Occupancy Costs Benchmarks for schools and sport facilities in Germany

Elisabeth Beusker
Research Assistant
Institute for Construction Economics
University of Stuttgart
Germany
elisabeth.beusker@bauoekonomie.uni-stuttgart.de

Prof. Dr. Christian Stoy
Full Professor
Institute for Construction Economics
University of Stuttgart
Germany

Summary

Sustainable and cost-optimized real estate can only be planned, built and used if the interrelationships existing between occupancy costs and their underlying drivers can be confirmed and translated into the practice of real-estate management. This empirical study determines and quantifies the relevant factors impacting on occupancy costs (e.g. water, heating energy, electricity) of schools and sport facilities in Germany by multivariate regression analysis to provide detailed cost indicators for an internal or external benchmarking and to help property owners identifying how they can better reduce occupancy expenditures.

Keywords: occupancy costs, water, heating energy, electricity, benchmarks, buildings, multivariate analysis, financially sustainability

1. Background

Over the past few years, extensive changes in German education policy have required that significant investments be made in both the development and maintenance of schools. This has resulted not only in higher occupancy costs - as a result of increased administrative costs, costs of utilities, waste disposal, cleaning and maintenance - but also a growing contingent of concerned investors. Municipalities like Stuttgart (Germany) see these changes as cost burdens negatively impacting both the short and long-term benefits on their real estate investments. For municipalities the problem of occupancy costs cannot be solved fast enough, however for that to happen it is important to determine what comprises and drives these expenditures.
According to DIN 18960:2008 [4] occupancy costs encompass the following cost types:

- Capital costs (e.g. external funds, equity capital, depreciation)
- Real estate management costs (e.g. labour costs, material costs, external services)
- Operating costs (e.g. costs of utilities, waste disposal, cleaning and maintenance of the building and external structures, inspection and maintenance of technical installations, security and control services, taxes)
- Maintenance costs (e.g. costs of maintenance of the building, technical installations, external structures and interiors)

Capital costs are directly related to the size of the initial investment and almost represent about 60% of the total amount of occupancy costs [5]. Also, when planning operating costs it is important to note how the underlying costs are sequenced. The reason is that the planning process is based on discounted cash flows, which leverage the amount of expenses as well as discount periods and

interest rates. Knowing what costs are coming in at what time allows one to better take advantage of these variables. In refer to Pfarr [2] the amount of occupancy costs always depends on the following factors:

- Usage (e.g. type, standard, intensity of use)
- Building characteristics (e.g. geometry of the building, durability of technical installations)
- Strategies (e.g. maintenance strategies, outsourcing rates)
- Location (e.g. topography)
- Market dynamics (e.g. capital market, real estate market)

2. Defining the problem

While the interrelationships between occupancy costs and their drivers can be in principle described, transferring that information into the practice of real estate management, to create an agreed upon standard for mitigating occupancy costs, has proven to be rather challenging. The simple reason is that there are no set design rules or basic conditions for planning, building or using real estate. Further complicating the situation is that it is nearly impossible to forecast what the total size of occupancy costs will be. Referring to investment costs this forecast uncertainty can be determined. According to Ruf [1], in Germany the discrepancy between the initial assumptions around investment costs and the final confirmed costs runs as high as 20-30%. In refer to occupancy costs, the need for statistically valid data is evident in order to produce accurate estimates and reliable benchmarks.

3. Objective

Sustainable and cost-optimized real estate can only be planned, built and used if the interrelationships existing between occupancy costs and their identified drivers can be confirmed and translated into practice. This empirical study seeks to make such a confirmation by quantifying the relevant drivers of occupancy costs. Based on these findings it will be possible to create occupancy cost benchmarks for early project phases and to accurately forecast occupancy costs.
The study will examine occupancy costs and all the factors that go into those costs, of 150 municipal buildings. Contained therein, will be descriptions of the relevant cost drivers, the design rules and basic conditions for planning, building and using financially sustainable real estate.

4. State of the art

In Germany, the examination of occupancy costs comes primarily from two sources. First, there is the research done by Horst Küsgen in the 1970's [6] and then there is Siegel and Wonneberg's [7] empirical study showing how occupancy costs affect commercial buildings. There have been further discourses on the subject, most notably in the 1990's when facility management companies started publishing incidental cost analyses for office buildings, see Office Key Report [8] and OSCAR [9]. In Switzerland, FM Monitor [10] published the first full-cost survey of office buildings (pom+Consulting AG, 2007). While the company identified benchmarks and cost drivers, it took a very narrow view of occupancy cost - ignoring capital and maintenance costs - which diminished the significance of the results. There is also research being done on occupancy costs in other countries. To see how it compares with what has been uncovered in Germany and Switzerland, please see table 1.

The most extensive work being done on this subject comes from the GSD Graduate School of Design at Harvard University [11], which recently looked at 1,2 million accommodation units to better understand how occupancy costs impact real estate investments. With the focus on residential buildings, the location represents a relevant cost driver in the design of the study. For this study especially the specifications of the data analysis are important.
The described researches present the different field of studies in which occupancy costs are

partially investigated. The most relevant approach to this study is done by Stoy [5] who has a similar focus - commercial real estate versus municipal buildings - and leverages DIN 18960:1999 [12] when detailing the relevant cost drivers.

