

Open Plan Office Design Features Affecting Staff's Health and Well-being Status

Arezou Shafaghat^{a*}, Ali Keyvanfar^a, Hasanuddin Lamit^b, Seyed Ali Mousavi^c, Mohd Zaimi Abd Majid^a

^aConstruction Research Center (CRC), Construction Research Alliance (CRA), Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

^bCenter of Built Environment in the Malays World (KALAM), Faculty of Built Environment, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

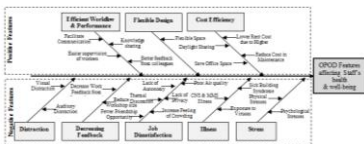
^cFaculty of Civil Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia

*Corresponding author: arezou-rcm@utm.my

Article history

Received :1 May 2014
Received in revised form :
14 September 2014
Accepted :1 Oktober 2014

Graphical abstract



Abstract

Sustainable office building indoor environment design is a challengeable issue for professionals in thermal comfort, satisfaction, health, and energy fields of research. The professionals intensively need a comprehensive list of office indoor environment design features to promote the level of performance and productivity of staff. One of the most effective factors dealing with staff performance and productivity is physical and psychological health which has not yet been investigated in depth is open-plan office design. In this regard, the current research aimed at establishing a comprehensive list of Open Plan Offices Design (OPOD) features affecting physical and psychological health and well-being of the staff at office buildings. Research methodology engaged two phases corresponding to two objectives. Phase one was to investigate OPOD features and sub-features through a critical literature review using fishbone cause-and-effect analysis technique. Phase one has clustered the OPOD features into two; positive and negative classes. The cause-and-effect analysis determined 3 positive features and 5 negative features involved in the positive and negative classes, respectively. The Efficient Workflow and Performance, Flexible Design, and Cost Efficient were identified as positive OPOD features which involves a number of sub-features. The Distraction, Decreasing Work Feedback, Job Dissatisfaction, Illness, and stress have been determined as OPOD features which impact negatively on staff's health. The second phase conducted a content analysis on reviewed literatures to indicate the popularity of citation of each OPOD feature in previous studies. The content analysis determined in the Positive cluster, the sub-feature "Facilitate Communication", under Efficient Workflow & Performance was investigated more than other sub-features. In addition, in the Negative cluster, the sub-feature Auditory Distraction under Distraction was highly investigated. The research asserts that undertaking the research outputs will promote performance and productivity of staff in office buildings. Architects, facility managers, design consultants, and authority may use the output as a decision support checklist for future office design and/or renovations.

Keywords: Open plan design; office building design; workplace assessment; staff health; staff well-being productivity; performance; social sustainable building

© 2014 Penerbit UTM Press. All rights reserved.

1.0 INTRODUCTION

Open Plan office is a workspace which perimeter boundaries do not go to the ceiling¹. Open Plan offices are in the forms of walls or partitions. The idea of Open Plan Office was initiated by two furniture manufacturers in Germany, namely, Eberhard and Wolfgang Schnelle, and then, was extended to the United States by 1960². From that date, the open plan offices became prevalent; because they were believed to improve Office environment design, impact significantly on behavior, perceptions, and performance of employees³. In addition, Open plan type of design improves communication and productivity of staff and employees^{3,4,5,6}. In 1904, Frank Lloyd Wright designed the first office building following the open plan design attributes⁷.

