An International Comparison of User Satisfaction in Buildings from the Perspective of Facility Management

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Abstract
User satisfaction in buildings plays a central role in Facility Management and can be influenced by the implementation of specific designs of real estate and the optimization of secondary processes. Satisfaction is a complex issue and especially in the international context there are multiple perspectives of user satisfaction, as well as different measurement criteria. The aim is to provide a transparent quantitative representation of publications from scientific journals on the subject of user satisfaction in the context of Facility Management & Real Estate Management. The main issues of the research focus on research design and the frequency of the investigated factors influencing user satisfaction.

Keywords: Building user satisfaction, influence coefficient, international comparison, research-design, systematic review

Description of the Problem/ Intention
User satisfaction and well-being in buildings become more and more important in facility management. They are supported by customized design of real estate and the optimization of the secondary processes, as can be seen in the German Facility Management Association (GEFMA) Guideline 100-1. Satisfaction is a complex issue, which is subject to subjective influences and conditions. In the international context, there are diverse viewpoints and definitions of user satisfaction, as well as different measurement criteria or factors from the viewpoint of facility management.

The term user satisfaction and its variables are difficult to describe in concrete terms because of the missing standardization for the measurement of user satisfaction. There are various publications in the field of user satisfaction investigating the topic but however, they are usually from other disciplines. A general overview of research on the subject of user satisfaction in buildings in terms of research designs and their influence factors is missing in the scientific discussion.

The aim of this study is to give a transparent, quantitative representation of publications of scientific journals on the subject of user satisfaction in the context of facility management and real estate management. This investigation focuses on two issues. On the one hand, research design (e.g. which survey methods are often used and whether there are sectorial or spatial...
frequencies), and on the other hand, the frequency of the investigated factors influencing user satisfaction in buildings. Our focus is on the frequency of use in the respective research results or publications and not on the significant conditions or statistical significance of the factors. This development can support the facility management with regard to the control and measurement of user satisfaction.

**Literature Review**

The term user satisfaction is very broad and differs for different types of buildings. Zanuzdana et al. (2012) give a short literature overview of the field of housing and residential satisfaction. In the field of housing different specializations can be found. E.g. Perez et al. (2001) focus their research and literature overview on the residential satisfaction of senior citizens. Muhammad et al. (2013) focus on the wellbeing in higher education institutions, which they subsequently review in their literature.

Hui (2013) shows the effect of facility management services and customer satisfaction in the shopping mall sector as documented in their literature review. Another view is shown by Appel-Meulenbroek et al (2011) with their research on the end-user’s perspective on activity-based office concepts. Their study includes the literature on the workplace in the context of employee satisfaction and productivity.

This short literature review shows the differentiation of the term user satisfaction which has been studied in different types of buildings. A general literature review of the individual terms of user satisfaction and of the building type is available in the respective literature, as seen above. However a general overview is missing, which is the reason why this study aims to provide a systematic review and a unified overview of the existing literature. In the following section we explain the research design of our systematic review in detail.

**Methodology**

In this study no significant review of influencing parameters is preferential, but rather the quantifiable preparation of research designs and the number of influence parameters of user satisfaction in the publications is in the foreground. So as to meet these requirements a methodical approach was used. These individual questions from a broad subject area were formulated and systematically worked through. In a systematic work it is essential to define and publish the search strategy in advance and also to disclose the publications (see Al-Nawas et al. 2010). In contrast to a purely qualitative description of the characteristics, the focus on a quantitative evaluation is to quantify the different issues. Although the values of the properties or questions were quantified it is not a meta-analysis, because here no numeric results from empirical research using statistical methods are summarized and evaluated based on their statistical significance (see Stamm & Schwab 1995).

As previously explained in the description of the problem, the aim is to analyze the research design (e.g. which survey methods are often used and whether there are sectorial or spatial frequencies), and additionally examine the frequency of the investigated factors influencing user satisfaction in buildings.

Therefore, based on a systematic review, the following steps were taken:

1.) Selection and identification of the terms for user satisfaction. The search of the articles was performed with a keyword search using the following terms: "thermal comfort, occupants, well-being, user satisfaction, indoor environmental quality (IEQ),
residential satisfaction, housing satisfaction, workplace satisfaction, tenant satisfaction”. The literature review reveals a lack of a clear definition of user satisfaction for buildings. On the basis of this fact key words and synonyms for user satisfaction were defined in consistence with the literature.

2.) The search of the contributions was essentially based on the data from EBSCO and Science Direct.

3.) For the selection of publications a period from 1990 until 2013 was chosen as criteria. By selecting the releases we stringently focused on the reference to the facility and real estate management. General monographs or studies that were not published in an international scientific journal were excluded from the search. This restriction was made to ensure the comparability and international consideration of publications. For example, the studies of Gossauer 2008 or Hellwig 2005 were not included in the evaluation, since they have not been published in an international journal. These requirements resulted in 87 international journal articles, which are listed at the end of this paper.

