The impact of office workspace on the satisfaction of employees and their overall health – research presentation

Vpliv pisarniškega delovnega prostora na zadovoljstvo zaposlenih in njihovo splošno zdravstveno stanje – predstavitev raziskave

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Izvleček

Izhodišče: Članek obravnava povezavo med nepremičninskimi dejavniki delovnega prostora in zadovoljstvom zaposlenih ter vplivom na splošno zdravstveno stanje zaposlenih. Namen raziskave je na osnovi odkritih parametrov s spremembami delovnega okolja in delovnih procesov trajnostno vplivati na izboljšanje zdravstvenega stanja zaposlenih. V raziskavi preverjamo dve hipotezi: 1. nepremičninski dejavniki delovnega prostora pomembno vplivajo na zadovoljstvo zaposlenih z delovnim prostorom, 2. zadovoljstvo zaposlenih z delovnim prostorom pomembno vpliva na splošno zdravstveno stanje zaposlenih.

Metode: Izvedena je bila kvantitativna raziskava z obsežnim kompleksom različnih vprašanj, lestvic in diferencialov, pri čemer je bila večina instrumentov izvirno konstruirana z ustreznimi merskimi značilnostmi. Testiranje vprašalnika z metodo notranje konsistentnosti je pokazalo, da vprašalnik izkazuje visoko stopnjo konsistentnosti. Celoten vprašalnik vključuje 163 spremenljivk, razdeljenih v vsebinske sklope: demografski del, poslovni objekt in delovno mesto, zasnova delovnega prostora, navade zaposlenih, pogoji v delovnem prostoru, organizacijska kultura, skrb za zdravje, zdravstveno stanje, duševno stanje. Na vprašalnik je v juliju in avgustu leta 2010 odgovorilo 1036 zaposlenih iz organizacij storitvenih dejavnosti, in sicer iz finančnega sektorja, zdravstva, javne uprave in drugih. Vsi anketirani, ki so bili zajeti v vzorec, opravljajo pretežno pisarniško delo. Anketa je bila anonimna in v skladu z etičnimi standardi. Rezultate smo statistično analizirali z uporabo faktorske analize, na podlagi katere smo ugotavljali pomembne dejavnike, z modeliranjem strukturnih enačb pa smo preverjali njihove statistično pomembne medsebojne vplive. Z analizo rezultatov in s statističnimi izračuni pa smo preverjali hipoteze.

Rezultati: Rezultati kažejo, da nepremičninski dejavniki delovnega prostora, tako s stališča ocenjevanja poslovnega objekta, delovnega mesta zaposlenega kot tudi zasnove delovnega prostora vplivajo na zadovoljstvo zaposlenih ter tako na oceno splošnega zdravstvenega stanja. Na podlagi rešitev modeliranja strukturnih enačb ugotavljamo, da imajo: čistoča delovnega prostora, osvetljenost delovnega prostora, orientacija delovnega prostora, uravnavanje osvetlite prostora in uravnavanje klime statistično pomemben vpliv na zadovoljstvo zaposlenih z delovnim prostorom. S pomočjo faktorske analize ter analize modeliranja strukturnih enačb smo v skladu s postavljenimi hipotezami preverjali, ali dejavnik 'zadovoljstvo zaposlenih' vpliva na dejavnik 'splošno zdravstveno stanje'. Ugotovili smo statistično pomembno negativno povezanost teh dveh dejavnikov.

Zaključki: Ugotavljamo statistično pomemben vpliv nepremičninskih dejavnikov delovnega prostora na zadovoljstvo zaposlenih ter zato na oceno splošnega zdravstvenega stanja. Poudarjamo potrebo po dodatnih analizah in raziskavah vpliva dejavnikov na zdravje zaposlenih ter po spremljanju le-tega s preventivnim in periodičnim preverjanjem stanja zaposlenih v delovnem okolju.

Abstract

Background: The present article addresses the links between the real-estate factors of the workspace on employee satisfaction and their impact on the overall health of employees. The purpose of the research is to facilitate the improvement of employee health through the application of base parameters, and consequently, the changes of workspace and work processes. The research tests two hypotheses: real-estate factors have a significant impact on employee satisfaction with the workspace; and that satisfaction of employ-

ees with the workspace has a significant impact on the overall health of employees.

Methodology: We carried out a quantitative research with a broad range of different questions, scales and differentials, whereby the majority of instruments was originally constructed with suitable measurement characteristics. Testing of the questionnaire with the method of internal consistency showed that the questionnaire demonstrates a high level of consistency. The entire questionnaire includes 163 variables divided into content sections: general questions, business building and workspace, workspace design, habits, conditions in the workspace, organisational culture, health care, physical health condition, mental health condition. In July and August 2010, the questionnaire was completed by 1,036 employees from entities in the service sector, i.e. the financial sector, health sector, civil service and others. All the respondents included in the research sample worked in offices. The questionnaire was anonymous in accordance with ethical standards. The results were statistically analysed with the application of factor analysis, which served as a basis for identifying the important factors, while we applied structural equation modelling for verifying the statistically significant mutual effects. Furthermore, we analysed the results and carried out statistical calculations to test the hypotheses.

