Factors Affecting Occupants’ Satisfaction in Governmental Buildings: The Case of the Kingdom of Bahrain

Noora Albuainain 1, Ghaleb Sweis 1, Wassim AlBalkhy 2,* Rateb Sweis 3 and Zoubeir Lafhaj 2

Abstract: Satisfaction is a very important factor in improving productivity and performance in the work environment. This study aims to investigate the levels of occupants’ satisfaction with the indoor environmental quality (IEQ) in the governmental buildings in the Kingdom of Bahrain and to investigate the impact of occupants’ demographics and building attributes (non-IEQ factors) on these levels. For these purposes, the study used a questionnaire that has 17 indoor environmental quality (IEQ) factors in addition to a group of non-IEQ factors. The questionnaire was distributed by hand or using email to 279 employees in the Bahraini governmental sector. The findings of the study revealed that occupants in the Bahraini governmental buildings are not strongly satisfied with IEQ factors, especially with sound privacy, followed by visual privacy and amount of space, and then noise levels. The findings also showed that for most IEQ factors, men are more satisfied than women are, those who work in enclosed private offices are more satisfied than those who work in open-plan offices, and those who have central air-conditioning at their workplace are more than those who have a wall-mounted air conditioner. The impact of age, nature of work, duration of working in the current building and at the current workstation, weekly working hours, and proximity to the window were also investigated. Accordingly, a group of recommendations was suggested aiming to improve the levels of occupants’ satisfaction.

Keywords: occupants’ satisfaction; governmental buildings; indoor environmental quality; post-occupancy evaluation; Bahrain

1. Introduction

Research has shown that occupants in buildings, in general, and in workplaces, in particular, are affected by many building-related factors. Studies about the impact of indoor environmental quality (IEQ) have shown that indoor factors such as thermal, visual, and acoustic factors can produce a noticeable influence on the well-being and satisfaction of occupants [1–7]. Correlations between health problems, including mental and physical illnesses were also found in numerous studies [7,8]. In this regard, IEQ factors are linked with a group of health problems that are called sick building syndrome (SBS) [7,9–16]. The symptoms of this syndrome can include irritation of the eyes and nose, headaches, cough, wheezing, cognitive disturbances, depression, light sensitivity, gastrointestinal distress, etc. [7,17,18]. Furthermore, work indoor environment can affect the outcomes of employees and their organizations as well. In a study conducted in the UK, Gensler [19] found that British businesses lost around GBP 135 billion annually due to poorly designed offices. The study also showed that around 79% of the participants in the study believe that the indoor environment affects their job satisfaction and productivity. Similarly, IEQ factors were found to affect job satisfaction in many other studies.
such as Veitch et al. [20] and Frontczak et al. [21] in the USA, Humphreys [22], Astolfi and Pellerey [23], and Bluyssen et al. [24] in a group of European countries, and Lai et al. [25] and Wong et al. [26] in Hong Kong. Furthermore, in a review that included 300 journal articles, Al Horr et al. [6] found that occupants’ comfort and productivity are influenced by eight IEQ factors, which are office layout, thermal comfort, indoor air quality, noise and acoustics, lighting, location and feel, location and amenities, biophilia, and views.

Globally, there are several initiatives and databases to evaluate building performance and occupants’ satisfaction in buildings such as the Center for Built Environment (CBE) in the United States, BOSS Methodology in the United Kingdom, and the Building Occupants Survey System Australia (BOSSA) in Australia. Additionally, the literature has several studies in which Post Occupancy Evaluation (POE) was used to assess occupants’ satisfaction with IEQ factors, economic value, and environmental performance [27]. Among these studies, several studies were conducted in the office building environment [7,16,21,28–37]. Although these studies are very important, there is still a need to conduct more studies about IEQ in governmental buildings aiming at understanding the relationship between IEQ and occupants’ satisfaction in this type of buildings, with their primary occupants being the governmental employees.

Public or governmental offices play a crucial and essential role in any country since they pursue national values of serving the citizens and residents in the country. Many authors and researchers found significant differences in job satisfaction, productivity, performance, behavior, motives, and commitment between the employees in these offices and in private offices [38–41]. Additionally, some authors showed some different characteristics in the governmental and private office buildings. For instance, Steel and Warner [42] claimed that the poorly organized workplace in governmental offices is one of the factors affecting employees’ satisfaction in this sector. On the contrary, Lee and Guerin [43] asserted that when Leadership in Energy Environmental Design (LEED) green building certification was established, most of the applications for LEED certification were sent by governmental buildings, after which commercial offices and private owners were encouraged to seek LEED certification.

Nevertheless, the studies that were specifically about occupants’ satisfaction with IEQ in governmental buildings were extremely scarce. In a study conducted by Li et al. [44], it was found that among 146 projects in 269 published articles about POE between 2010 and 2017, only 5 projects were about governmental buildings. Among these studies, Daish et al. [45] developed a tool for POE to evaluate occupants’ satisfaction in governmental buildings in New Zealand. Nawawi and Khalil [46] studied the performance of governmental buildings in Malaysia and its relation with employees’ satisfaction in these buildings. Their study revealed that most of the performance factors were correlated with occupants’ satisfaction. The highest correlations were in windows, staircases, lighting, lifts, finishes, air-conditioning, and maintenance. Cao et al. [47] studied the results of different field studies about IEQ factors in public buildings in Shanghai and Beijing in 2008 and 2009. The reports included measurements of different parameters including air temperature, mean radiant temperature, relative humidity, air velocity, CO2 concentration, illumination intensity, and A-weighted sound pressure levels. Then, based on these measurements and their relationships with occupants’ satisfaction, a model was developed to use designers to adopt the most satisfying scheme.