4.) The selected studies were examined by the research design on the one hand and the variables for user satisfaction and the definition on the other hand. The following parameters were processed systematically:

- The research design is differentiated into the areas publications according to property type and geography, the year of publications and the data collection.
- The research part of variables and user satisfaction is divided into the examination of the explanatory variable and the influence of the explanatory variables.

Subsequently the results of the survey are presented structured according to the examination parameters.

**Result: Research Design**

This section shows the results in terms of the research designs in the field of user satisfaction. The evaluation of the publications focuses on property type, geographic selection, year of publication and data collection. In the latter, the sample size and response rate is also represented.

**Publications according to property type and geography**

In 84 of the analyzed journal article (97%) investigations were conducted in a geographical region. 3 publications (3%) examined the user satisfaction across the continent. Figure 1 shows that most publications were made in the geographic regions of Europe (34%), the United States (31%), Asia (29%) and 12 studies (14%) of buildings in Australia or Africa. In 81 (93%) of the analyzed journal articles only one building typology was treated, whereas 6 publications (7%) treated several types of buildings. It is striking that most of the studies, which are looking at office real estate, were carried out in North America. Here more studies focusing on office real estate than on residential real estate were published. In other continents there were more studies published on residential real estate rather than on office real estate. With over 60% of all publications residential real estate was examined most often. In Asia, almost all publications are based on residential real estate, and Europe has the largest number in this area with 17 publications. This is also where most studies in the field of special real estate, even if they
include only a low inspection rate, were publicized. Special real estate values include health real estate and shopping centers, but also hotels.

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<th>Percentage of publications (multiple answers possible)</th>
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<tr>
<td>Africa</td>
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<tr>
<td>Special Building</td>
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<tr>
<td>Housing</td>
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<tr>
<td>Office Building</td>
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**Figure 1: Publications by property type and geography**

The main results can be stated as follows: a vast geographical focus on regions could be detected and there are fewer studies, which give an overview of multiple countries. Similarly, only a single type of building was examined in the studies and no comparison was made between different types of buildings. The focus of these studies was very limited, because they confined only to specific topic areas.

**Year of publication**
The investigation period was 1990 to 2013. Only 7 publications (8%) which met the requirements could be identified for the period of 1990 until 2000. 80 publications (92%) from the years 2000 until 2013 were identified and the highest density was between 2008-2013 with 64 studies (74%) published. Figure 2 also shows the presentation of the publication year according to the geographical level in addition to the overall picture. For North America a slight tendency for a past publication density as compared to other continents can be noticed. Generally, it should be inferred that user satisfaction in the context of facility management and real estate management is a young scientific discussion.

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<th>Numbers of publications</th>
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<tr>
<td>North America</td>
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**Figure 2: Publications according to geographic location, and year of publication**
This disproportionately strong increase of publications in the investigated range of topics since 2000 is reflected in the comparison of the keyword search results with the entirety of all publications in the individual databases. An increase in publications on the topic of “user satisfaction” and related topics can be found, reflecting the importance.

**Data collection**

The publications show that the techniques of questionnaires, interviews and physical measurements resorted to the analysis and measurement of user satisfaction. 76 (87%) articles relate to these three methods and only 11 articles (13%) analyze the topic of theoretical points of view or summarize results in the sense of a literature overview. In some studies, several collection methods have been applied. In five studies (6%) a questionnaire as well as personal interviews had been used, whereas in 58 trials (67%) data was collected only with the help of questionnaires. The table in Figure 3 illustrates the dominance of the questionnaires according to the building typology and figure 4 shows the survey art according to the geographical location. Generally, surveys and results of individual studies can be difficult to comprehend. A conclusion based on the questions was only possible in 22 publications (25%). This was done with some publications only by a reflection of the issues in the text. Merely 10 studies (12%) publish the questionnaire. In the studies, interviews were significantly less often applied. Only in 15 publications (18%) surveys had been conducted and only seven (8%) studies show physical measurements. It turned out that the validation of the results of the questionnaires and interview surveys with physical measurements had only been performed in the lower dimensions. This is remarkable, because through questionnaires or interviews the subjective assessment of the subjects increases, so that the physical measures can be seen as objective representation.

![Figure 3: Survey art according to building typology](image-url)
In particular, when using the questionnaire technique, also the number of participants (samples) and the return rate of interest are, in addition to the questionnaire, very important. Half of the evaluable studies have between 100 and 500 participants and 30% of the studies have between 1,000 and 5,000. Five studies (12%) of the evaluable ones show a participation of 10,000 to 500,000 people. These are meta-studies, based on statistical surveys for large geographical areas. The sample size is shown in Fig. 5.
The evaluation of return rates compared to the field of market research (cf. 5-40% (Peples 2008)) shows a relatively high response rate. To figure 6 we have to note that the high return rates of 90 percent are due to the publications with few participants. In these publications it must also be noted that the response rate was respected while collecting data and volunteers were repeatedly reminded to participate.

To examine user satisfaction, questionnaires are most commonly used regardless of the building typology.