Results: The results show that real-estate factors of the workspace – both in terms of the assessment of business building and position of the employee, as well as the workspace design – have an impact on the satisfaction of employees, and consequently, their assessment of health. On the basis of solutions of structural equation modelling, we established that: the cleanliness of the workspace, lighting of the workspace, orientation of the workspace, regulation of lighting and regulation of air-conditioning in the premises, have a statistically significant impact on the satisfaction of employees with the workspace. With the aid of factor analysis and analysis of the structural equation modelling, as well as in accordance with the set hypotheses, we tested whether the 'employment satisfaction' factor affects the 'overall health' factor. We established a significant negative link between these two factors.

Conclusions: We established a statistically significant impact of real-estate factors of the workspace on the satisfaction of employees, and consequently, the assessment of their overall health. We highlight the need for additional analysis and research of the effect of relevant factors on the health of employees, as well as monitoring thereof through preventive and periodic testing of the health of employees in the work environment.

1. Background

The aim of the research is to explore different real-estate factors in the work environment, which are related to the psycho--physical state of employees and thereby exert influence on their health. The research is oriented to the design parameters as elements of a healthy building and their effect on the health and behaviour patterns of the daily work process in the office. The factors are assessed in terms of their relation to health and health care.

The real-estate factors of the work environment relate to the environment research,[1,2] whereby we discovered that each environment which "surrounds the person" has specific characteristics to which we pay special attention; i.e. because they are important for the individual, his/her life, survival, leisure or work. The comfort of the work environment is divided into[3,4] physical (measured with basic parameters of the building), functional (relates to fulfilment of different functions or tasks in the environment) and psychological (related to pleasure – feeling of loyalty, ownership, control).

When measuring the quality of the internal environment, the researchers were focused on the physical ergonomic conditions of the workspace,[5-7] which affect the job and satisfaction and efficiency of individuals and/or the conditions which can harm individuals at the level of specific parts of the human body. Thus, the external factors result in an imbalance, diseases and other obtrusive conditions which affect:[7] the immune system (unfavourable conditions that affect the senses: smells, noise, heat, cold, dry air; systemic effects: tiredness, bad concentration; psychological effects: lack of control, depression, nervousness;), nervous

system (irritation, allergies, consequences of hyperactivity (irritated mucosa, respirator system, asthma, rash, burns, loss of hearing and damaged sight) and infectious diseases (Legionaires' disease), toxic chronic effects, which gradually increase (cancer).

The effects of workspace lighting on employees and problems with lighting have been researched by different authors.[5,7-11] The more recent research in the relevant field mostly focuses on more precise measurements of luminosity, measuring the psychological effects of the balance between artificial and natural lighting in a workspace, measuring of mood, increased motivation and performance related to the lighting in the workspace, the use of shades and the possibility for manual control of shades, the intensity of luminosity and colour temperature in relation to mood changes . Most researches were more complex since they were focused on heterogeneous physical factors of the work environment; i.e. quality of air at the workspace, ergonomically adjusted furniture, thermal comfort, exposure to noise, workspace lighting and effect on performance at the workspace and satisfaction with the workspace.[12-15] Many researchers have stressed the correlation between the satisfaction of building users and the importance of individual control of conditions in their work environment.[12,16-19]

When reviewing literature, we discovered that some researchers[20] also based their research on the evidence that in-building conditions can cause illness. They highlighted a few researches that document the harmful effect of chronic exposure to noise and studies of the impact of noise on cardio-vascular diseases. Some researchers[21,22] were looking for a positive correlation between the physical environment and improvement of employees' mental health, e.g. improvement of health with increased daily exposure to light. Others[23] researched the negative correlations between the quality of residential units and mental health. On the basis of the Evan's Chart of Residence Quality, researchers[24] discovered that the quality of the interior, exterior and neighbourhood predicts a child's socio-emotional health, whereby they controlled other factors which could affect the results, e.g. parents' income level, education, their mental health state and the child's gender.

Taking into account the fact that we spend a vast majority of the day on the job, work as a specific context of life represents an important part of our lives and has a significant impact on our perception of overall satisfaction. Satisfaction with work is probably the most frequently studied variable in the field of employee health. More recent researches have shown that the level of job satisfaction has been decreasing during recent decades.[25,26] Some researchers[27] claim that job satisfaction synthesizes a series of evaluations, which refer to the individual's work: cognitive and emotional, general and specific. When assessing their work, employees weight its benefits and its drawbacks and create a specific image about their satisfaction. Satisfaction means subjective assessment of work whereby the individual's own experience is particularly relevant. One of the most widely used instruments is the Job Descriptive Index (JDI) authored by Smith, Kendall, and Hulin. The JDI questionnaire measures satisfaction with the following aspects of work: work, co-workers, boss, salary and promotions. In the review of literature in the relevant field, researchers[28] stressed the criticism of researchers towards the individual approach when addressing satisfaction of users with their job, where they warn about focusing merely on the individual opinion of employees about their job, without considering the influence of other work conditions.

