VALUE ADDING SPACE MANAGEMENT IN HIGHER EDUCATION

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ABSTRACT

Purpose: Develop a methodology for space optimisation in educational facilities, that can add value to organisations with particular focus on gymnasiums in Denmark.

Background: Gymnasiums are pre-university higher educational institutions, which in 2007 went from being state-owned to being self-governing. Many older gymnasiums face the challenge that the institutions’ buildings and spaces are unsuitable to support modern teaching methods. A space optimisation process can help overcome some of these challenges as long as it makes use of a holistic analysis, is related to the strategic objectives of the organisation and reflects the organisational culture as well as the teaching methods.

Approach: The research is based on case studies of two gymnasiums utilising an array of different methods based on a combination of the evaluation methodologies Post Occupancy Evaluations (POE) and the Norwegian USEtool. The study examined which aspects should be included in a space optimisation process in order to add value and included extensive user involvement.

Results: A number of space optimisation initiatives that could lead to improvements in space utilisation as well as in the learning environment were identified. The study also provides a critical assessment of POE and USEtool, and proposes a new space optimisation process.

Practical implications: The research provides examples of how value adding space optimisation processes can be undertaken using a combination of different methods, including extensive user involvement, and recommends a new space optimisation procedure.

Research limitations: The research is based on two case studies of gymnasiums in Denmark, which limits the possibility to generalise, and the new recommended procedure has not been tested.

Originality/value: The study provides a critical evaluation of the combined use of POE and USEtool and represents an original contribution to the development of knowledge and methodology of value adding space management.

Keywords: Space Management, Higher education, Learning environment, Value adding, Case study
1 INTRODUCTION

The purpose of this research is to develop a methodology for space optimisation in educational facilities, which adds value to the organisations with particular focus on gymnasiums in Denmark.

Gymnasiums are pre-university higher educational institutions (HEI), and they currently face a number of challenges, which makes it relevant to optimise their use of resources, including the utilisation of space (Tinsfeldt, 2013):

- In 2007 all Danish gymnasiums changed from being state-owned to being self-governing and today they to a high degree function as independent companies.
- As part of the Danish state budget for 2012 the government in November 2011 decided to introduce a maximum number of 28 instead of earlier 32 students in each class in gymnasium educations.
- The public payment per student in gymnasium educations will be reduced during the period from 2012 to 2016, which will cause severe organizational and economic challenges for several institutions.
- The buildings belonging to many older gymnasiums are not suitable to support modern educational environments and teaching methods, which are prescribed in the recent reform of gymnasium educations.

A space optimisation process can help overcome some of these challenges as long as it makes use of a holistic approach and acknowledges, that space optimisation is not only about placing more people on less space but that it has an influence on the overall learning environment. A space optimisation process should according to literature be related to the strategic objectives of the organisation and reflect the organisational culture as well as the teaching methods.

The research is empirically based on case studies of two gymnasiums. The case studies included an array of different methods, such as document studies, interviews, walk-throughs, observations and questionnaire surveys. The methods were based on a combination of the evaluation methodologies Post Occupancy Evaluations (POE) and the Norwegian USEtool. The study examines which aspects should be included in a space optimisation process in order to add value. The space analyses were based on an extensive user involvement to provide insights in the opinions of the primary stakeholders.

Based on the evaluations the case studies identified a number of space optimisation initiatives for each gymnasium that could lead to improvements in space utilisation as well as in the learning environment. The research also included a critical assessment of POE and USEtool based on the completed space optimisation analyses and the development of a new space optimisation procedure which can be used to ensure added value at gymnasiums in general.

This paper briefly summarizes the empirical findings. However, the main focus is on the assessment of the evaluation methodologies and presenting the proposed space optimisation procedure.
2 STATE OF THE ART

Space Management (SM) is an essential aspect of Facilities Management (FM). The purpose of FM is to support and improve the effectiveness of the primary processes in an organisation (CEN, 2006). SM is about the management of space in facilities, and this paper particularly focuses on the management of space in educational buildings.

The development of FM has particularly in practice for a long time been dominated by a focus on cost reduction. Optimisation of space utilisation can be a very important way to save cost, because use of less square metres can reduce the cost for providing, operating and maintaining the space (Ibrahim et al., 2011). However, it is just as - or perhaps even more - important, that FM adds value to the organisation (Jensen et al., 2012), and improving the way the space supports the needs of the organisation is an essential way for FM to add value. This general dilemma for FM is illustrated in Figure 1. It is a crucial management task in FM to balance the demand and supply of space and at the same time balance the considerations for minimizing cost and adding value.