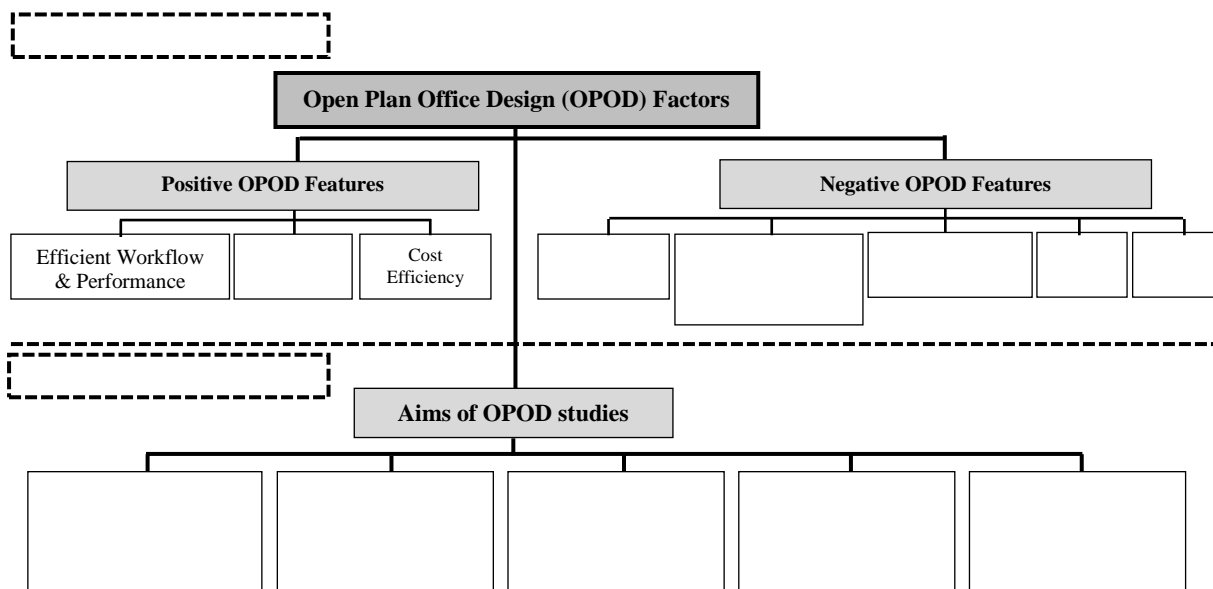
Due to inadequate number of studies, there is insufficient literature on the topic. For this reason, it is not clear to determine whether or not enhancements to open plan office indoor design can enhance the staff's health and well-being, and in turn, to increase level of productivity and performance at office. Most of the previous studies focused on the environmental effects on employees by comparing the traditional enclosed private office type to open plan offices. None of the previous studies specifically focus on open plan office design features that can affect the physical and psychological aspects of staff's health and well-being. According to the literature, there two approaches on definition of health and well-being. As the positive approach, health and well-being can be described as the achievement and maintenance of physical fitness and mental stability. As the negative approach, health and well-being can be defined as the

absence of physical illness, disease and mental distress. The current study covers both approaches. The current study aimed at establishing a comprehensive list of Open Plan Office Design (OPOD) features which enhance the physical and psychological health and well-being of the staff.

Regarding issues and problems discussed, this research aimed at determining Open Plan Offices Design (OPOD) features which affect physical and psychological health and well-being of staff at office indoor environment. Relatively, the study planned to answer the question “What are the open plan design features (OPOD) that affect staff’s health and well-being?, and, “which one(s) of the OPOD features impact more on staff’s health and well-being?” To achieve the aim, the research was designed into two phases corresponding to two objectives have been structured. The first objective is to conduct a cause-effect analysis study on OPOD features using fishbone technique. The second objective is to conduct content analysis on OPOD features reviewed in the literatures. The following sections present the phase one and phase two of the research, respectively.

2.0 TAXONOMY OF OPEN PLAN OFFICE DESIGN STUDIES

The research provided the taxonomy of Open Plan Office Design studies (Figure 1). The taxonomy indicates the aims of OPOD in previous studies. According to Figure 1, previous Open Plan Office Design studies were conducted with diverse aims. The OPOD studies aimed at measuring staff’s productivity and performances, to assess staff’s satisfaction and dissatisfaction, to evaluate ergonomic design effects on work stress reduction. In addition, the taxonomy revealed two approaches, positive and negative which affect Open Plan Office Design (OPOD). The OPOD positively affect the office environment by providing an Efficient Workflow and Performance, Flexible Design, and Cost efficiency. In opposite, OPOD impact negatively by making Distractions, Decreasing Work Feedback from Supervisors, causing Job Dissatisfaction, Illness and Stress. In the next section, the cause and effect analysis on OPOD features will be discussed.