There have been many researches on the topics of employees' health, job satisfaction, stress, depression, obesity, and cardiovascular diseases. Usually, they have been focused on the aspects of healthcare. The effect of health promotion on the job has been studied by various researchers.[27,29-34] On the basis of the research of organisational risk factors, which affect diseases and injuries on the job and adequate preventative measures, some researchers[29] specified the three most common types of problems: injuries, diseases, and muscular problems. On the basis of constructive criticism of the Programme for the Promotion of Health in the Workplace and

its positivity within the context of removing specific limitations, a table of factors that affect the reduction of injuries in the workplace has been designed. The table includes differences among the individual, organisational and social levels. The table includes the parameter of organisational performance, and the entrepreneurial strategy is linked with worker's health more closely. The ecological model of health in the workplace and the integrated model of psycho-sociological and biological aspects, which affect the conduct of employees in terms of ergonomics, as well as a model which identifies different levels of factors (micro-, mezzo-, exo-system) that affect the health of employees are considered. Thus, the model takes into account: the training of employees, management style and culture, authority and labour force, long-term employment contracts as an incentive for the labour force, good relations between managers and workers, organisational philosophy, delegation of protection activities, the active role of senior management, protective supervision, evaluation of protection risks, the monitoring of danger during workers' activities, duration of training, employees' medical examinations, injury times and changed labour provision, labour force characteristics and other specific factors.

Health problems can occur due to bad workplace conditions[35,36] or bad habits of employees'[37-39] and consequently define suitable corresponding solutions; usually by removing the cause of inadequate workplace conditions or by raising awareness about a medical condition and the changing of employees' habits. Researchers[35] discovered that due to the health risks which employees are exposed to at work (concerns regarding the exposure or use of suspicious materials or substances, quality of interior air, etc.), about 8 % of women surveyed had abandoned their jobs. Researchers[40] also discovered a negative link between patience, irritability and job satisfaction, as well as a positive link between a high level of orientation towards achievements and job satisfaction. People who are dissatisfied with their job demonstrate more coronary risk factors.[41] Some researchers[38] claim that during the last two

decades research in the field of public health was focused on the lack of actions regarding health problems and chronic diseases (e.g. colon cancer, diabetes, coronary heart disease). Since they were convinced that business buildings affect the users' daily activities to a significant extent, they carried out qualitative and quantitative monitoring of human activities in business buildings during a typical work week. They used the information to construct a model, which simulates and assesses the use of energy per person during day. They used the ratio between physical elements (proportion of window surface versus wall surface – comparison between offices) and processes (frequency of transitions from one location to another (number per day; i.e. transitions to kitchen, printing or photocopier room, coffee corner, co-worker's desk, meeting room, receptionist, office, toilet; they counted the number of stairs that must be walked per day per employee). They discovered that the most often visited premises are the kitchen and the printing room; an increase in distance reduces the number of visits to these premises; a higher number of stairs also reduces the number of visits; in joint rooms a decreased ratio between the window and wall surfaces reduces the number of activities. Furthermore, several researchers[39,42,43,45] reported links between self-efficiency, workspace design, job satisfaction, somatic complaints and pain endurance.

The present research is therefore focused on the analysis of specific elements of the work environment and behavioural habits of employees at their jobs with the aim to establish the characteristics of the workspace that has the most effect on the individual. The long-run objective of this research is to consider the findings and changes of the work environment and work processes with the aim to ensure a sustainable impact on the improvement of employees' health and – consequently – their performance at work.

1.1 Hypotheses

The broader research was devoted to the analysis of specific elements of work environment and behavioural habits of employees

at their jobs with the aim to establish the characteristics of the workspace that have the most effect on the individual. The objective of the research was to use the established parameters and consequential changes of the work environment and work processes to ensure a sustainable effect on the improvement of employees' health. The research was based on two fundamental hypotheses within which we specified the sub-hypotheses.

Hypothesis 1: Real-estate factors of the workspace have a significant impact on the satisfaction of employees with the workspace.

Hypothesis 2 (previously researched, referenced literature and tested it in the present research): Satisfaction of employees with their workspace has a significant impact on the overall health of employees.

2. Methods

We carried out a quantitative research with a wide range of different questions, scales and differentials, whereby the majority of instruments were specially constructed with suitable measurement characteristics. Testing of the questionnaire with the method of internal consistency or the Cronbach alpha coefficient showed that the questionnaire demonstrated a high level of consistency.

The questionnaire comprises 163 variables divided into content sections: general questions, business building and workspace, workspace design, habits, conditions in the workspace, organisational culture, health care, physical health condition, mental health condition.

2.1 Research parameters

For the need of collecting information, we designed an online anonymous survey questionnaire with closed questions and based on theoretical definitions. The composition of the questionnaire is a part of a broader research while its fundamental objective is to research the relationship among the selected factors of workspace, organisational culture and the physical and mental health condition of employees.

The cover letter asked respondents to provide answers relating to the business building and workspace where they work, the organisation at which they are employed and the work which they perform.

