PERCEIVED COMFORT AND DISCOMFORT IN OFFICE BUILDINGS

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Summary

The quality of the environment within buildings is a topic of major importance for public health. Many studies suggest that existing technologies and techniques can improve indoor environment in a manner that significantly increase health and productivity. Healthy, comfortable employees are invariably more satisfied and productive. At the present, we can develop only crude estimates of the magnitude of productivity gains that may be obtained by providing better indoor environment. Consequently, businesses should be strongly motivated to change buildings design or operation if these changes improved user performance by even a significant fraction of a percent or reduced sick leave by a day or more per year. The solution is a smart building equipped with modern technology, which meeting the requirements on comfort and safety of investor. But there is less known problem of smart buildings which raises with overrun the optimal rate of intelligence, psychological impact of the microclimate of the indoor environment and the inability to create comfort for the inhabitant. This paper deals with analysis and examination of indoor risk factors and their impact to perceived comfort of indoor environment of office buildings and respondents' opinion on smart buildings.

Keywords: smart buildings, indoor environment, risk factors, perceived discomfort

1 Introduction

The need to save energy brought many alternative solutions of intelligent elements into practice with benefits which are undeniable. But their full-value and effective utilize depends on estimate optimum rate of buildings intelligence through compromise between energy saving and user's comfort. People may be wholly satisfied with their job, but could also be quite unhappy about their environment of workplace. Even all indoor environmental standards are met the users are usually not satisfied and perceived discomfort is occurred in the smart buildings.

It is very important to think of future building users, character and sort of work performed and particularity of each of them so as to provide the best user's performance rate. The goal of the post-occupation evaluation is to learn from previous projects and apply this learning to the design of new, in an environment of continual improvement [1]. The application of evidence to design decisions means that the results of feedback studies designed to study human behavior in relation to specific features are needed to make "right" design and construction decisions. Transforming the evidence from research into

intelligence that informs and enlightens building performance is a new opportunity for delivering intelligent buildings. The intelligent building is a reality in the foreseeable future based on the informed and rational way in which it is produced [2].

2 State of art

Use of facilities implemented in different environments is very different, as well as the different user behavior. It follows that the negative factors arising in different environments are different [3]. From a sociological point of view, comfort and well-being are not only bound to the individual perspective of the individual, but also relate to the cultural history and shared conventions that are common to specific places and sometimes physically rooted in the built environment [4, 5].

To achieve the greatest uptake, the ideal feedback technique would be simple to use; widely applicable; robust but comprehensive; and cheap, and quick and easy to operate. The technique would give useful results speedily, but preferably in a form that can satisfy a range of users, from researchers testing hypotheses to designers and managers wanting to know the key issues on which they should act now [6]. The three main survey data collection techniques to be considered include questionnaire by mail, face-to-face structured interview and telephone interview. Each of the three data-collecting techniques has advantages and disadvantages. The response rates of telephone interviews and mail questionnaires have traditionally been viewed as being weaker than face-to-face interviews. In terms of cost, the face-to-face method is the most expensive and the mail questionnaire the least expensive. In fact the mail questionnaire produces the best quality of answers and has least problems with regards to implementation [7].

3 Objectives and methods of research

There are many definitions of smart buildings but what do people really think about this type of buildings? Or how could smart buildings look like according to needs of users? Research focuses on respondents' feedback about an ideal office building related with perceived comfort of workplace. Evaluation investigates a collection of information that relates to smart buildings in Slovak republic, building in term of intelligence and suggests the most important factors of indoor environment by respondents from view of their performance.

The questionnaire survey was performed in both paper and electronic form. Respondents were users that perform a sedentary work in different office buildings with various intelligence rates of buildings. Overall count of collected questionnaires was 257. The number of 80 questionnaires was excluded due to incomplete questionnaires and vague answers. Final count of evaluated questionnaires was 177. The questionnaire as subjective assessment tool consists of demographic characteristics (gender and age), the questions about respondents' opinion on smart buildings and what benefits and characters that they should provide. What sort of operation do they desire in their workplaces? Would they want to work in smart or standard building?

