
</tr>
<tr>
<td>Lecture Hall D</td>
<td>157.679</td>
<td>46.22</td>
<td>1</td>
<td>46.22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>174</td>
<td>RM 6,076.22</td>
</tr>
</tbody>
</table>

7. Discussion

Overall, there are 25 classrooms was not in optimum use. The percentage of space wastage is between 2 percent to 42 percent. The classroom not in use can contribute to wastage of space. This has lead to the contribution of wastage of electric utility likes, lamp and fan and also for air conditioning because all of the equipment's were operating without user. Waste of space needs to be resolved because it can result in increased operating costs and maintenance of the particular building. In order to overcome the problem of wasted space, methods of Space Charging Model approach plays a role in determining the charges for the space not fully utilized. The charges to be imposed are depending on the result of space audit which will be done for the respective space. The audit is based on the time table from the Academic Department Office compare with the real usage of the classes. Charges are based on space audit conducted on the space. Table 1 above shows the cost of charges hourly, number of space wastage and the penalties imposed for each of the classroom in blocks of G3. Penalties can be imposed on booked classrooms but not used. The total penalty/cost for all classrooms is RM 6076.22. So, the university had to incur significantly large amounts of money within a week in which its use begins at 8 am till 6pm daily from Monday to Friday if the classroom is not used. Parties who do not use the classroom will be charged but this paper only focus
on how to develop a Space Charging Model and not to be determining who must pay for the charge. However, this study not only limits to the imposition of charges but also for internal rent. In addition to the imposing charges for space wasted which can generate income for university. This income can be used as university funds.

8. Conclusion

This paper has attempted to describe how higher education institutions have large and valuable physical resources that can help in fulfilling the vision and their goals in accordance with the new and more challenging world. It also discussed how these physical resources could be managed. Nevertheless, this physical resource can be managed efficiently and effectively by using the best way for space management. Space Charging Model is the best purposed method for space management tool. This method is supported by NAO and has been certified as the best method in 1996. Many facilities experts said that this method is the best management tool (NAO, 1996). Analysis and discussion of these studies have already shown that these resources are in very large value and sadly wasted if not fully optimized. The amount of RM 6,076.22 a week is a large number of major institutions of higher education institutions such as UTHM. The institutions of higher education institutions such as universities, polytechnics and colleges are the main source of economic activity. They have a physical resources and a big properties user. The size of this resource inventory, the cost of providing, maintaining, and operating and technical complexities faced was developing rapidly. However, the physical resources are the supporter of the functions (support function) and the largest non-academic staff in institutions of higher education. From the above discussion, space management model can be considered as a systematic approach for space management tool, thus leading to a continuous support of the organization’s objective. Hopefully, this study can provide awareness to users about the importance of optimum use of space and not see space as a free good. In such a case, other higher education institutions can develop their own Space Charging Model with the appropriate cost elements to improve space management technique for their institutions. Indirectly, they have come to appreciate the space that they possessed. Therefore, if physical resources can appropriately be dealt with efficiency and effectiveness, it has the potential to help the institutions of higher education institutions to implement and achieve its objectives, particularly in the lack of budget challenges and demands of the public and stakeholders about the functions of higher education institutions as the center of knowledge and economic catalyst.

9. Acknowledgment

This work is supported partially by University Tun Hussein Onn Malaysia and the authors would like to thank the supervisor for his ideas and time and also all of the support received from relevant parties to the success of this research. Moreover, the authors are also grateful to the anonymous referees for helpful comments and numerous suggestions to improve the paper.

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