NOTE. Env. Extends to Environment

Figure 1 Taxonomy of open plan office design studies

3.0 CAUSE-EFFECT ANALYSIS ON OPEN PLAN DESIGN STUDIES

In phase one, the research conducted a cause and effect study on OPOD literature. Through cause and effect analysis, the research planned to determine the OPOD features and involved sub-features within two Positive and Negative categories.

The authors have searched the following sources to identify all relevant literature, Journal of Indoor Air, Journal of Ergonomics, Environment and Behavior, Indoor and Built Environment, Journal of Environmental Psychology, Journal of Facilities Management, using available online databases, Scencedirect, Google Scholar, and Scopus, Taylor and Francis, Emerald, and Sage. The authors searched a set of specific keywords in the literatures. The keywords were, Open plan office, Activity-related office, Desk-sharing, Flexible office/workplace, Innovative office, Shared office, Dynamic Office, office renovation, Density and Office, Crowding and Office, Privacy in Office, Noise in Office, Staff health, and staff productivity.

To decrease the human errors and the risk of bias, the research conducted the literature review on final set of articles through a team of four researchers. The research team members were trained on how to find the terminologies and corresponding definitions, and how to find the OPOD features in their reviews. In addition, the authors reviewed those articles that studied the OPOD features, not just those that introduce it at the conclusion or further research.

Using fishbone cause-and-effect technique, the research came up with the OPOD features and sub-features affecting staff’s health and well-being (Figure 2). Figure 2 classifies the OPOD features and sub-features into ‘Positive Features’ and ‘Negative Features’. In depth review on those literatures helped the authors to came up with specified OPOD features involved in each sub-cluster.

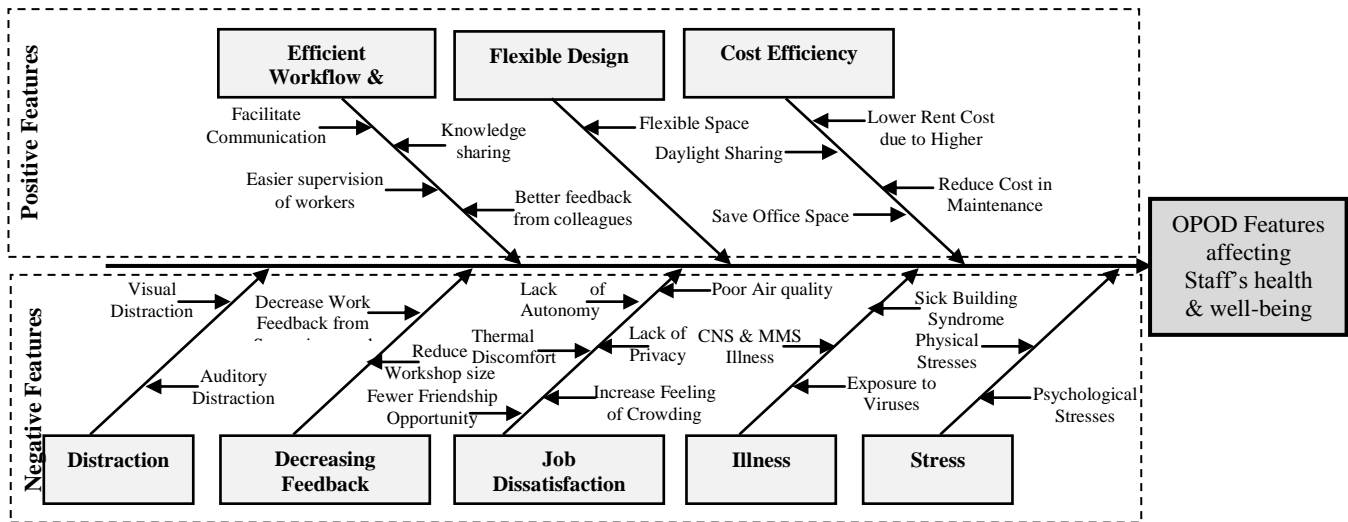


Figure 2 Fishbone cause and effect diagram on OPOD features affecting the health and well-being status of staff in office buildings - Positive and Negative effective OPOD Features

4.0 CONTENT ANALYSIS ON OPOD STUDIES

In the second phase, the research conducted the content analysis on the reviewed OPOD literature with the aim of identifying the most effective OPOD sub-feature affecting staff's health, positively and negatively.