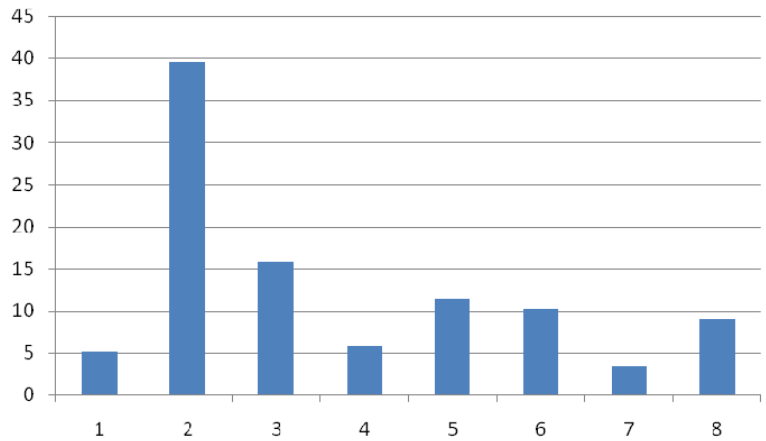
The following factors are evaluated by respondents: temperature, quality of indoor air, ventilation, lighting, noise, visual contact with outdoor environment, and contact with plants in the workplace, electro smog and character of workplace and facilities. These factors were evaluated according to impact on users' comfort and performance in general

at their workplaces. Respondents attributed importance of the factors in the interface 1 to 10, where 1 means the least and 10 the largest impact on users' comfort and performance.

4 Results

Research participants consist of 43 % women and 57 % men. 74 % of them stated that they would like to work in smart building. Other questions are focused on operation of building in term of building automation level. The vast majority of respondents (89 %) would like to prefer combination of manual and automatic operation in their workplace, 3 % of them automatic and 8% manual operation.

The answers about respondents' opinion on smart buildings were followed (Fig. 1).



1 – The building, which provides comfortable environment for users; 2 – automatically controlled building; 3 – energy efficient building, which uses of renewable energy sources and providing comfort to users; 4 – The building, which should be safe for users, ensure the required indoor environment quality and comfort for the user; 5 – The building with technologies which providing required indoor environment quality, comfort for users and energy saving; 6 – The building with technologies which are able to communicate with each other and has the ability to predict and respond to users' needs; 7 – The building with ability to respond to the conditions of the external and indoor environment; 8 – Vague or no answer.

Fig. 1 *Results of respondent's opinion on smart buildings*

Most of respondents (51.9 %) answered that smart buildings should provide energy savings, 49.7 % creating comfort and convenience for the users, 29.9 % safety of the users, 27.1 % operation of all equipment in the building.

Results of evaluated workplace factors show that thermal state and air quality has significant impact on respondents' comfort and performance. Other significant factors are lighting and acoustic.

5 Conclusions

Indoor environmental quality is important for human well-being regardless of the type of indoor environment control. The presented investigation is introduction to the research

focused on comfort and productivity in buildings with smart elements. The investigation shows that the most of respondents indicate the smart building as automatically controlled building and as building saving energy. Results suggest that the most of users want work in smart workplace but they would like to control their indoor environmental state. Results also suggest that temperature and air quality have significant impact on respondents' comfort and performance. Another factor like lighting, facilities and acoustic have lower impact on respondents' comfort and performance. Other factors as ventilation, electro smog, and character of workplace, visual contact with outdoor environment and contact with plants in the workplace have no significant impact on respondents' comfort and performance too. The challenge is for the developer to understand the true needs of the future tenant and transform those needs into the requirements for the design and construction of the building.

The following research will be oriented to monitoring of indoor environment in terms of physical and chemical parameters and questionnaire surveys in selected building with smart elements.

Acknowledgement

This case study was financially supported by European Union Structural Funds (Grant code: ITMS 26220220064) and the Grant Agency of Slovak Republic to support of project No. 004TUKE-4/2011.

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