**Result: Variables and User Satisfaction**

The variable user satisfaction represents the target variable or the variable to invalidate the investigations, which is described with the help of explanatory variables such as age, temperature sensitivity, acoustics, etc. The analysis of the publications showed that, in addition to the actual name "User satisfaction" also "productivity" and "customer - or clientele binding", have been used as synonyms for user satisfaction and thus set as target variable. Figure 7 shows, that the productivity in 7 studies (24%), dealing with office properties, was investigated. The customer or tenant retention was applied in 9 trials (18%), dealing with residential real estate, as the target variable. Special real estate shows a relatively heterogeneous picture concerning productivity and customer loyalty. Geographical differences were found to be insignificant. However, the variable user satisfaction is the most common target variable of all building types and geographical regions.

The most important result in the field of variables and user satisfaction was the finding that the target to be examined is defined differently for different building typologies and the common target “user satisfaction” is followed by “productivity” and the small but significant proportion of "customer - or clientele loyalty ".

**Examination of the explanatory variable**

The variety of the explanatory variables in the individual studies was grouped into categories to ensure comparability. It turned out that each study used its own questionnaire to find out the
relationship by asking specific questions. Uniform questionnaire design in particular as regards the number of questions could be determined as the investigation of single explanatory variables. As shown in figure 7, common interrelationships in the explanatory variables for different categories of buildings can be seen. So the following categories are frequently collected in studies for office real estate: temperature is mentioned 14 times (45%), air 15 times (48%), lighting 12 times (39%) and acoustics 9 times (29%). In residential real estate room configuration (42%) and social environment (40%) were queried in almost half of all studies. In contrast to office real estate, less than a quarter of all studies on residential real estate examined the variable temperature (23%), air (21%), lighting (17%) and acoustics (13%). It is shown that in the questionnaire design it was often assumed that user satisfaction in offices depends on other variables, such as in residential real estate. In the GEFMA directive 520 there are facility services listed, such as, for example, repair, cleaning, grounds maintenance, security services, waste disposal, building logistics and catering, which are not included in the analyses at all or only marginally in the analyzed studies. However, issues such as ergonomics and space configuration, and the query of the social environment or working were examined in great number of studies.

It was found that the explanatory variables cannot be clearly identified in the studies. There are variables that are often taken into consideration, such as temperature or light, but a standard could not be detected. The considered explanatory variables differ again on different building types. Furthermore figure 7 provides additional important information. After all, there are not only the frequencies of the investigation shown but also the ranking of importance of the respective criteria.

**Influence of the explanatory variables**

A comparison of the correlation coefficients of individual studies has been impossible due to the large differences in the survey design. For this reason we weighed the most important results and compared them. Figure 7 shows that in all studies of office buildings, where temperature sensation as a variable had been examined, a high influence on user satisfaction could be noticed. This was the case in just 60% of the studies which examined the variable "temperature" on user satisfaction in residential real estate, this, however, with a high impact.

It can be noted, that depending on the building type, different subject areas have influence on user satisfaction. Geographical differences of the influence of the explanatory variables on the respective priorities of investigation could not be established.
Figure 1: Examined criteria and interdependencies according to types of buildings and number of publications which have a high influence on user satisfaction.
Considering the frequency of examination with simultaneous consideration of the rankings of importance, it becomes evident that the frequency of the survey criteria does not match with the importance. There are some criteria, e.g. for office real estate, which would be important to investigate. An example of this is IT, which is queried in only 2 studies, but has a very high impact on user experience. 100% of the studies that have dealt with this issue see IT as one of the most important criteria.

The detection of criteria does not reflect the importance of the criteria as an influence on user satisfaction.

**Conclusion and summary of results**

The present systematic review analyses the approaches and results of international studies on the topic of user satisfaction. Below an overview summarizes the most important results:

- A growing interest in recent years in the subject “user satisfaction” and related topics was examined.
- Fewer studies give an overview of different countries.
- The studies mainly focus on a single type of building.
- No comparison between building types and countries is shown.
- Questionnaires are by far the most common collection type.
- There is no uniform questions design.
- The examined target is defined differently for different building typologies and the common target “user satisfaction” is followed by “productivity” and the small but significant proportion of "customer - or clientele loyalty".
- Explanatory variables cannot be clearly identified in the studies.
- Explanatory variables differ for different building types.
- The detection of criteria does not reflect the importance of the criteria as an influence on user satisfaction.

Based on this knowledge, further research can be conducted.

**Outlook and Research Opportunities**

The results of this study form the basis for further in-depth research. The aim is to develop a standardized questionnaire which includes the different structures and requirements of the various types of buildings and users. It should be possible to compare user satisfaction and the influencing factors of each survey in the field of user satisfaction. A focused sample of questions, which are individually combined in a questionnaire depending on the building and the user, should be developed. To close these gaps the University of Applied Sciences Kufstein is working on an online questionnaire project "Modular questionnaire to user satisfaction in buildings" as a standardized "gauge".

**References**

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Supplemental References