According to the literatures, the relationship between the physical trait of the workplace and employee perceptions and behavior have been studied for both open and close offices^{8,9,10,11}. These studies revealed that the characteristics of the office environment can impact the perception, productivity, and behavior of staff at working places^{12,13}. The office layout is an essential element contributing to such employee behaviors. Conventional workplace designs tend to equip closed and private offices for employees. In contrast, in modern era, open plan design is characterized by an absence of floor-to-ceiling walls and internal boundaries¹⁴.

Open plan offices have broad span such as following: Team-oriented 'bullpen'(employees can see and hear each other freely, but desks are grouped into teams), High-paneled cubicles (employees can't see other employees when seated), Low-paneled cubicles (employees can see over the panels when seated), Clusters or 'pods' (a group of low-paneled work stations, separated by high panels from other pods), Virtual office (a la carte work spaces, offices and communication services.), and Executive suite (subleased office space, even open, in a large professional environment or office building). In previous Open plan offices design studies, the office environment have been assessed in terms of the number of partitions, the height of partitions, density of space, and openness¹⁵. Open plan offices have some advantages which makes it most popular around the world such as lower cost of interior design, because it reduces the required partitions with higher adjustability and access to daylight.

Expositors of open plan offices believe that they boost social relations, cooperation, feedback, solidarity, and knowledge-sharing communication among the employees. In addition, expositors of the open plan office recommend that the open plan creates flexible space which makes reconfiguration and construction of office easier in smaller amount of time and cost. It also provides accommodation for great numbers of employees by reducing amounts of space¹⁵. In fact, the total office space is reduced, and organizations can spend the budget for other essential technical services, such as, air conditioning, maintenance

and building electrical and energy consumption costs. Advocating open plan design enhances the design, facilitates communication and increases the interaction between employees and may promote the level of satisfaction and productivity of the employees¹⁶.

The literature review revealed that the open plan design have positive effects mostly on communication and office cost but also have negative effects on employee attitude and behavior. Open plan offices increase the level of workplace noise^{14,18,19}, increases disturbances and distractions^{17,10,12}, increase feelings of crowding²⁰, and loss of privacy^{7,10,21}. Open plan offices reduce the functional efficiency⁵, decrease the staff performance^{12,22}, reduce required square meters per person, and decrease cost and number of labor needed for maintainance¹⁵. Noise and visual distractions were known as the negative effects of Open plan offices which cause less concentration, specifically, at auditory and governmental organizations^{17,23}. Privacy referring to the degree of individual's social interactions are delimited. It is clustered into two categories, included, visual privacy¹¹, acoustic privacy, and privacy from distractions²⁴. Lack of privacy is very significant in open plan offices^{7,25}. Lack of privacy causes distribution of personal conversations, and also, distribution of communication with supervisors.

The research came up with total of 27 most related articles in OPOD. All reviewed OPOD articles have been transferred into the checklist table which resulted from phase one. The content of the literatures were analyzed to identify which OPOD sub-feature(s) have been focused on. Table 1 presents the content analysis on reviewed open plan office design studies. The research provided the row 'Total' to determine the time(s) of citation for each sub-feature. As can be seen, the 'Facilitate Communication' sub-feature under 'Efficient Workflow & Performance' feature has been mostly investigated in the positive category. In addition, the sub-feature 'Auditory Distraction' under 'Distraction' feature has been mostly addressed in previous studies that focused on the negative aspects.