In accordance with this dilemma we can distinguish between two approaches to space optimisation. A quantitative approach which addresses space utilisation in terms of the amount of square metres with a main focus on reducing cost, while a qualitative approach focuses on changing the way that space is used to improve the effectiveness of the primary processes. In this research we want to combine these two approaches to develop a methodology that is aimed at achieving an optimised space utilisation and organisational impact at the same time. This is what we call Value Adding Space Management. It is important that the strategies for FM and SM are synchronised and aligned with the vision, mission and strategy of the core business organisation to achieve successful results (Mosbech, 2004).

A large number of methods have been developed for both quantitative and qualitative space analyses and evaluations. Quantitative measurements of space utilisation can provide important data, because the users’ perceptions of space utilisation often are very different from the actual space utilisation (Ibrahim et al., 2012). A quantitative analysis will provide objective data about the company’s space utilisation which hardly can be contested (Mosbech, 2004). However, there will often be special circumstances in the specific type of business or organisation that needs to be taken into consideration in quantitative analyses, for instance.
hours of operation. Therefore, it is difficult to identify a generic process for collecting quantitative data.

There are some international studies of the quantitative space utilisation of higher educational institutions. Biddison and Hier (1998, in Downie, 2005) conducted such a study of American institutions showing a space utilisation in some institutions as low as 20% and rarely above 50%. A study by Downie (2005) in English institutions conducted in 2002 showed a space utilisation of approx. 50%. Che Ani et al. (2012) have developed an index for space utilisation as shown in Table 1. This has been used as a guideline in our study.

<table>
<thead>
<tr>
<th>Index</th>
<th>Range</th>
<th>Indicator</th>
<th>Usage intervals percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-1</td>
<td>Minimal Usage</td>
<td>0-50 %</td>
<td>The usage frequency at the low Level</td>
</tr>
<tr>
<td>2</td>
<td>1-2</td>
<td>Optimal Usage</td>
<td>51-75 %</td>
<td>The usage frequency at the best Level</td>
</tr>
<tr>
<td>3</td>
<td>2-3</td>
<td>Maximal Usage</td>
<td>76-100 %</td>
<td>The usage frequency at the high level</td>
</tr>
<tr>
<td>4</td>
<td>3-4</td>
<td>Critical Usage</td>
<td>&gt;101 %</td>
<td>The usage frequency at the crucial stage because it has exceeded the typical time</td>
</tr>
</tbody>
</table>

There have also been some international studies showing the qualitative importance and impact of educational facilities. The effectiveness and performance of students and teachers depends according to Earthman (2002, in Hasbullah et al., 2011) and Ismail (2002, in Che Ani et al., 2012) on the quality of their school environment. Furthermore, schools with modern and functional equipment give the students better opportunities to perform (Earthman, 2004). Even though technology has become a part of the modern school, there are still many school buildings that do not support the use of the technology, and which are far from supporting the teaching methods, which are commonly used in the 21st century (Kuuskorpi and Gonzáles, 2011). To achieve a satisfactory quality of education it is extremely important, that the buildings and the spaces in schools fulfil the requirements of society and FM has a crucial role in ensuring this (Mei-yeung and Fung, 2005).

3 APPROACH

The evaluation of the two case studies - Herlev Gymnasium and Falkonergården - has in general followed the procedure for building evaluation with three stages which is recommended by Ornstein et al., 2005. The first stage is the data collection, the second is the analysis of each case with diagnosis and recommendations, and the third stage is a comparative analysis resulting in general recommendations. The procedure as adapted to our study is shown in Figure 2.

There are a huge number of different methods and techniques for evaluation of buildings and spaces in use with various combinations of qualitative assessments and quantitative measurements. Fronczek-Munter (2013) has identified more than 150 different techniques. In this study we have used a combination of the more general methodology called Post-Occupancy Evaluation (POE) and the recently developed Norwegian tool for usability evaluation of buildings called USEtool.
POE was developed in the 1960’s in USA and is today the most well-known method to evaluate buildings. The name refers to the evaluation being conducted after a building has been occupied. According to Preiser et al. (1988, Blakstad et al., 2010) POE is: “[...] the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time”. There are many versions of POE. In this study we have mostly used the version published by the Higher Education Funding Council for England (Blyth et al., 2006).