Questionnaire was completed by 1036 employees from organisations within the service sector (i.e. financial sector, healthcare sector, civil service and other). All respondents who were included in the sample performed only office tasks and participated voluntarily with the assurance of their anonymity.

2.2 Data processing

The data were processed with the SPSS statistical software. We applied factor analysis and structured equation modelling. The collected data were first processed with exploratory factor analysis, which was used to research the number of factors required for the presentation of specific information. We continued with a confirmatory factor analysis, which was used to test the quality of the metric and structural part of the model. The confirmatory factor analysis was also used to test hypotheses and the links and/or structure in exploratory factor analysis of specific factors. In the final stage we applied the Structural equation modelling method to overcome the restrictions of multi-variant techniques and to achieve statistically efficient and transparent assessment of relationships when dealing with several mutual relationships at the same time.

3. Results

3.1 Theoretical model

In the theoretical model of the studied influences we included the following constructs:
- The *workspace* construct included the 'Business building and workspace', 'Workspace design' and 'Satisfaction with workspace' questionnaire sections, and comprised a total of seven dimensions. All dimensions were assigned a total of sixty-one variables.
- The construct *health condition of employees* included the 'Health condition' que-

stionnaire section. It was assigned eleven dimensions, which were explained by forty-nine variables.

3.2 'Business building and workplace' section

The 'Business building' section of the questionnaire comprised 20 questions or statements regarding the description of the macro- and micro-location of the works-

Table 1: Component and Rotated Component Matrix – 'Business building and workspace' section.

Variable/Question	Component Matrix(a)					Rotated Component Matrix(a)				
	Component					Component				
	F2_1	F2_2	F2_3	F2_4	F2_5	F2_1	F2_2	F2_3	F2_4	F2_5
Work premises are clean	-0.769					-0.875				
Hygiene standards in the business premises are high	-0.751		0.303			-0.875				
Work premises are cleaned (several times a day...less than 2 times a week)	0.455		-0.308			0.559				
The nearest window is (less than 1m... more than 1 m) away from my workspace		0.692	0.348				0.815			
My workspace is located (I am alone in the office...in an open space)	0.367	0.393	0.367				0.793			
Window surfaces which are the nearest to my workspace are oriented towards (North...West)		-0.611	0.683					0.96		
The largest window and wall surfaces of the workspace are oriented towards (North...West)		-0.610	0.680					0.96		
My workspace is located (in the basement...on a higher floor)				0.597					0.663	
The workplace of my direct superior is located (on the same floor...in the next building)				-0.426					-0.572	
I use public transport to get to work				-0.342					-0.484	
The building in which the business premises are located is (a residential-business building... a business building)				0.337					0.428	
In and/or next to the business building there is sufficient available parking space for personal vehicles	0.376			0.358					0.457	
Work premises were last thoroughly renovated–construction work, heating, ventilation, etc.–before (they were never renovated...more than 121 months ago)	0.373				0.602					0.716
The age of the business building is (less than 5 years ... more than 30 years)	0.389				0.534					0.676
The height of ceiling is (less than 2.5 m ... more than 4.05 m)					0.477					0.469

Component Matrix(a): Extraction Method: Principal Component Analysis. a 5 components extracted.
Rotated Component Matrix(a): Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 6 iterations.

pace, e.g.: workspace location, building location, accessibility by public transport, use of public transport, possibility of parking, building's age, description of building construction, description of specific construction components (walls, ceiling and floor) information on building renovation and maintenance, job description (micro location, type of office, location of the nearest superior's office, information on the cleaning of premises.

We confirmed the suitability of data for factor analysis and confirmation of typical correlations in the correlation matrix with the Bartlett test (p = 0.000). The results of the KMO test (0.587) showed that the connection and suitability of variables were adequate. Through the application of factor analysis and on the basis of the Kaiser criterion we selected a solution with five factors, which explained 41.32 % of the total variance. Upon the completed rotation we used the

first factor of the section to explain 9.77 % of the total variance, the second factor to explain 8.77 %, the third factor to explain 8.4 %, the fourth factor to explain 7.52 % and the fifth facto to explain 6.86 % of the total variance.

During further analysis we excluded six variables, the communality of which did not exceed a border value of 0.2. We excluded the following variables: *location of the business building where the workspace is located, information on the distance between the nearest public transport station and the business building, information on the construction of the business building, information on the walls of the workspace, information on the ceiling of the workspace, information on the floor of the workspace.* After rotation, we also excluded the *distance from the largest external wall to the workspace of the respondent* variable, since it did not form a typical correlation with any of the five factors. Moreover, we also

Table 2: Component and Rotated Component Matrix – 'Workspace design' section.