Scope of the Study

Most studies about POE and IEQ were conducted in Europe and North America [44]. A very little number of studies were conducted in the Arabian Gulf region; most of them are about residential buildings, and no study was found about governmental buildings. In the Kingdom of Bahrain, the case study of this research, governmental organizations and institutes participated in around 25% of the national economic growth [48], and they are responsible for leading the “2030 Economic Vision” that was set to develop the kingdom’s economy and achieve sustainability in all Bahraini sectors. However, the authors have
not found any published study that investigates the factors that affect productivity or performance in this sector, especially those related to the built environment. This study aims at identifying the factors and the standards and indicators that the Bahraini government, designers, planners, and other professionals in the construction sector have to be aware of to create safe, comfortable, and healthy workplaces for employees in Bahrain. It also aims at investigating the weaknesses and strengths in the governmental buildings in the kingdom and evaluating the quality of the indoor environment in these buildings. As a result, the findings of the study might be very helpful to improve provided value to occupants, as well as to citizens and the national economy of the kingdom. Further, due to the lack of studies in the region and about governmental buildings in general, the findings of the study might be applicable in several other places around the globe.

2. Research Methodology

The current study used the quantitative approach using a questionnaire to collect quantitative data to achieve its objectives. The use of the quantitative approach is very common in managerial studies since it gives the researcher quantitative insights into the perceptions of individuals in the organizations [49–51]. Accordingly, it is useful to assess the satisfaction of employees as occupants of the buildings. In addition, the use of questionnaires as a data collection tool is common in the studies of POE and occupants’ satisfaction [21,29,30,35–37,52–55].

The used questionnaire in this study was developed after reviewing the literature about POE. The questionnaire included two main parts: the first part included the non-IEQ factors, while the second included the IEQ factors. Both parts’ items were selected from different resources in the literature. Table 1 shows examples of the references used to select the items. IEQ factors were taken from two main studies, which are Kim and de Dear [34] and Ren and Dai [30], who analyzed the CBE POE database and listed the 16 IEQ factors in their studies to assess the occupants’ satisfaction in offices. The assessment of IEQ factors was based on a five-point Likert scale as follows: (1 = Strongly dissatisfied, 2 = Dissatisfied, 3 = Neutral, 4 = Satisfied, 5 = Strongly satisfied).

| Group              | Item                                      | Reference                                      |
|--------------------|-------------------------------------------|------------------------------------------------|
| Non-IEQ factors    | Gender                                    | [21,29,33,35–37,56–59]                         |
|                    | Age                                       | [21,29,33,35–37,58,59]                         |
|                    | Office Layout                              | [21,31–36,43,60]                               |
|                    | Job category                               | [21,33,35,36]                                  |
|                    | Duration of working in the building        | [21,29]                                       |
|                    | Duration of working at the present workspace |                                               |
|                    | Time spent at workspace per week           | [21,29,35]                                    |
|                    | Workstation’s distance from a window       | [21,35,36]                                    |
|                    | Ventilation system                         | [21]                                           |
| IEQ factors        | Temperature                               | [30,34]                                       |
|                    | Air quality                               |                                                |
|                    | Amount of light                            |                                                |
|                    | Visual comfort                             |                                                |
|                    | Noise level                                |                                                |
|                    | Sound privacy                              |                                                |
|                    | Amount of space                            |                                                |
|                    | Visual privacy                             |                                                |
The questionnaire was then sent to employees in the Bahraini Buildings of Ministry of Education, Ministry of Health, Ministry of Housing, Ministry of Justice, Ministry of Works Municipalities Affairs and Urban Planning, Ministry of Interior, and Customs Headquarter. Most of these buildings are not new. Therefore, this study aims to assess the levels of satisfaction of occupants, aiming at developing strategies for future design and renovation processes.

The total number of employees in the governmental sector in Bahrain is 63,000 employees. The study used the random sampling technique to collect data; this was achieved by random assignments to lists of employees from the government using random number generators in Microsoft Excel. Using sample size formula (Equation (1)) [61], with defining 63,000 as population size, $\alpha = 0.05$ as a significance level, 0.5 as a sample proportion, and a 6% margin of error, the needed sample size was found as 266 employees.

$$n = \frac{Z^2 \cdot p(1 - p)}{Me^2} = \frac{1.96^2 \cdot 0.5 \cdot 0.5}{(0.06)^2} = 266$$  \hspace{1cm}(1)

where $n$ is the needed sample size, $Z$ is the critical value of the normal distribution at $\alpha/2$, $p$ is the sample proportion, and $Me$ is the margin error.

After distributing the questionnaire by hand and using emails to a group of employees in different governmental employees, 279 questionnaires were received and were valid for the study.

After the data collection phases ended, the data were analyzed using Statistical Package for the Social Sciences (SPSS), version 25.0. The analysis of the data includes demographic profile using percentages and frequencies for non-IEQ factors (to describe the sample profile), assessing satisfaction levels with IEQ using means and standard deviations for IEQ factors, and testing the differences in IEQ assessment due to non-IEQ factors. Differences were tested using independent t-test or one-way analysis of variance (ANOVA), for normally distributed data, and Mann–Whitney test or Kruskal–Wallis test for non-normally distributed data.

3. Results and Discussion

3.1. Occupants’ Characteristics and Building Attributes

Table 2 shows the occupants’ characteristics and building attributes (non-IEQ factors). The table shows that more than half of the sample are females (57.7%), those who are younger than 30 years old constitute around one-third of the sample ($n = 84$), and more than half of the sample are either occupying administrative positions ($n = 87$) or professional positions ($n = 92$). Concerning office type, around half of the sample working in cubicles with low ($n = 80$) or high ($n = 57$) partitions, 30.8% of the sample work in enclosed shared offices, 14.0% work in enclosed private offices, and only 6.1% of the sample work in open offices with no partitions. It also shows that around two-thirds of the sample have been working in their current building for more than five years ($n = 181$), and the vast majority...
of the sample has been working at their current workstation (office) for more than one year \((n = 239)\). Most of the participants spend at least 30 h per week at work at their offices \((n = 193)\). The table also shows that most participants work in a place that has a distance of less than 4.6 m from the window. Concerning ventilation systems, more than 75% of the sample work in offices that have a central air-conditioning system.