Table 1 Content analysis of the open plan office design studies

Citations	Positive Features										Negative Features																		
	Efficient Workflow & Performance			Flexible Design	Cost Efficiency							Distraction	Decreasing Feedback	Job Dissatisfaction			Illness			Stress									
	Facilitate Communication	Accommodate Knowledge Sharing	Easier Supervision of Workers		Daylight Sharing	Reduce General and Technical Service Cost	Lower Rent Cost due to Higher Worker Density	Save Office Space	Reduce Cost in Construction	Reduce Cost in Maintenance	Easy to Change the Office Design by minimum Cost			Visual Distraction	Auditory Distraction	Decreasing Work Feedback from Supervisors and coworkers	Reduce Workstation Size	Lack of Autonomy	Thermal Discomfort	Fewer Friendship Opportunity	Increase Feeling of Crowding	Lack of Privacy	Poor Air Quality and Ventilation	Exposure to Viruses	Sick Building Syndrome	CNS & MMS Illness	Physical Stress	Psychological stress	
Hedge (10)											✓	✓															✓		
Maher and Hippel (17)	✓				✓						✓	✓							✓	✓									
Brennan et al. (15)					✓							✓																✓	
Zalesny and Farace (14)	✓					✓						✓		✓															
Kaarlela-Tuomaala et al. (26)	✓	✓		✓	✓							✓		✓															
De Croon et al. (27)	✓				✓			✓											✓	✓									
Lee (28)	✓					✓						✓		✓															
Pejtersen et al. (29)	✓			✓						✓	✓				✓	✓											✓		
Duval et al. (30)	✓		✓		✓	✓				✓	✓			✓															
Balazova et al. (31)	✓	✓	✓								✓					✓													
Smith-Jackson and Klein (24)	✓					✓				✓				✓					✓										
Navai and Veitch (32)	✓								✓				✓						✓										
Haynes (33)	✓				✓							✓							✓										
Pejtersen et al. (34)	✓	✓										✓				✓						✓	✓						
Marquardt et al. (3)	✓								✓	✓																			
De Korte et al. (35)											✓																		
Liebla et al. (36)												✓	✓																
Bodin Danielsson and Bodin (37)												✓																	
Feige et al. (38)																											✓		✓
Vischer (39)																											✓		✓
Jensen et al. (18)													✓																
Banbury and Berry (40)	✓	✓																											
Leather et al. (40)													✓																✓
Roelofsen (41)													✓																
Schutte et al. (23)													✓																
Red et al. (42)																											✓		✓
Cardozo et al. (43)	✓																												✓
TOTAL CITATION	16	4	2	2	6	1	5	4	3	3	3	5	5	17	2	2	3	2	1	3	13	4	1	1	2	4	2		

5.0 DISCUSSION AND CONCLUSION

In conclusion, the research proved that there are OPOD features which positively and negatively affect staff's health and well-beings.

The research came up with three OPOD features that can positively promote staff health and physical fitness and their mental stability. Those features are Efficient Workflow & Performance, Flexible Design, and Cost Efficiency. Each feature involved a number of sub-features. Among the sub-features in the positive category, the Facilitate Communication have been mostly addressed in previous studies, in opposite, the Daylight Sharing sub-feature has been least addressed. In parallel, five OPOD features were identified as OPOD features that negatively impact the physical illness and mental distress to staff, named, Distraction, Decreasing Feedback, Job Dissatisfaction, Illness, and Stress. Among the sub-features, the Auditory Distraction has been indicated as the mostly cited sub-feature in prior studies. In contrast, the Fewer Friendship Opportunity, Exposure to Viruses,

and Sick Building Syndrome have been studied in the minimum rate.

Notably, in this research, demographics, age, race, ethnicity, nationality, education level, office typology (government or private organization), square size of office layout, staff needs and cognition, number of staff, as well as other perceived support or barriers to staff health (e.g., satisfaction, enjoyment, self-selection, self-efficacy) have not been taken into account. These factors can be considered in future works. The research asserts that promoting staff's health and well-being within office indoor environment may vary over time and shift in different ethics, cultures, and life ages.

The end-users of the research output would be both the professionals and practitioners. Architects, facility managers, building owners, consultants, authority, contractor, and academic researchers may use this comprehensive list of OPOD features for fulfilling the requirement of sustainability accreditation in design phase of office building lifecycle. Limited access to the available data sources gave this research some limitations. The research

claims if more data sources were available, more OPOD features may be identified.

6.0 FURTHER STUDY

The outputs of the current research paved the path for next steps in enhancing the office building indoor design. Definitely, empowering positive features, and in turn, reducing negative features, can impact directly on staff's health, which can boost the level of performance and productivity. However, to achieve this ultimate goal, a lot of research is needed. For instance, the further research may focus on the following approaches, formulating correlation of OPOD and Staff's Health, and developing a framework to assess correlation of OPOD and Staff's Health.