Variable (Question)	Component Matrix(a) Component				Rotated Component Matrix(a) Component			
	F3_1	F3_2	F3_3	F3_4	F3_1	F3_2	F3_3	F3_4
I can regulate window shades from my workspace	0.585	-0.396			0.766			
I have shades installed on my windows	0.582				0.763			
Sunlight directly reaches my workspace for at least a part of a day	0.468	-0.442			0.672			
Premises are cooled/heated with a thermal-cooling-heating appliance	0.483		-0.714			0.878		
Heating appliances are equipped with thermostatic valves for regulation of cooling/heating	0.500		-0.693			0.868		
I can regulate the air-conditioning appliance myself with the help of a switch in the workplace	0.633			-0.531			0.884	
The premises are cooled/heated with an air-conditioning device	0.472	0.494	0.331	-0.435			0.852	
Premises are ventilated with a central ventilation system		0.645						0.885
Level of ventilation can be adjusted with a switch in the workplace	0.494	0.472		0.354				0.709

Component Matrix(a): Extraction Method: Principal Component Analysis. a 4 components extracted.
Rotated Component Matrix(a): Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 5 iterations.

excluded the information on the *maintenance of work premises* variable, which reached borderline significance, but the processing of the results showed that it explained two factors. Table 1 shows the connections of the remaining 15 variables (Variable/question) of the 'Business building and workspace' section with the following factors (Components): Cleanliness (F2_1), Natural lighting (F2_2), Orientation (F2_3), Location (F2_4) and tidiness (F2_5) of work premises.

3.3 'Workspace design' section

The 'Workspace design' section of the questionnaire included 10 questions and/or statements on the possibility to control devices in the workplace, e.g.: questions regarding heating, cooling, natural lighting and the possibility of control thereof. The Bartlett test (p = 0.000) confirmed the suitability of data for factor analysis, while the result of the KMO test (0.587) indicates a sufficient connection and suitability of variables.

We specified four factors for the 'Workspace design' section, which together explained 67.55 % of the total variance. After rotation the first factor explained 20.56 % of the total variance, the second 16.14 %, the third 16.13 % and the fourth 14.70 % of the total variance. We transferred all variables to further analysis since all of them exceeded communality bounds. After rotation we excluded the variable that gives information on the possibility to open windows at the workplace, since it had a significant impact on two factors. Other variables reached suitable factor weights after rotation and we kept them in the model. Their connections with factors

are shown in Table 2, while we named the factors of the 'Workspace design' section, as follows: Regulation of lighting (F3_1), Regulation of heating/cooling (F3_2), Regulation of air-conditioning (F3_3) and Regulation of ventilation (F3_4).

3.4 'Satisfaction with workspace' section

The 'Satisfaction with workspace' section included 28 questions and/or claims. The suitability of data for factor analysis was confirmed with the Bartlett test (p = 0.000), while the result of the KMO test (0.904) showed a high level of connection and suitability of variables for examination.

On the basis of the presented own values of the 'Satisfaction with workspace' section, it is possible to assess the model with a maximum of one factor, and therefore we did not carry out a rotation of factors. The selected factor can be used to explain 29.89 % of the entire pattern variance. The factor of the section was named Satisfaction with workspace (F5_1). It is explained to the largest possible extent by the following three variables: *satisfaction with conditions in the workplace of the respondent* with a factor weight of 0.855, *assessment of the appeal of the respondent's workspace* with a factor weight of 0.847, and the *assessment of wellbeing of the respondent at the workplace* with a factor weight of 0.833. The factor is also explained by five variables with a factor weight of 0.5 or less; among them the lowest weight is 0.450 for the *assessment of the respondent on experiencing a draught in the workplace*.

Table 3: Pattern Matrix – 'Health' section.

Pattern Matrix(a)

Variable (Question)	Component							
	F8_1	F8_2	F8_3	F8_4	F8_5	F8_6	F8_7	F8_8
Currently I do not have any diagnosed illnesses							0.868	
I assess my overall health as very good							0.423	

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization. A Rotation converged in 8 iterations.

Table 4: Indicators of the final Model.

Final model	Indicator						
	χ2 (chi-square)	df	p	RMSEA	CFI	GFI	SRMR
	917.30	161	0.000	0.068	0.91	0.93	0.073

3.5 'Health condition' section

The 'Health condition' section of the questionnaire included 27 questions and/or claims from the perspective of self-assessment of health: does the respondent hold the disabled person status; is he/she a chronic patient; has he/she been diagnosed with an occupational disease; does he/she experience pain in the back, spine, neck, or has high blood pressure; does he/she suffer from headaches, rheumatism, problems with blood flow, allergies; is he/she on a diet; does he/she connect medical problems with workplace conditions; is he/she on sick leave and, if so, how long was he/she absent; has he/she had health treatment in spas; does he/she take any medication; how many times has he/she been operated on in a hospital; does he/she have regular medical examinations. The typical correlations of the correlation matrix were confirmed by a Bartlett test (p = 0.000), while the result of the KMO test (0.530) confirmed the suitability of the variables for examination. The criterion of own value determined eight factors of the section, which – together – explained 55.99 % of the total variance. The first factor explained 19.31 %, the second an additional 8.09 %, the third 6.55 %, the fourth 5.11 %, the fifth 4.86 %, the sixth 4.21, the seventh 3.99 % and the eight, which – with its own value of 1.042 – additionally explained 3.86 % of the total variance.

