

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

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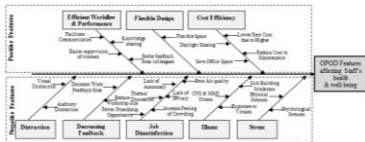
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Graphical abstract



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

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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.

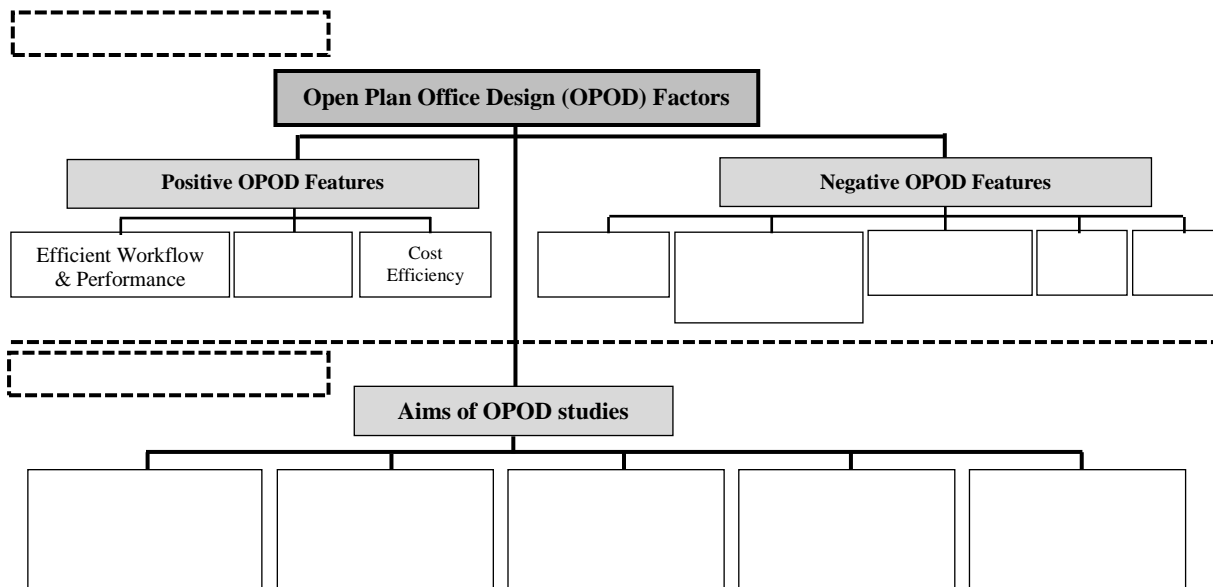
Due to inadequate number of studies, there is insufficient literature on the topic. For this reason, it is not clear to determine whether or not enhancements to open plan office indoor design can enhance the staff's health and well-being, and in turn, to increase level of productivity and performance 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.

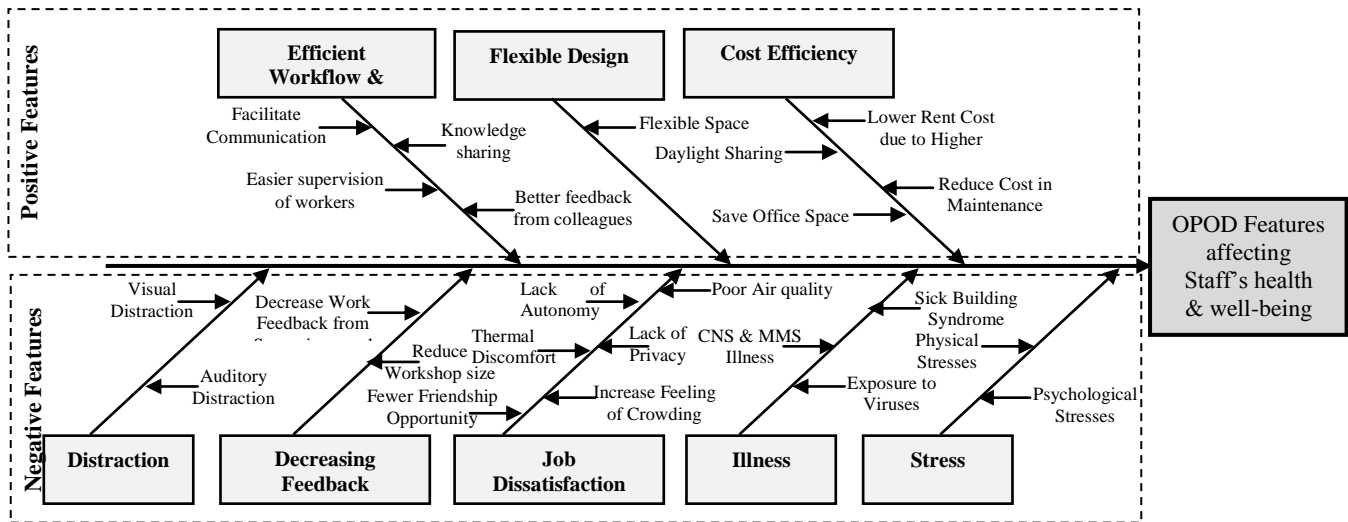


Figure 2 Fishbone cause and effect diagram on OPOD features affecting the health and well-being status of staff in office buildings - Positive and Negative effective OPOD Features

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.

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.

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