Table 2. Occupants’ characteristics and building attributes (non-IEQ factors).

| Non-IEQ Factor | Groups                      | Frequencies (%) |
|----------------|-----------------------------|-----------------|
| Gender         | Male                        | 118 (42.3%)     |
|                | Female                      | 161 (57.7%)     |
| Age            | Less than 30 years          | 84 (30.1%)      |
|                | 30–50 years                 | 163 (58.4%)     |
|                | More than 50 years          | 32 (11.5%)      |
| Job category   | Administrative              | 87 (31.2%)      |
|                | Technical                   | 34 (12.2%)      |
|                | Professional                | 92 (33.0%)      |
|                | Managerial-supervisory      | 36 (12.9%)      |
|                | Other                       | 30 (10.8%)      |
| Office layout  | Enclosed Private (EP)       | 39 (14.0%)      |
|                | Enclosed shared (ES)        | 87 (31.2%)      |
|                | Cubicles with low partitions (CLP) | 79 (28.3%) |
|                | Cubicles with high partitions (CHP) | 57 (20.4%) |
|                | Open office with no partitions (OO) | 17 (6.1%) |
| Duration of working in the building | Less than 1 year | 14 (5.0%) |
|                | 1–3 years                   | 52 (18.6%)      |
|                | 3–5 years                   | 32 (11.5%)      |
|                | More than 5 years           | 181 (64.9%)     |
| Duration of working at the present workspace | Less than 1 year | 40 (14.3%) |
|                | One year or more            | 239 (85.7%)     |
| Time spent at workspace per week | Less than 10 h per week | 28 (10.0%) |
|                | 10–30 h per week            | 58 (20.8%)      |
|                | More than 30 h per week     | 193 (69.2%)     |
| Workstation’s distance from a window | Within 4.6 m | 183 (65.6%) |
|                | Further than 4.6 m          | 64 (22.9%)      |
|                | No window                   | 32 (11.5%)      |
| Ventilation system | Wall-mounted air conditioner | 66 (23.7%) |
|                | Central air-conditioning    | 213 (76.3%)     |

3.2. Levels of Occupants’ Satisfaction

Table 3 shows the means and standard deviations for the satisfaction levels with IEQ factors in the Bahraini governmental building. The table shows that overall satisfaction has a mean score of (3.11), which is not that high when compared to complete satisfaction (5.00). The highest satisfaction levels with the IEQ factor are ease of interaction, followed by building cleanliness, and then the amount of light, while the lowest satisfaction levels with IEQ factors are sound privacy, followed by visual privacy, and then the amount of space. Regarding IEQ dimensions, the highest satisfaction levels are with thermal comfort,
lighting, and cleanliness, while the lowest satisfaction levels are with acoustic quality, office layout (including the amount of space and visual privacy), and office furnishings.

Table 3. Occupants’ satisfaction levels.

| IEQ Dimension                  | IEQ Factor          | Mean  | Std. Deviation |
|--------------------------------|---------------------|-------|----------------|
| Thermal comfort                | Temperature         | 3.24  | 1.228          |
| Air quality                    | Air quality         | 3.07  | 1.282          |
| Lighting                       | Amount of light     | 3.33  | 1.190          |
|                                | Visual comfort      | 3.23  | 1.158          |
| Acoustic quality               | Noise level         | 3.03  | 1.155          |
|                                | Sound privacy       | 2.79  | 1.226          |
| Office layout                  | Amount of space     | 2.82  | 1.219          |
|                                | Visual privacy      | 2.81  | 1.175          |
|                                | Ease of interaction | 3.41  | 1.229          |
| Office furnishings             | Comfort of furnishing | 3.07  | 1.232          |
|                                | Adjustability of furniture | 3.05  | 1.241          |
|                                | Colors and textures | 3.03  | 1.216          |
| Cleanliness and maintenance    | Building cleanliness| 3.35  | 1.263          |
|                                | Workspace cleanliness| 3.29  | 1.311          |
|                                | Building maintenance| 3.10  | 1.247          |
| Overall satisfaction           | Overall satisfaction| 3.11  | 1.192          |

These results show that occupants in the Bahraini governmental buildings are not completely satisfied with the indoor environmental quality factors. The overall satisfaction level is (3.11), which is so close to being dissatisfied. This study is one of its kind in the Arabian Gulf region since the previous studies were not about the satisfaction with either governmental buildings or office buildings [27,54,62–70]. Therefore, this result is incomparable with the previous studies in the region. In comparison with other studies in the US [21,32], in the UK [28], and several European countries [59], it seems that occupants of the governmental buildings in the Kingdom of Bahrain are less satisfied than occupants of office buildings in the above-mentioned countries since the previous studies described their participants as “generally satisfied.” However, more studies need to be conducted and similar methods need to be adopted to test the differences in satisfaction levels in Bahraini buildings and buildings from other countries.

The highest and lowest satisfaction levels align with most of the studies in the literature [21,29,30,35,59,71]. The most apparent inconsistency between the current study and the previous studies is in rating the thermal comfort satisfaction. While most studies found low levels of satisfaction with temperature [29,34,35,59], the temperature was among the top five satisfactory factors in this study. This might be attributed to the differences in the climate between this study and other studies, as the Kingdom of Bahrain has a very hot climate throughout the year and all offices in the governmental buildings in Bahrain have air conditioners that work continuously.

3.3. Differences in Occupants’ Satisfaction Levels Due to Non-IEQ Factors

3.3.1. Gender

Figure 1 shows the differences in the levels of occupants’ satisfaction between male and female respondents. The figure shows that male respondents are more satisfied than female respondents with all IEQ factors. The analysis revealed statistically significant differences in the means of satisfaction levels between both genders for most of the IEQ
factors. Noise level, colors and textures of the furniture, and overall satisfaction are the only exceptions.