The analysis was continued with all variables of the section since their calculated communality was suitable. Afterwards we eliminated variables that were based on several factors at the same time: *regular use of pills, capsules, drops or ointments*; *information on the potential rheumatism of the respondent* and the *assessment of the health of the respondent during the last twelve months*. We used a pattern matrix as the basis for explanation of factors in the relevant section. In accordance with the theoretic model and the purpose of the paper we present only the Overall health (F8_7) factor. It is determined by the statements regarding a *non-diagnosed illness of the respondent* and *respondent's own assessment of health*.

3.6 Testing of hypotheses

Hereinafter we use the confirmatory factor analysis to test the quality of the measurement and structural part of the model. In the measurement part we verified the compatibility of pattern data with the theoretic model. We applied the following suitability indicators: chi-squared (χ^2), RMSEA, CFI, GFI and SRMR. The obtained values of the final model are shown in Table 4.

We specified two hypotheses and nine sub-hypotheses for the original research question: "Do real-estate factors of the workspace have a significant impact on the satisfaction of employees with the workspace and consequently their overall health?"

H1: Real-estate factors of the workspace have a significant impact on the satisfaction of employees with the workspace.

Through the application of factor analysis and on the basis of factor weight matrix we identified the following factors of the 'Business building and workplace (F2)' and 'Workspace design (F3)' sections:

- Cleanliness (F2_1)
- Natural lighting (F2_2)
- Orientation (F2_3)
- Location (F2_4)
- Regulation of lighting (F3_1)
- Regulation of heating/cooling (F3_2)
- Regulation of air-conditioning (F3_3)
- Regulation of ventilation (F3_4)

For the 'Employee satisfaction (F5)' section of the factor weight matrix we identified the following factor for the 'Satisfaction with workspace (F5)' section:
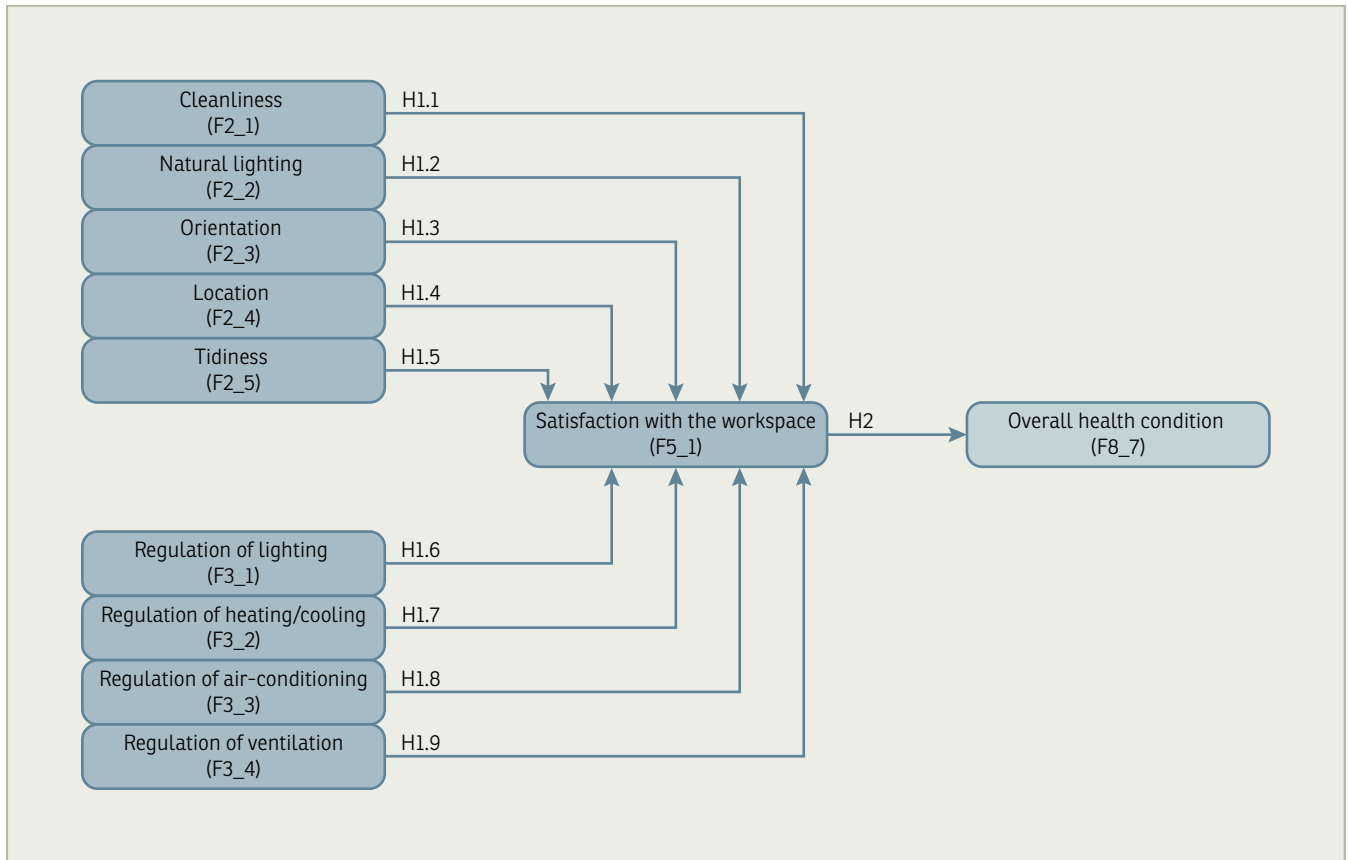
- Satisfaction with workspace (F5_1)

Figure 1: Plan of research of structural equation modelling.