Regarding Lamit *et al.*⁴⁵ decision making model, the research asserts that the output can be developed as a design decision support tool for future office design and/or renovations. In addition, the structural and physical aspects of open plan office design and construction need to be investigated as future studies, which have been recommended in previous construction researches, such as, Lee *et al.*⁴⁵, Talebi *et al.*⁴⁶, and Kueh *et al.*⁴⁷.

Acknowledgement

The authors would like to thank the Ministry of Science, Technology, and Innovation (MOSTI) for funding this research projects with vote no. 4S055 and 4S042. Also, the authors appreciate these organizations for their supports and contributions, Research Management Center, KALAM, and Sustainability Research Alliance (SUTRA) at Universiti Teknologi Malaysia.

References

- [1] M. Brill, E. Keable, J. Fabiniak. 2000. The Myth of Open Plan. *Facilities Design and Management*. 19(2): 36–39.
- [2] A. T. Hundert, N. Greenfield. 1969. Physical Space and Organizational Behavior: A Study of an Office Landscape. *Proceedings of the 77th Annual Convention of the American Psychological Association (APA)*. 601–602.
- [3] C. J. G. Marquardt, J. A. Veitch, K. E. Charles. 2000. Environmental Satisfaction with Open-Plan Office Furniture Design and Layout. Institute for Research in Construction, Canada.
- [4] H. B. Lamit, A. Shafaghat, M. Z. Majid, A. Keyvanfar, M. H. B. Ahmad, T. A. Malik. The Path Walkability Index (PAWDEX) Model: To Measure Built Environment Variables Influencing Residents' Walking Behavior. *Advanced Science Letters*. 19(10): 3017–3020.
- [5] M. Z. Abd Majid; W. Z. Zakaria; H. Lamit; A. Keyvanfar; A. Shafaghat; E. S. Bakti. 2012. Construction Information Systems for Executive Management in Monitoring Work Progress. *Advanced Science Letters*. 15(1): 169–171.
- [6] H. B. Lamit; A. Shafaghat; M. Z. Abd. Majid; A. Keyvanfar; Mohd Hamdan Bin Ahmad; T. A. Malik; Rosli Bin Zin; Mohammadreza Yadollahi. Application of the Path Walkability Index (PAWDEX) Model: A Case Study of Retail Walking Pattern Recognition in Taman University Skudai, Johor, Malaysia. *Advanced Science Letters*. 19(10): 3021–3024
- [7] E. Sundstrom, R. Kring Herbert. 1982. Privacy and Communication in an Open-Plan Office-A Case Study. *Environment and Behavior*. 14(3): 379–392. doi: 10.1177/0013916582143007.
- [8] L. K. Block, G. S. Stokes. 1989. Performance and Satisfaction in Private versus Nonprivate Work Settings. *Environment and Behavior*. 21(3): 277–297. doi: 10.1177/0013916589213003.
- [9] A. Crouch, U. Nimran. 1989. Perceived Facilitators and Inhibitors of Work Performance in an Office Environment. *Environment and Behavior*. 21(2): 206–226. doi: 10.1177/0013916589212004.
- [10] A. Hedge. 1980. The Open-Plan Office A Systematic Investigation of Employee Reactions to Their Work Environment. *Environment and Behavior*. 14: 519. doi: 10.1177/0013916582145002.
- [11] M. J. O'Neill, P. Carayon. 1993. The Relationship between Privacy, Control, and Stress Responses in Office Workers. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. 37(7): 479–483. doi: 10.1177/154193129303700702.
- [12] G. R. Oldham. 1988. Effects of Changes in Workspace Partitions and Spatial Density on Employee Reactions: A Quasi-experiment. *Journal of Applied Psychology*. 73: 253–258.
- [13] R. Woods, D. Canter. 1970. The Effect of the Meaning of Buildings on Behavior. *Applied Ergonomics*. 1: 144–150.
- [14] M. D. Zalesny, R. V. Farace. 1987. Traditional Versus Open Offices: A Comparison of Sociotechnical, Social Relations, and Symbolic Meaning Perspectives. *Academy of Management Journal*. 30(2): 240–259. doi: 10.2307/256272.