![Figure 1. The impact of gender on satisfaction with IEQ factors.](image)

It was found that most studies in the literature about the impact of gender on occupants’ satisfaction used ordinal logistic regression (OLS) to identify the most affected factors by gender. Therefore, OLS was used for the same purpose in this study; the results of OLS are shown in Table 4. The table shows odd ratios (OR) for male participants with having odd ratios for female participants as a reference (OR = 1.00). The odd ratios for noise level, colors and textures, and overall satisfaction levels are insignificant, which shows that overall satisfaction is not affected by gender difference. It is also shown that for all other factors, OR for male participants is greater than one, which means that female participants are more sensitive and critical to IEQ factors than male participants. Moreover, the table shows that for building cleanliness (OR = 2.568), temperature (OR = 2.557), workspace cleanliness (OR = 2.184), and air quality (OR = 2.119), male participants are more than two times more likely to have higher satisfaction than female participants.

These results confirm the results of most of the studies about the impact of gender on occupants’ satisfaction. For instance, Kim et al. [33] found statistically significant higher levels of satisfaction levels among men than those among women with all IEQ factors, except for overall satisfaction. Their study also found that the greatest differences were in the levels of satisfaction with temperature, air quality, sound privacy, and workspace cleanliness. Similarly, in their study about satisfaction with 12 overall factors and 14 sub-attributes, Bae et al. [29] found that men have higher means of satisfaction with the vast majority of these factors. The highest differences were also found in thermal conditions and privacy factors.

The results from OLR also confirm the results of many studies about gender preferences for IEQ factors. In regard to thermal conditions, most studies have found that women have higher dissatisfaction levels than men in the same thermal conditions [33,35,57,72–77]. This gap in satisfaction levels was even found regardless of the climate, as it was found in Australia [57], North America [33,36], Europe [78–80], and East Asia [81,82]. Only a few studies found insignificant differences in satisfaction with thermal comfort [59,83–85] or inverted results [58]. The usual explanation for the differences in satisfaction with temperature is the differences in clothing between males and females [75,76]. This explanation might be suitable for the Bahraini environment, where women are more likely to wear Islamic clothes in a hot climate. However, according to De Carli et al. [86] and
Karjalainen [57], this explanation cannot be the sole explanation, and it cannot be generalized. Other explanations for the differences in satisfaction with temperature pointed at the differences in the physiological nature of the two sexes. Rates of metabolism are lower among females [87], and females have 20% less body mass, 14% more body fat, and 18% less surface area the males [88]. In addition, the skin temperature of women is less than that among men [82].

Table 4. Differences in satisfaction levels in terms of respondents’ gender.

| IEQ Factor          | Odd Ratio | CI (95%)       |
|---------------------|-----------|----------------|
| Temperature         | 2.557     | [1.629–4.015]  |
| Air quality         | 2.119     | [1.373–3.271]  |
| Amount of light     | 1.699     | [1.101–2.625]  |
| Visual comfort      | 1.718     | [1.116–2.641]  |
| Noise level         | NS *      | NS *           |
| Sound privacy       | 1.962     | [1.278–3.013]  |
| Amount of space     | 1.820     | [1.186–2.795]  |
| Visual privacy      | 1.554     | [1.015–2.382]  |
| Ease of interaction | 1.865     | [1.209–2.872]  |
| Comfort of furnishing | 1.711    | [1.114–2.627]  |
| Adjustability of furniture | 1.927 | [1.254–2.962] |
| Colors and textures | NS *      | NS *           |
| Building cleanliness | 2.568    | [1.649–3.995]  |
| Workspace cleanliness | 2.184    | [1.418–3.367]  |
| Building maintenance | 1.994    | [1.293–3.074]  |
| Overall satisfaction | NS*       | NS *           |

*NS: Not significant, a: CI: Confidence Interval.

The high OR (2.119) for males, in comparison to females, indicates a high gap between levels of satisfaction with air quality between the two sexes. This gap was also found in many previous studies [29,33]. The literature has shown that females have a higher prevalence to have symptoms due to indoor air quality-related problems such as stuffy air, drought, and dust [89], and they are more likely to have symptoms of sick building syndrome (SBS) than males [90–96]. These differences in the prevalence of SBS and in air-quality satisfaction were attributed by some authors to the differences in hormonal levels between females and males, which, in turn, give different psychosocial thresholds for the stimuli [97]. Others believed that using eye make-up and contact lenses increases the prevalence of SBS symptoms and eye irritations [98].

Generally, differences in satisfaction levels between females and males in the office environment have been found in many studies. However, these differences might be affected by other confounding factors, including psychological factors, job-related factors, or cultural factors [33,58,99–101]. Other confounding variables than those mentioned above might include low occupational pride, nature of work, job strain, lack of social support, lack of work control, etc.

3.3.2. Age

Figure 2 shows that the senior group (above 50 years) have the highest levels of satisfaction for all IEQ factors, while the middle (30–50 years) have the lowest levels of satisfaction with all IEQ factors except sound privacy (the junior group has the lowest levels for sound privacy). Regarding the significant differences, Figure 2 shows that age influence was significant for five IEQ factors, which are temperature, air quality, adjustability of
furniture, workspace cleanliness, and building cleanliness. Post hoc analysis shows that most of these differences are results of the higher satisfaction levels among those who are aged more than 50 years old, in comparison to the other two groups.

The impact of age on occupant satisfaction with IEQ factors was not thoroughly discussed as much as the impact of gender, and generally, there is no agreement in the literature on the influence of age on occupants’ satisfaction. Therefore, the results of this study are both similar and different from the results in the previous studies. Bae et al. [29] found similar results since they found that the lowest satisfaction levels were among the middle group for most IEQ factors but not for sound privacy, and they found significant differences in the levels of satisfaction with cleaning factors and air quality and higher satisfaction levels with thermal conditions among the senior group. Sakellaris et al. [59] found higher levels of satisfaction with air quality and noise levels among the older groups but insignificant differences for the other factors. Contrastingly, several researchers found an insignificant effect of age on IEQ satisfaction [28,35]. Concerning SBS, a study in Singapore found that being younger, in addition to air quality, low thermal comfort, and high noise levels, is the main risk factor for SBS [94]. Concerning satisfaction with temperature, Choi et al. [72] found higher levels of thermal comfort among participants who are older than 40 years old in the cooling seasons (when the mode of air conditioners is put on cooling, not heating). This is consistent with the results of this study but inconsistent with Indraganti et al. [58]. According to Choi et al. [72], usually, it is expected to have a negative relationship between age and thermal comfort due to the lower metabolic rates among the elderly. However, this is only applicable in a colder environment, but in a hot environment, the elderly have lower thermal sensitivity due to the lower cold thermal preceptors, in comparison to younger people [102,103]. Accordingly, this might produce higher levels of thermal comfort among older groups in hot regions such as Bahrain.