In accordance with the factors identified, we verified whether specific factors from the theoretical model (F2 and F3 sections) had a statistically significant impact on the satisfaction with workspace (F5 section), which we expressed with the following sub-hypotheses:

H1.1 Cleanliness of the workspace has a significant impact on the satisfaction of employees with the workspace (F2_1 → F5_1).

H1.2 Natural lighting of the workspace has a significant impact on the satisfaction of employees with the workspace (F2_2 → F5_1).

H1.3 Orientation of the workspace has a significant impact on the satisfaction of

Table 5: Structural equation model results for H1.

Hypothesis	Causal Path	Path Coefficient	t value		Results
H1.1	F2_1 → F5_1	-0.34	-14.81	***	Supported
H1.2	F2_2 → F5_1	-0.14	-5.62	***	Supported
H1.3	F2_3 → F5_1	-0.06	-2.48	*	Supported
H1.4	F2_4 → F5_1	/	/		Not supported
H1.5	F2_5 → F5_1	/	/		Not supported
H1.6	F3_1 → F5_1	-0.24	-9.64	***	Supported
H1.7	F3_2 → F5_1	/	/		Not supported
H1.8	F3_3 → F5_1	-0.08	-3.71	***	Supported
H1.9	F3_4 → F5_1	/	/		Not supported

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

employees with the workspace (F2_3 → F5_1).

H1.4 Location of the workspace has a significant impact on the satisfaction of employees with the workspace (F2_4 → F5_1).

H1.5 Tidiness of the workspace has a significant impact on the satisfaction of employees with the workspace (F2_5 → F5_1).

H1.6 Regulation of lighting of premises has a significant impact on the satisfaction of employees with the workspace (F3_1 → F5_1).

H1.7 Regulation of heating/cooling has a significant impact on the satisfaction of employees with the workspace (F3_2 → F5_1).

H1.8 Regulation of air-conditioning has a significant impact on the satisfaction of employees with the workspace (F3_3 → F5_1).

H1.9 Regulation of ventilation of premises has a significant impact on the satisfaction of employees with the workspace (F3_4 → F5_1).

On the basis of the results of structural equation modelling shown in Table 5 we established that the '*cleanliness of the workspace*' (F2_1) has a statistically significant ($p < 0.001$) and a medium ($\beta = -0.34$, $t = -14.81$) negative impact on the *satisfaction of employees with their workspace* (F5_1). Moreover, the following variables also have a statistically significant impact on the *satisfaction of employees with the workspace* (F5_1): *natural lighting of the workspace* (F2_2) with a standardised β coefficient (-0.14) and value of t test (-5.62); *regulation of lighting of premises* (F3_1) with $\beta = -0.24$ ($t = -9.64$); *regulation of air-conditioning* (F3_3) of the premises with $\beta = -0.08$ ($t = -3.71$). However, *orientation of the workspace* (F2_3) with significance of $p < 0.05$,

standardised β coefficient of -0.06 ($t = -2.48$) has a negative impact on the *satisfaction with the workspace* (F5_1). We also examined the impact of the *workspace location* (F2_4), *tidiness of the workspace* (F2_5), *regulation of heating/cooling* (F3_2) and *regulation of ventilation of premises* (F3_4) on the *satisfaction of employees with the workspace* (F5_1). The link between the listed combinations proved as statistically insignificant, since the p value exceeded the set limit of $p < 0.05$.

A summary of testing of H1 for the first research question gives the following results: we accept the sub-hypotheses H1.1, H1.2, H1.3, H1.6 and H1.8. On the basis of statistical analysis we can reject the sub-hypotheses: H1.4, H1.5, H1.7 and H1.9.

H1 hypothesis has thus been confirmed in part.

H2: Satisfaction of employees with their workspace has a significant impact on the overall health of employees.

Through the application of factor analysis and on the basis of factor weight matrix we identified the following factor of the 'Health condition (F8)' section:

• Overall health (F8_7)

In accordance with the factors identified, we verified whether the specific factors from the theoretical model (F5 section) had a statistically significant impact on the overall health (F8 section).

The solution of structural equation modelling for Hypothesis 2 is shown in Table 6.

With $\beta = -0.17$ ($t = -5.08$) we established the negative link between the *satisfaction with workspace* (F5_1) and the *overall health of employees* (F8_7).

Hypothesis 2 has thus been confirmed.

5. Discussion

The main purpose of the research was to determine the connection between the

Table 6: Structure equation model results for H2.