- [15] A. Brennan, J. S. Chugh, T. Kline. 2002. Traditional versus Open Office Design: A Longitudinal Field Study. *Environment and Behavior*. 34: 279. doi: 0.1177/0013916502034003001.
- [16] Keyvanfar A. Shafaghat A., Abd Majid M. Z., Lamit H. B., Hussin M. W., Binti Ali Kh. N., Dhafer Saad A. 2014. User Satisfaction Adaptive Behaviors for Assessing Energy Efficient Building Indoor Cooling and Lighting Environment. *Renewable and Sustainable Energy Reviews*. 39: 277–295
- [17] A. Maher, C. von Hippel. 2005. Individual Differences in Employee Reactions to Open-plan Offices. *Journal of Environmental Psychology*. 25(2): 219–229.
- [18] K. L. Jensen, E. Arens, L. Zagreus. 2005. Acoustical Quality in Office Workstation, as Assessed by Occupant Surveys. *Proceedings, Indoor Air*. 2401–2405.
- [19] S. Banbury, D. Berry. 2005. Office Noise and Employee Concentration: Identifying Causes of Disruption and Potential Improvements. *Ergonomics*. 48(1): 25–37.
- [20] P. B. Paulus, R. W. Matthews. 1980. Crowding Attribution and Task Performance. *Basic and Applied Social Psychology*. 1: 3–14.
- [21] N. A. Nelson, J. D. Kaufman, J. Burt, C. Karr. 1995. Health Symptoms and the Work Environment in Four Non-problem United States Office Buildings. *Scandinavian Journal of Work, Environment and Health*. 21(1): 51–59.
- [22] J. O. Crawford, S. M. Bolas. 1996. Sick Building Syndrome, Work Factors and Occupational Stress. *Scandinavian Journal of Work, Environment and Health*. 22(4): 243–250.
- [23] M. Schutte, A. Marks, E. Wenning, B. Griefahn. 2007 The Development of the Noise Sensitivity Questionnaire. *Noise and Health*. 9(34): 15–24.
- [24] T. L. Smith-Jackson, K. W. Klein. 2009. Open-plan Offices: Task Performance and Mental Workload. *Journal of Environmental Psychology*. 29(2): 279–289.
- [25] V. W. Kupritz. Privacy. 1998. In The Work Place: The Impact Of Building Design. *Journal of Environmental Psychology*. 18(4): 341–356.
- [26] A. Kaarilela-Tuomaala, R. Helenius, E. Keskinen, V. Hongisto. 2009. Effects of Acoustic Environment on Work in Private Office Rooms and Open-plan Offices—longitudinal Study During Relocation. *Ergonomics*. 52(11): 1423–1444. doi: 10.1080/00140130903154579.
- [27] E. De Croon, J. Sluiter, P. P. Kuijer, M. Frings-Dresen. 2005. The Effect of Office Concepts on Worker Health and Performance: A Systematic Review of the literature. *Ergonomics*. 119–134. doi: 10.1080/00140130512331319409.
- [28] Y. S. Lee. 2010. Office Layout Affecting Privacy, Interaction, and Acoustic Quality in LEED-certified Buildings. *Building and Environment*. 45(7): 1594–1600.
- [29] J. Pejtersen, L. Allermann, T. S. Kristensen. 2006. Indoor Climate, Psychosocial Work Environment and Symptoms in Open Plan Offices. *Indoor Air*. 16(5): 392–401. doi: 10.1111/j.1600-0668.2006.00444.x.
- [30] C. L. Duval, J. A. Veitch, K. E. Charles. 2002. Open-plan Office Density and Environmental Satisfaction. Institute for Research in Construction, Canada.
- [31] I. Balazova, G. Clausen, J. H. Rindel, T. Poulsen, D. P. Wyon. 2008. Open-plan Office Environments: A Laboratory Experiment to Examine the Effect of Office Noise and Temperature on Human Perception, Comfort and Office Work Performance. *Indoor Air*. 17–22.
- [32] M. Navai, V. A. Veitch. 2003. Acoustic Satisfaction in Open-plan Offices: Review and Recommendations. Institute for Research in Construction, Canada. <http://irc.nrc-cnrc.gc.ca/ircpubs>.
- [33] B. P. Haynes. 2008. The Impact of Office Layout on Productivity. *Journal of Facilities Management*. 6(3): 189–201.
- [34] J. H. Pejtersen, H. Feveile, K. B. Christensen, H. Burr. 2011. Sickness Absence Associated with Shared and Open-plan Offices—A National