POE is in general divided in 3 areas: Process, Functional Performance and Technical Performance. In relation to space optimisation Functional Performance is most relevant and therefore this is the area of POE that has been of interest for our study. The different aspects that can be involved in a functional evaluation are shown in Table 2. Our study, however, has not included the cost aspects.

<table>
<thead>
<tr>
<th>Strategic Value</th>
<th>Achievement of original business objectives.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetics and Image</td>
<td>Harmonious, natural, iconic, powerful, bland.</td>
</tr>
<tr>
<td>Space</td>
<td>Size, relationships, adaptability.</td>
</tr>
<tr>
<td>Comfort</td>
<td>Environmental aspects: lightning, temperature, ventilation, noise, user control.</td>
</tr>
<tr>
<td>Amenity</td>
<td>Services and equipment: completeness, capacity, positioning.</td>
</tr>
<tr>
<td>Serviceability</td>
<td>Cleaning, routine maintenance, security, essential changes.</td>
</tr>
<tr>
<td>Operational Cost</td>
<td>Energy costs, water and waste, leases, cleaning insurance.</td>
</tr>
<tr>
<td>Life-cycle Cost</td>
<td>Initial constructions costs, cost of operating, maintenance and repairs, replacement costs, alterations demolition.</td>
</tr>
<tr>
<td>Operational Management</td>
<td>Booking and space allocation systems, user support systems, help desks, manuals, training.</td>
</tr>
</tbody>
</table>
USEtool is an evaluation methodology that in contrast to POE does not focus on a building’s technical performance but on the usability of the building. USEtool is a quite new methodology that was developed as part of a research project in Norway (Hansen et al., 2011). The aim was to develop a tool with focus on evaluation of the effectiveness of a building, which can be used by internal FM units in large organisations to evaluate their facilities together with the users. An essential part of USEtool is a facilitated walk-through in the buildings followed by a workshop together with users. USEtool consists of 5 phases as shown in Figure 3.

The study included an array of different methods for data collection selected from the methodologies of POE and USEtool and decided in collaboration with the management of the two schools. Blyth et al. (2006) present a matrix with recommended methods for different types of POE, which has been used as a guideline in our study together with the methods in USEtool mentioned in Figure 3. Based on that we have utilized the following methods:

- Initial interview with the head of school and the facilities manager at each of the two gymnasia (Herlev Gymnasium and Falkonerergården) to get general introduction to the school, available documents like drawings etc. and make agreement about the case study procedure.
- Walk-through together with the head of school and the facilities manager at Herlev Gymnasium and with the facilities manager at Falkonerergården.
- Observations at each gymnasium during school hours with focus on shared spaces on 3 days at different times.
- Interviews with teachers at each gymnasium – 4 at Herlev Gymnasium and 3 at Falkonerergården – besides the heads of school, who also teach at each their gymnasium. At Falkonerergården one of the teachers interviewed also is responsible for planning the teaching schedules.
• Interview with the student who is chairman of the student council at Herlev Gymnasium.
• Questionnaire survey with students representing 3 classes at 3 different levels at each gymnasium filled in on-line during school hours supervised by teachers resulting in a response rate of 100%.
• Document and information studies of drawings, reports and the schools’ intranet.

The main limitation of the methods, compared to what we ideally would have wanted, is that it was not possible to interview students except for the chairman of the student council at Herlev Gymnasium and that it was not possible to arrange focus group meetings and workshops with users.

4 RESULTS

4.1 Case presentations

Aerial photos of the two gymnasiums are shown in Figure 4 and 5, respectively. Both are placed in greater Copenhagen, but they are not part of the Copenhagen Municipality.

Figure 4: Aerial photos of Herlev Gymnasium

Herlev Gymnasium is placed in Herlev Municipality, which covers a suburban area northwest of Copenhagen. The institution is accommodated in one building, which was finished in 1976 and designed as a typical concrete panel building shaped as a rectangular box in 2 storeys. The gymnasium has approx. 800 students and a staff of approx. 110.

Figure 5: Aerial photos of Falkonergården
Falkonergården is placed in Frederiksberg Municipality, which is an old urban area surrounded by the Copenhagen Municipality. The institution has several connected buildings built in 1955, but also rent space in the neighbourhood. It has approx. 1,000 students and a staff of approx. 100.