3.3.3. Job Category

Figure 3 shows the differences in occupant satisfaction levels between respondents with different nature of work. The figure shows that those who have technical works have the highest satisfaction levels with all IEQ factors, in comparison to the other groups. It also shows that the participants in the study have significantly different satisfaction levels with temperature, air quality, sound privacy, visual privacy, building cleanliness, workspace cleanliness, and building maintenance. Post hoc test showed that most of these differences
are due to the higher satisfaction levels among technical employees, in comparison to satisfaction levels among the other groups.

![Figure 3. The impact of job category on satisfaction with IEQ factors.](image)

While this factor was introduced in several studies, its effect on occupants’ satisfaction in office buildings was overlooked [21,34,35,60,104] or found to be insignificant [36]. Kim et al. [33] studied the combined effect of gender and type of work on occupants’ satisfaction; however, the independent effect of type of work was not studied. That might be due to its relation to the type of office, which has received much more attention in the literature. However, in this study, different results are found for the impact of these two factors, which calls the need for more investigations about the influence of the type of work, especially in the presence of some evidence about the impact of the type of work on SBS. For instance, Burge et al. [105] found that it is more likely to find SBS symptoms among clerical and secretarial workers, then among technical and professional workers, and then among managers.

3.3.4. Office Layout

Figure 4 shows the differences in occupants’ satisfaction levels between respondents who have different office layouts. The figure shows that the employees who are working in enclosed offices have the highest satisfaction levels, and those who are working in private offices have the highest levels of satisfaction with factors related to acoustic quality (sound privacy and noise level). The same employees have the highest overall satisfaction levels (mean score = 3.53), while those who are working in open offices without partitions have the lowest overall satisfaction levels (mean score = 2.24). The analysis revealed statistically significant differences between satisfaction levels with all factors, except air quality, amount of light, building cleanliness, workspace cleanliness, and building maintenance. Post hoc analysis revealed that most of the differences are due to the high satisfaction levels among employees who are working in enclosed offices and the low satisfaction levels among those who are working in open offices without partitions.

The results of the current study are consistent with many of these studies. Most of the previous studies reported problems such as lack of privacy, high noise levels, feeling of crowding, less thermal comfort, furnishing, and uncontrolled interaction and interruptions in open offices [21,28,30–32,34,36,59,106–110].
More specifically, acoustic quality factors (noise levels and sound privacy) and visual privacy are the most problematic IEQ concerns among the employees in open offices. This result is confirmed in this study since there is a noticeable gap between the levels of satisfaction with these acoustic quality factors between enclosed private offices and open offices with no partitions, and there is a positive relationship between the levels of enclosure and satisfaction with these three factors. The lack of privacy, interruptions, and noise (noise from people and noise due to the use of some shared equipment in the office) negatively affect the productivity and performance of employees in offices, in addition to causing several psychological and social problems (e.g., headaches, frustration, stress, anger, tiredness, short-term memory failure, loss of motivation, and low levels of belongingness) [6,16,111–115].

In terms of ease of interaction, some researchers support the idea that the main advantage of open offices is improving the interaction between employees, which, in turn, improves communication, knowledge transfer, collaboration, performance, and productivity in the work [116–118]. Others found similarities in the levels of ease of interactions among employees in different office layouts and insignificant effect of office configuration on the level of interaction among employees [34,111]. In this study, employees in enclosed offices (private and shared) have statistically higher levels of satisfaction with ease of interaction than those in open offices with no partitions. These differences between the current study and the other studies might be attributed to the impact of distraction on the rating of interaction, which might create an inverse impact among employees. This idea is partially supported by what was addressed by Al-Esia and Skok [119] who claimed that the Arab knowledge-sharing attitude is a bit different from other groups since it is affected by some factors such as informal communication and informal meetings, which, in turn, might create some distraction.

Regarding the other significant IEQ factors, the results of this study support the results of some studies in the literature that showed higher levels of satisfaction with these IEQ factors in enclosed offices [21,34]. These might be attributed to the fact that in most cases, the degree of enclosure and privacy of the office is related to the position in the hierarchical structure of the organization, which means that those in private or enclosed shared offices...
are expected to have higher positions than employees in other types of offices. That might be reflected in the furniture and colors and textures in their offices. Moreover, employees in private offices or offices with a lower number of people have higher levels of personal control on factors such as temperature and amount of space, which, in turn, would be reflected in their levels of satisfaction with these factors [21,34,111,120].

Open-plan offices are more associated with high levels of sick leaves, low levels of psychological physiological well-being, and deterioration of relations among employees [16,71,121–123]. However, the use of these offices is more beneficial to reduce cost by reducing the needed area per person and reducing energy consumption. In addition, their use might have a positive impact on team working [6,111,124]. Therefore, there is a need for more innovative solutions that have financial benefits but, at the same time, cannot affect the well-being, satisfaction, productivity, and performance of the employees. The results of this study show that the use of partitions, regardless of their heights, is much more beneficial than the dependence on having open-plan offices. Another solution was suggested by Haynes et al. [111], which is having a range of different spaces for employees where they can meet, rather than having one large open-plan environment.

3.3.5. Duration in Building and Duration at the Current Workstation (Office)

Figure 5 shows the differences in occupants’ satisfaction levels due to the duration of working in the building. The figure shows that the highest overall satisfaction is for the employees who have been working for less than one year in the building, while the lowest is for those who have been working in the building for one to three years. The figure also shows that the highest satisfaction levels for most IEQ factors are among those who have been working in the building for less than one year. The analysis revealed statistically significant differences in satisfaction levels with visual privacy, ease of interaction, adjustability of furniture, building cleanliness, and workplace cleanliness. Post hoc analysis revealed that most of the differences are due to the high satisfaction levels among respondents who have been working for less than one year in the buildings and the low levels among those who have been there for 3–5 years or more than five years.