- Cross Sectional Questionnaire Survey. *Scandinavian Journal of Work Environment and Health*. 376-382, doi:10.5271/sjweh.3167.
- [35] E. De Korte, L. Kuijt-Evers, P. Vink. 2007. Effects of the Office Environment on Health and Productivity 1: Auditory and Visual Distraction. *Ergonomics and Health Aspects of Work with Computers*. 4566: 26–33.
- [36] A. Liebla, J. Haller, B. Jödicke, H. Baumgartner, S. Schlittmeier, Hellbrück J. 2012. Combined Effects of Acoustic and Visual Distraction on Cognitive Performance and Well-being. *Applied Ergonomics*. 43(2): 424–434.
- [37] Ch. Bodin Danielsson, L. Bodin. 2008. Office Type in Relation to Health, Well-Being, and Job Satisfaction Among Employees. *Environment and Behavior*. 40: 636. doi: 10.1177/0013916507307459.
- [38] A. Feige, H. Wallbaum, M. Janser, L. Windlinger. 2013. Impact of Sustainable Office Buildings on Occupant's Comfort and Productivity. *Journal of Corporate Real Estate*. 15(1): 7–34.
- [39] J. C. Vischer. 2008. Towards an Environmental Psychology of Workspace: How People are affected by Environments for Work. *Architectural Science Review*. 51(2): 97–108.
- [40] P. Leather, D. Beale, L. Sullivan. 2003. Noise, Psychosocial Stress and Their Interaction in the Workplace. *J. Exp. Psychology*. 23: 391–397.
- [41] P. Roelofsens. 2008. Performance Loss in Open-plan Offices Due to Noise by Speech. *Journal of Facilities Management*. 6(3): 202–211.
- [42] A. A. Red, S. Fisseha, B. Mengistie, J. M. Vandeweerd. 2010. Standard Precautions: Occupational Exposure and Behavior of Health Care Workers in Ethiopia. *PLOS One*. DOI: 10.1371/journal.pone.0014420.
- [43] B. L. Cardozo, C. G. Crawford, C. Eriksson, J. Zhu, M. Sabin, A. Ager, D. Foy, L. Snider, W. Scholte, R. Kaiser, M. Olf, B. Rijnen, W. Simon, W. 2012. Psychological Distress, Depression, Anxiety, and Burnout among International Humanitarian Aid Workers: A Longitudinal Study. *PLOS One*. DOI: 10.1371/journal.pone.0044948.
- [44] H. Lamit, A. Shafaghat, M. Z. Abd. Majid, A. Keyvanfar, Mohd Hamdan Bin Ahmad, and T. A. Malik. 2013. GROUNDED GROUP DECISION MAKING (GGDM) MODEL. *Journal of Advanced Science Letters*. 19(10): 3077–3080.
- [45] Y. H. Lee, Ch.S Tan., Sh. Mohammad, M. M. D. Tahir, P.N. Shek. 2014. Review on Cold-Formed Steel Connections. *The Scientific World Journal*. 11–19.
- [46] E. Talebi; M. M. D. Tahir, F. Zahmatkesh, A. Yasreen, J. Mirza. 2014. Thermal Behavior of Cylindrical Buckling Restrained Braces at Elevated Temperatures. *The Scientific World Journal*.
- [47] A. B. H. Kueh, W.W. She, P. N. Shek, C. S. Tan, M. M. Tahir. 2011. Maximum Local Thermal Effects Carpet Plot for Symmetric Laminated Composite Plates. *Advanced Materials Research*. 250–253: 3748–3751.