4.2 Strategic value and optimisation proposals
The case studies show that none of the two gymnasiums have managed to integrate their use of space in accordance with their overall strategic goals for the institutions. The analyses confirm that it is essential that a space optimisation process is based on the values and the strategic goals of the organisation. For Herlev Gymnasium the aim of the space optimisation was mostly qualitative with a focus on creating spaces that better can support the teaching, motivate students and teachers and attract more students. For Falkonergården the aim of the space optimisation was mostly quantitative with a focus on an increase of the utilisation of existing spaces to accommodate an increasing number of students but also if possible to avoid rented space outside the school buildings.

Besides defining the purpose and clarifying the specific conditions at the institution in question it is also important that the space optimisation project includes an analysis of the less concrete aspects like the culture and the habits of the users, which can be crucial in developing specific proposals for optimisation. A holistic approach and an all-round insight can ensure that the proposals are not only based on a superficial and theoretical understanding but that the proposed solutions after implementation really create the added value that is demanded. Both aspects can be revealed by involvement of the users in the process. This can also help to ensure that the optimisations do not improve some aspects at the expenses of others.

The project resulted in 11 proposals for space optimisations at Herlev Gymnasium and 7 at Falkonergården. Even though the purpose of the space optimisations and the layout of the existing buildings are very different for the two institutions, there are also some striking similarities:

- A lack of development of the school buildings in relation to changes in the teaching activities that takes place in the building, including an increasing use of group work
- Limited and insufficient spaces dedicated for teachers to prepare
- The possibilities to make quantitative space optimisation are limited

We do not know whether these problems are general for other gymnasiums in Denmark, but we hypothesise that many other gymnasiums in older buildings face similar problems as Herlev Gymnasium and Falkonergården.

4.3 POE and USEtool
POE has contributed to specify which aspects should be included in the analyses, including most importantly the first four in Table 2: Strategic Value, Aesthetics and Image, Space, and Comfort. These aspects have helped to make the results from the two schools comparable to some degree. POE has also contributed with specific procedures to be used in the analyses and made it possible to relate the space optimisation to the people using the spaces and who eventually will be affected by an implementation.

USEtool has contributed to give structure to the evaluation and to put focus on the users of the spaces. USEtool have provided a useful overall frame for the process. The focus on in-
Involving the users has given the analysis multi-sided aspects, which has helped to provide a holistic analysis of all relevant aspects in the space optimisation.

The study has revealed a number of advantages and drawbacks of both methodologies. An overview of these is shown in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POE</strong></td>
<td>• Includes many different aspects which all are seen as relevant in relation to space optimisation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Several methods can be used to conduct the analyses</td>
<td>• The lack of structure (freedom of choice of methods) makes it difficult to decide the optimal procedure of the analyses</td>
</tr>
<tr>
<td></td>
<td>• Works well as a checklist to cover many important aspects</td>
<td>• There is no clear definition of which users that should be involved in the analyses of the different areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Only to a limited degree presents concrete procedures in relation to interviews, questionnaires, observations etc.</td>
</tr>
<tr>
<td><strong>USEtool</strong></td>
<td>• The methodology solely focuses of the needs and wishes of users, which is seen as relevant considering that the space optimisation mostly affects the users</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• USEtool is a structured methodology which clearly describes the procedure of the analyses</td>
<td>• It cannot be taken for granted that the users are capable of evaluating the usability of a building</td>
</tr>
<tr>
<td></td>
<td>• USEtool is flexible and can be adapted to the organisation in question</td>
<td>• The perception of the usability of a building can be very subjective, which makes it difficult to generalise the different views in a group of users</td>
</tr>
<tr>
<td></td>
<td>• USEtool encourage to involve several different groups of users</td>
<td>• Based on our experiences from the two case studies the phases in USEtool do not seem to be optimal</td>
</tr>
</tbody>
</table>

Among these is that POE functions as an efficient check list, which ensures that all the essential aspects are included in the evaluation of existing spaces. The lack of structure in POE on the other hand makes it difficult to decide in which order the analyses should be carried out.

One of the advantages of USEtool is that it helps structuring a space analysis and at the same time involves different stakeholders, which ensures an all-round analysis. One of the pitfalls of USEtool is that if the user involvement is not handled appropriately it may create a false picture of the actual situation. Furthermore, the division in phases in USEtool does not seem optimal from our experiences and the methodology in the present form does not call for iterations between the different phases, see section 4.4.