Table 1 Studies and identified cost drivers of occupancy costs

Study	Data base	Reviewed cost types	Categories of cost drivers
Siegel und Wonneberg, 1977 [7]	110 office buildings	• Real estate management costs • Occupancy costs	• **Building characteristics**
Kalusche, 1988 [14]	Siegel und Wonneberg, 1977	• Capital costs (incl. provision) • Real estate management costs • Occupancy costs • Maintenance costs	• **Building characteristics**
BMI, 1999 [15]	7 office buildings	• Real estate management costs • Occupancy costs • Maintenance costs	• **Building characteristics** • **Utilization**
BMI, 2000 [16]	2 office buildings	• Real estate management costs • Occupancy costs • Maintenance costs	• **Strategies** • **Building characteristics**
GSD, 2003 [11]	1,2 million accomodation units	• Real estate management costs • Occupancy costs	• **Location** • **Environment**
BMI, 2003 [17]	several investigations (et al. office buildings.)	• Occupancy costs • Maintenance costs	• **Strategies** • **Building characteristics** • **Utilization**
BMI, 2003 [18]	several investigations (et al. office buildings.)	• Real estate management costs • Occupancy costs • Maintenance costs	• **Utilization**
Stoy, 2005 [3]	116 office buildings	• Capital costs (incl. provision) • Real estate management costs • Occupancy costs • Maintenance costs	• **Building characteristics** • **Strategies** • **Location**
Jones Lang LaSalle, 1996-07 [9}	413 office buildings (2007)	• Real estate management costs • Occupancy costs • Maintenance costs	• **Strategies** • **Location**
pom+Consulting AG, 2003-07 [10]	1.242 objects (2007)	• Real estate management costs • Occupancy costs	• **Utilization** • **Environment** • **Building characteristics**

5. Approach

5.1 Framing the topic

This study only focuses on those occupancy costs that directly impact the building. Operational labour costs or material expenses are not considered, because there is a greater chance of optimizing costs during planning and building (compare Pfarr, 1976, page 23-24 [2]). It should also be pointed out that the study only looks at relevant costs drivers, which require a less detailed cost structure (comparable to DIN 276:2006 [13]).

5.2 Definition of relevant factors of the investigation

During the preparation of the study it was important to define the most appropriate cost structure. In addition to the cost structure of the project partner the following sources give a guideline to structure occupancy costs:

- DIN 18960:2008 [4] User costs of buildings.
- VDI 6009:200 [19] Facility Management.
- GEFMA 200:2204 [20] Costs of Facility Management, Cost structure for GEFMA 100.
- CEEC:2004 [21] European Code of Measure.
- DIN 276:2006 [13] Building costs.
- ISO 15686:2007 [22] Buildings and constructed assets, Service life planning, Part 5.
- BCIS - Standard Form of Property Occupancy Cost Analysis (1991) [23].
- NEN 2632:1980 [24] Working costs of buildings, Terminology and classification.
- ÖNOMRM B 1801-2:1997 [25] Civil engineering and building construction costs.

Additionally to the definition of the dependent variables (occupancy costs), also the independent variables (cost drivers) are differentiated. The definition of cost drivers comes from secondary literature and expert interviews with all relevant industry stakeholders, e.g. investors, architects and facilities managers.

5.3 Collecting the data

The collection of data formed the main part over the course of the study. The study examines occupancy costs and all the factors that go into those costs, of around 150 municipal schools and sport facilities in Germany. Contained therein, will be descriptions of the relevant cost drivers, as design rules or basic conditions for planning, building and using financially sustainable real estate. In general three types of data are collected:

- Investigation of general data
- Investigation of the dependent variables (occupancy costs)
- Investigation of the independent variables (cost drivers)

Once the data is collected, a system is designed that allows a uniform examination of each of the data sets. Regarding the occupancy costs (dependent variables) the cost structure of the project partner is cross tabulated with that of the investigation to develop a structure that can be uniformly applied to all occupancy costs. In reference to the defined cost drivers the independent variables are listed in a data entry form to consistently investigate 150 schools and sport facilities.

5.4 Analyzing and describing the data

Based on statistical pre-analysis, the data is analysed by conducting a series of multivariate regression analysis, which have proven to be an appropriate approach to investigate cost indicators. The description of data will be framed by methods of descriptive statistic (median, upper- and lower quartile). Contained in the descriptions will be an overview of the data that had been collected and also remarks on outlier statistics.

6. Discussion and Conclusions

The introduced models to forecast occupancy costs (e.g. water, heating energy, electricity) verify a good quality and comply with all sufficient conditions for providing consistent, unbiased and efficient estimates. As an example, the proposed model to estimate heating energy consumption indicates an increase of 84% in heating energy consumption for facilities with indoor swimming pool in comparison with those facilities not having this additional sport facility.

In addition, the integrity and transferability of introduced models are evaluated, performing power analyses to discuss the probability of inferences about examined population parameters. However, the statistical power and significance of single cost drivers have to be discussed for the practice of real-estate management.

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