Hypothesis	Causal Path	Path Coefficient	t value		Results
H2	F5_1 à F8_7	-0.17	-5.08	***	Supported

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

physical attributes of work environment and the satisfaction of employees including their health conditions, within the financial, healthcare and civil service sector. In the discussion part we have to stress out that some of the findings are similar to the findings from the literature review part, while some are more specific for the Slovenian environment.

In line with the researchers[12,16-19] who have stressed the importance of natural lighting of the workspace and individual control of conditions in their work environment, we similarly found the importance of regulation of lighting of premises and regulation of air-conditioning. Danish researchers[12] for example, carried out research of control mechanisms for the comfort of internal environments: natural air-conditioning, heating, lighting and shades. Their basic presumptions were the link between the satisfaction of users and the possibility to control the circumstances which affect their thermal comfort and that residents are much more lenient towards natural ventilation of buildings, and that only these types of buildings save more energy than artificially ventilated buildings. Moreover, researchers[19] claim that the possibility of individual control of ventilation has a far greater effect on the satisfaction of users than whether the building has a natural ventilation system or whether it has a built-in centralised ventilation system. The researchers also used a questionnaire to ask respondents about their medical state in buildings or outside (e.g. how many times a week do they have problems with fatigue, heavy head, headaches, problems with concentration, irritated nose and irritated eyes. Other researches of indoor environment quality[46] established that in office buildings users mostly complained about (too) low temperature, dry air, bad air or cold radiation next to windows, lack of sound privacy in open office spaces, as well as bad cleaning services. In the field of air quality and its impact on the well-being of employees and their medical conditions, researchers[7] have designed a table of recommendations for the best possible quality of air in buildings: avoid smoking inside the building; use construction and finishing materials without harmful substances; keep harmful waste separated near its source (printers, photocopiers); well-insulated and well-sealed buildings; regular maintenance checks and repairs of ventilation systems; do not use recycled air when using air-conditioning (mandatory introduction of fresh air into the systems); strict supervision while sealing the system during air heating or re-circulation of air; measure the humidity of the premises; regular changing of air filters; regular cleaning of air channels, regular maintenance of cooling devices. Similar results were also confirmed by researchers[47] who were interested in the mixed mode for regulation of the environment: natural or mechanical ventilation. They focused on seven fields of residential comfort on the IEQ scale: thermal comfort, air quality, acoustics, lighting, cleanliness, spatial arrangement and furniture. The results show that only 11 % of 370 buildings in the sample (i.e. units which have regular ventilation systems) can achieve good residential standards (80 % satisfaction of residents). With reference to air quality standards, they stress that buildings with moderate air-conditioning systems and a high level of direct control received good grades too.

We were surprised that location and availability of parking places were not found as important variables for employees, contrary to many other reports.[47-51,1,2] The only important factor found was orientation of the workspace. Cleanliness as a satisfaction variable was mentioned in many papers, but through the literature review we found out its importance only in the papers in which the hospital, hotel and school objects were researched.[52,53] In the health sector it is usual to check the patient satisfaction within the hospital environment, especially in terms of information and communication with doctors, nursery, visits, comfort, privacy and cleanness. In the research,[53] the service characteristic factor was stressed, interpreted as an organizational dimension of patient satisfaction, for which such attributes as free chairs in the waiting room, accessibility of the toilets and cleanness were represented. For the difference from others, we found that for the financial and civil service sec-

tors, cleanliness is also the most important factor for the satisfaction of employees.

6. Conclusions

The present research examined the impact of real-estate factors of the business building on the satisfaction of employees with workspace and, consequently, on the overall health of employees. Thereby, we set up a research impact model, which included three constructs: *real-estate factors of the business building, satisfaction of employees* and *health of employees*. Furthermore, we designed dimensions for each of the above.

On the basis of the results of structural equation modelling, and comparable to researches presented in the introduction, we have established that within the framework of the real-estate factors of the business building construct, the following factors have a significant impact on the *satisfaction of employees with the workspace*: *cleanliness of the workspace, natural lighting of the workspace, orientation of the workspace*, and *regulation of lighting of the workspace*. On the basis of the hypotheses set, we have also confirmed the impact of *satisfaction with the workspace* factor on the *overall health* factor. We established a statistically significant negative link between these two factors.

We can summarise that in order to ensure overall health of the employees, it is important to ensure promotion of health in the workplace with its primary aim: to provide a healthy and safe work environment; to preserve working ability; to reduce excessive absence from work due to illness; to prevent work-related injuries; occupational diseases or diseases caused by work or through the work environment.

Heterogeneous impacts of real-estate factors and/or workspace on the employees are expected; therefore it is necessary to upgrade these elements from the ergonomic and design aspects, also with the help of additional research and its findings.

Our future research will therefore be focused on an in-depth research of impacts or connections between specific real-estate factors and the occurrence of depression symptoms, the link between specific real-estate factors and specific elements of organisational culture, the research on the link of satisfaction with the physical workspace, specific elements of organisational culture and research of the link between the perception of workspace and specific elements of organisational culture.

Furthermore, it would be necessary to perform an evaluation analysis of recognised statistically significant correlations of factors, and additionally research their impact on employees' health, which must be monitored through preventive and periodic medical checks of the employees.

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