The two methodologies complement each other as POE defines relevant aspects for the analysis and USEtool contributes with a structure to the analysis. Thus, we find that a combination of the methodologies creates a synergy effect compared to using the methodologies individually. Figure 6 illustrates how the two methodologies diverge and overlap.
4.4 Proposal for a new procedure

Based on experiences from the two case studies and the combined use of POE and USEtool as a basis for data collection, space analyses and proposing space optimisations we have developed a proposal for a new procedure for space optimisation in HEI. The procedure includes 7 phases, which are described in Table 4. The first phase is crucial to frame the project in relation to the specific organisation, the strategic situation and defining the purpose together with the school management. For the project to add value it is essential to define which kind of value the project should aim at. This is suggested to be specified in a number of success criteria.

The procedure includes both qualitative and quantitative data collections with an extensive involvement of the primary stakeholders covering teachers and students as users. This covers interviews, observations, focus groups, walk-throughs, questionnaire surveys and workshops. The project is expected to result in proposals for both qualitative and quantitative space optimisations.

USEtool only includes one walk-through, but in the new procedure we have included two walk-throughs in different phases. In the start of the project the new procedure in phase 1 includes a walk-through, which supports a visual introduction to the buildings with some of the stakeholders (head of school and facilities manager) and later in phase a walk-through with the primary stakeholders (teachers and students). We find this important as the “two” stakeholders groups most likely have different views on the space utilization. Furthermore, USEtool does not include a phase which allows a larger group of stakeholders to get involved in the space evaluation which the new procedure includes as questionnaire survey(s) in phase 5, which can involve separate surveys for students and teachers.

5 PRACTICAL IMPLICATIONS

The research provides examples of how value adding space optimisation processes can be undertaken in HEI by using a combination of different methods and extensive user involvement. Based on two case studies utilising a combination of the methodologies POE and USE-tool it proposes a new procedure for space optimisations. The procedure can be used by the
management of HEI and by consultants for HEI. The procedure can also give inspiration for space optimisation in other types of organisations.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Objectives</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clarification of purpose and success criteria</td>
<td>Interview the head of school and the facilities manager</td>
</tr>
<tr>
<td></td>
<td>Identifying stakeholders</td>
<td>Walk-through with the head of school and the facilities manager</td>
</tr>
<tr>
<td></td>
<td>Preparing project plan and clarify resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collection of data about the organisation, the buildings and space challenges</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Collection of data about use of space</td>
<td>Observations and interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analyse space utilisation</td>
</tr>
<tr>
<td>3</td>
<td>Discussions about the existing use of space</td>
<td>Focus groups with the primary stakeholders</td>
</tr>
<tr>
<td>4</td>
<td>Clarifying which space solutions work well and not well – generally and related to specific aspects of the analysis</td>
<td>Walk-through with the primary stakeholders</td>
</tr>
<tr>
<td>5</td>
<td>Involvement of a larger groups of stakeholders</td>
<td>Questionnaire survey</td>
</tr>
<tr>
<td>6</td>
<td>Preparation of proposals for space optimisation and implementation plan</td>
<td>Workshop with the primary stakeholders, the head of school and the facilities manager</td>
</tr>
<tr>
<td>7</td>
<td>Implementation of space optimisations</td>
<td>Churns, rebuilding etc.</td>
</tr>
</tbody>
</table>

6 CONCLUSION

Space optimisation should be regarded as a complex activity which cannot be characterised by one correct procedure or with only one right solution. To create added value it is necessary that the space optimisation focus on exactly the aspects relevant for the specific organisation, its strategy and circumstances that define the purpose of the project.

The case studies showed that both gymnasiums lack a development of the school buildings in relation to changes in the teaching activities that takes place in the building, including an increasing use of group work. Many other Danish gymnasiums in older buildings might face similar problems.

Several space optimisation initiatives that could lead to improvements in space utilisation as well as in the learning environment were identified. The study combined the methodologies POE and USEtool and provides a critical assessment of these methodologies. The methodologies complement each other. A new procedure for space optimisation in HEI is proposed including a structured combination of aspects included in POE and USEtool.
The research is based on two case studies on Gymnasiums in Denmark, which limits the possibility to generalise, and the new proposed procedure for space optimisation in HEI has not been tested.

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