![Figure 5. The impact of duration in the building on satisfaction with IEQ factors.](image-url)

Figure 6 shows the differences in occupants’ satisfaction levels due to the duration of working at the current workstation. The figure shows that, in general, there are no
statistically significant differences in satisfaction levels between those who have been working at their current workstation for less or more than one year. The only significant differences are with sound privacy and building cleanliness, as those who have been at their current workstation have higher levels of satisfaction.

![Bar chart showing differences in satisfaction levels](chart.png)

**Figure 6.** The impact of duration at the current workstation on satisfaction with IEQ factors.

Only a little number of studies have discussed the impact of duration at the current workstation and the impact of duration in the building on satisfaction with IEQ. Schiavon and Altomonte [35] found that occupants who had been at LEED buildings for less than one year were more satisfied than those who spent more time in the buildings. Altomonte et al. [28] found a negative relationship between IEQ satisfaction and time spent in both buildings and the workplace in BREEAM buildings (Building Research Establishment Environmental Assessment Method). Bae et al. [29] found statistically significant higher levels of satisfaction among occupants who spent less than two years in office buildings in Minnesota with privacy, cleaning and maintenance, and acoustic quality. The differences in privacy might be attributed to the relationship between the demanded privacy and seniority in the work as addressed by Newsham et al. [125]. Despite the consistency between this study and the other three studies, there is still a need for more investigations on the impact of duration at building/workspace on IEQ satisfaction.

### 3.3.6. Time Spent at Workspace per Week

Figure 7 shows the differences in occupants’ satisfaction levels due to time spent at work per week. The figure shows that except for noise level, visual comfort, and amount of light, there are no statistically significant differences in employees’ satisfaction due to the different number of working hours per week. For overall satisfaction, the lowest mean score is for those who are working for more than 30 h per week (mean score = 2.90); however, this mean score’s difference from those in the other two groups is not statistically significant. For the factors that have statistically significant differences, the source of differences is in the higher satisfaction level among those who work for more than 30 h per week, in comparison to those who work for 10–30 h per week.
The number of weekly working hours was considered in several surveys in the literature [21, 29, 35, 60, 104]. However, its effect was rarely investigated. Regarding satisfaction with temperature, this study confirms the results of Erlandson et al. [80], who found insignificant correlation between working hours and thermal sensation. However, the result of this study contradicts the results of the study of Bae et al. [29], who found a significantly negative impact on the number of weekly working hours on most IEQ factors. The higher satisfaction levels among those who spent more hours at work might be attributed to higher belongingness or feelings of stability, in comparison to the other groups. However, this hypothesis needs more investigations to be accepted or rejected.

3.3.7. Distance to Window

Figure 8 shows the differences in occupants’ satisfaction levels due to distance from a window. The figure shows that, in general, levels of satisfaction with IEQ factors increase when the employee is closer to a window. Significant differences are found in the levels of satisfaction with the amount of light, visual comfort, visual privacy, noise level, and sound privacy.

The results of this study confirm the results of many studies in the literature, as the proximity to the window was found useful to gain higher ratings from employees about the planning, privacy, and lighting of their workspace [106] and reduce discomfort [126]. It was also found to have a positive effect on mental and psychological functions, satisfaction, productivity, and performance of employees [6, 28, 36, 60, 127–132]. While some studies in the literature showed a negative impact for the proximity to window and temperature and lighting satisfaction due to the impact of glare and thermal problems [126, 133], surprisingly, in a country that has a sharp sun such as Bahrain, the opposite but insignificant relationship was found in this study between distance to window and satisfaction with temperature and lighting.

3.3.8. Ventilation System

Figure 9 shows the differences in occupants’ satisfaction levels due to the ventilation system. The figure shows that the use of central air-conditioning helps to achieve higher levels of satisfaction with all IEQ factors. Surprisingly, the only exception for that is the satisfaction with temperature, which shows that wall-mounted air conditioners in Bahraini
governmental buildings can achieve acceptable thermal effectiveness, in comparison to central heating. However, this type of air conditioner, which is less cost effective than central air conditioning, has a negative impact on other IEQ factors such as air quality, acoustic quality, cleanliness, and overall satisfaction.

![Figure 8. The impact of proximity to window on satisfaction with IEQ factors.](image)

![Figure 9. The impact of ventilation system on satisfaction with IEQ factors.](image)
While most studies in the literature compared different types of ventilation systems, including natural ventilation during heating and cooling seasons [134–137], this study compared only two types of mechanical systems because the other types are rarely used in Bahrain, and all ventilation systems are only used for cooling purposes. Therefore, this study recommended conducting more studies about the impact of mechanical ventilation systems on IEQ satisfaction in a similar environment.

4. Conclusions

In the work environment, occupants’ satisfaction with the indoor environmental quality (IEQ) is a critical factor that affects their health, well-being, job satisfaction and performance, and productivity [6,7,16,111]. Although considerable research has been devoted to study occupants’ satisfaction in office buildings, little attention has been paid to occupants’ satisfaction in governmental buildings, especially in the Middle East [44]. Therefore, this study sought to present the assessment of the occupants’ satisfaction with IEQ factors in the governmental buildings in the Kingdom of Bahrain. For this purpose, the study collected data from 279 employees in the Bahraini governmental buildings using the POE survey.

The results of the study are summarized in Table 5. The study has the following conclusions:

1. Occupants in the Bahraini governmental buildings are not strongly satisfied with their workplaces. The findings also showed that the lowest satisfaction levels were with sound privacy, then visual privacy and amount of space, and then noise levels;
2. The study revealed that gender, office layout, and ventilation system are affecting most of the IEQ factors. Additionally, it showed that privacy factors (visual and sound) and cleanliness factors (workspace and building) are the most affected IEQ factors by the differences in non-IEQ factors;
3. Male participants have higher levels of satisfaction than female participants in all IEQ factors. The greatest gaps in satisfaction levels were found in satisfaction with temperature, air quality, and cleanliness factors. This confirms the results of the previous studies, which found that women have a higher sensitivity to thermal conditions and a higher prevalence of being under the risk of SBS symptoms;
4. The highest levels of satisfaction with most IEQ factors were in enclosed private offices, and the lowest was in the open offices with no partitions, where occupants were strongly dissatisfied with sound privacy, visual privacy, and amount of space;
5. Central air-conditioning is useful to achieve higher levels of satisfaction for most IEQ factors when it is compared with a wall-mounted air conditioner. The only exception in this rule is satisfaction with temperature;
6. For the other non-IEQ factors, the study found that the middle age group (30–50 years) is significantly less satisfied than the other groups with temperature, air quality, adjustability of furniture, and building and workplace cleanliness. Additionally, the job category significantly influences satisfaction with temperature, air quality, sound and visual privacy, building and workspace cleanliness, and building maintenance. Further, those who have been working in the buildings for less than one year have statistically significantly higher levels of satisfaction with visual privacy, building and workspace cleanliness, adjustability of furniture, and ease of interaction. Those who are closer to the window have statistically significant levels of satisfaction than those who are seated away with visual privacy, sound privacy, visual comfort, noise level, and amount of light. Finally, the influence of weekly working hours and duration at the current workstation were found insignificant for most IEQ factors.
Table 5. Summary of the differences in satisfaction levels due to non-IEQ factors.

| IEQ Factor             | Gender | Age | Job Category | Office Layout | Duration at Building | Duration at Workplace | Time Spent at Work | Distance to Window | Ventilation System |
|------------------------|--------|-----|--------------|---------------|----------------------|----------------------|---------------------|--------------------|-------------------|
| Temperature            | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Air quality            | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Amount of light        | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Visual comfort         | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Noise level            | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Sound privacy          | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Amount of space        | *      | *   | *            | *             |                      |                      |                     |                    | *                |
| Visual privacy         | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Ease of interaction    | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Comfort of furnishing  | *      | *   | *            | *             |                      |                      |                     |                    | *                |
| Adjustability of       | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| furniture              |        | *   |              |               |                      |                      |                     |                    | *                |
| Colors and textures    | *      | *   | *            | *             | *                    | *                    | *                   | *                  | *                |
| Building cleanliness   | *      | *   | *            | *             |                      |                      |                     | *                  | *                |
| Workspace cleanliness  | *      | *   | *            | *             |                      |                      |                     | *                  | *                |
| Building maintenance   | *      | *   | *            | *             |                      |                      |                     | *                  | *                |
| Overall satisfaction   | *      | *   | *            | *             |                      |                      |                     | *                  | *                |

*: Significant differences at a significant level of $\alpha = 0.050$.

Based on the findings of the study, a group of recommendations can be made as follows: firstly, more studies are needed to investigate the presence of SBS or other building-related distresses and problems among the occupants of governmental buildings in the Kingdom of Bahrain, especially among females. Secondly, more investigations are needed to know the exact reasons for the low satisfaction levels among the occupants of the buildings, especially among females. Accordingly, strategies to improve these levels should be adopted. Thirdly, adopting more innovative strategies in the design of workplaces would help to improve levels of satisfaction among employees. These strategies are highly needed to replace the open-plan offices in a way that helps employees to interact and communicate without violating their privacy or without creating too much distraction for each other. Fourthly, reducing the use of wall-mounted air-conditioners in the governmental buildings in Bahrain and replacing them with more cost-effective solutions would also help to ensure better satisfaction levels of employees. Fifthly, conducting more studies about the influence of job category, duration at building/workspace, and weekly working hours on IEQ satisfaction is needed. In addition to conducting more studies about the interaction between the variables, the impact of other confounding variables such as job stress, office location, individual control, etc. should also be considered. Finally, future studies can investigate the differences between occupants’ satisfaction in private and governmental buildings in a specific location or using specific methods of design; the differences between the two sectors in terms of the nature of work and relationships with clients can be introduced in these cases as control variables.

This work is not free of limitations. The first limitation is the use of a self-administrated questionnaire to collect the data in this study. Although this methodology is highly adopted in the literature, there is still a need for more physical measurements such as the preferred temperature by occupants, air velocity, percentage of contaminants, etc. Additionally, there is a need for conducting more qualitative investigations to gain further insights from the participants. Therefore, future research can use more than one method to assess occupants’ satisfaction. The second limitation is related to the duration of data collection; the data
were collected in one round, which means that the findings might be affected by the mood of respondents at the time of data collection. Therefore, future research may use continuing POE in different phases. In this way, the employment of data from phase to phase would be more meaningful. However, the cost of the study would rise significantly. The third limitation is the low number of those who have been for less than one year in building or at offices, in comparison to the other groups. This low number is a result of random sampling; therefore, future research may consider using other sampling techniques. The fourth limitation, the study used a POE survey that included 17 IEQ factors. Other factors related to IEQ or factors related to the external environment (such as views and proximity to other facilities) can be considered in future studies. Finally, although this study was conducted on the same number as the required sample size for random sampling, conducting a study with the same or close objectives on a larger sample size and using different sampling techniques is highly recommended to make more generalized perceptions.

The study aimed at filling the gap in the literature regarding the scarcity of studies that specifically investigated occupants’ satisfaction in governmental buildings. The findings of this study are beneficial for decision makers and design teams to be used during the design or renovation phases of governmental buildings in the Kingdom of Bahrain, and in similar environments (e.g., other Arabian Gulf countries). These findings help stakeholders to understand the sources of differences in the levels of satisfaction with IEQ among employees who are the real occupants of Bahraini governmental buildings and who are the link between the government and the citizens of the kingdom. Therefore, these findings might be reflected in the overall performance of the government.

Moreover, the used methodology in this study might be applicable to other types of buildings (e.g., office buildings, commercial buildings, educational facilities, etc.) inside and outside the Kingdom of Bahrain.

Author Contributions: Conceptualization, N.A., G.S and W.A.; methodology, W.A. and N.A; software, W.A.; validation, G.S., R.S., and Z.L.; formal analysis, W.A and R.S.; investigation, N.A.; resources, N.A and G.S.; data curation, W.A.; writing—original draft preparation, W.A and R.S.; writing—review and editing, G.S., R.S and Z.L; visualization, W.A.; supervision, G.S.; project administration, G.S and N.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Bourikas, L.; Gauthier, S.; En, N.K.S.; Xiong, P. Effect of Thermal, Acoustic and Air Quality Perception Interactions on the Comfort and Satisfaction of People in Office Buildings. *Energies* 2021, 14, 333. [CrossRef]
2. Bortolini, R.; Forcada, N. Association between Building Characteristics and Indoor Environmental Quality through Post-Occupancy Evaluation. *Energies* 2021, 14, 1659. [CrossRef]
3. Chen, C.-F.; Yilmaz, S.; Pisello, A.L.; De Simone, M.; Kim, A.; Hong, T.; Bandurski, K.; Bavaresco, M.V.; Liu, P.-L.; Zhu, Y. The impacts of building characteristics, social psychological and cultural factors on indoor environment quality productivity belief. *Build. Environ.* 2020, 185, 107189. [CrossRef]
4. Lecese, F.; Rocca, M.; Salvadori, G.; Belloni, E.; Buratti, C. Towards a holistic approach to indoor environmental quality assessment: Weighting schemes to combine effects of multiple environmental factors. *Energy Build.* 2021, 245, 11056. [CrossRef]
5. Apte, M.G.; Fisk, W.J.; Daisey, J.M. Associations Between Indoor CO2 Concentrations and Sick Building Syndrome Symptoms in U.S. Office Buildings: An Analysis of the 1994-1996 BASE Study Data. *Indoor Air* 2000, 10, 246–257. [CrossRef]
6. Al Horr, Y.; Arif, M.; Kaushik, A.; Mazroei, A.; Katayfjioutou, M.; Elsarrag, E. Occupant productivity and office indoor environment quality: A review of the literature. *Build. Environ.* 2016, 105, 369–389. [CrossRef]
7. Al Horr, Y.; Arif, M.; Katayfjioutou, M.; Mazroei, A.; Kaushik, A.; Elsarrag, E. Impact of indoor environmental quality on occupant well-being and comfort: A review of the literature. *Int. J. Sustain. Built Environ.* 2016, 5, 1–11. [CrossRef]
19. Wheeler, G.; Almeida, A. These Four Walls: The Real British Office; Gensler Architecture, Design and Planning Worldwide; Taylor & Francis: London, UK, 2005.

20. Veitch, J.A.; Charles, K.E.; Farley, K.M.; Newsham, G.R. A model of satisfaction with open-plan office conditions: COPE field findings. J. Environ. Psychol. 2007, 27, 177–189. [CrossRef]

21. Frontczak, M.J.; Schiavon, S.; Goins, J.; Arens, E.; Zhang, H.; Wargocki, P. Quantitative relationships between occupant satisfaction and satisfaction aspects of indoor environmental quality and building design. Indoor Air 2011, 22, 119–131. [CrossRef] [PubMed]

22. Humphreys, M.A. Quantifying occupant comfort: Are combined indices of the indoor environment practicable? Build. Res. Inf. 2005, 33, 317–325. [CrossRef]

23. Astolfi, A.; Pellerey, F. Subjective and objective assessment of acoustical and overall environmental quality in secondary school classrooms. J. Acoust. Soc. Am. 2008, 123, 163–173. [CrossRef]

24. Bluyssen, P.M.; Aries, M.; van Dommelen, P. Comfort of workers in office buildings: The European HOPE project. Build. Environ. 2011, 46, 280–288. [CrossRef]

25. Lai, A.; Mui, K.; Wong, L.; Law, L. An evaluation model for indoor environmental quality (IEQ) acceptance in residential buildings. Energy Build. 2009, 41, 930–936. [CrossRef]

26. Wong, L.; Mui, K.; Hui, P. A multivariate-logistic model for acceptance of indoor environmental quality (IEQ) in offices. Build. Environ. 2008, 43, 1–6. [CrossRef]

27. Sanni-Anibire, M.O.; Hassanain, M.A. Quality assessment of student housing facilities through post-occupancy evaluation. Arch. Eng. Des. Manag. 2016, 12, 367–380. [CrossRef]

28. Altomonte, S.; Saadouni, S.; Kent, M.G.; Schiavon, S. Satisfaction with indoor environmental quality in BREEAM and non-BREEAM certified office buildings. Arch. Sci. Rev. 2017, 60, 343–355. [CrossRef]

29. Bae, S.; Asojo, A.O.; Martin, C.S. Impact of occupants’ demographics on indoor environmental quality satisfaction in the workplace. Build. Res. Inf. 2019, 48, 301–315. [CrossRef]

30. Ren, S.; Dai, L. The Various Factors Affecting Occupants’ Satisfaction in the Open-Plan Shared Office. In Proceedings of the Advances in Intelligent Systems and Computing; Springer: Berlin/Heidelberg, Germany, 2019; pp. 436–446.

31. Danielsson, C.B.; Bodin, L. Difference in Satisfaction with Office Environment among Employees in Different Office Type. J. Archit. Plann. Res. 2009, 26, 241–257.

32. Guerin, D.A.; Brigham, J.K.; Kim, H.-Y.; Choi, S.; Scott, A. Post-occupancy evaluation of employees’ work performance and satisfaction as related to sustainable design criteria and workstation type. J. Green Build. 2012, 7, 85–99. [CrossRef]

33. Kim, J.; de Dear, R.; Cândido, C.; Zhang, H.; Arens, E. Gender differences in office occupant perception of indoor environmental quality (IEQ). Build. Environ. 2013, 70, 245–256. [CrossRef]

34. Kim, J.; de Dear, R. Workspace satisfaction: The privacy-communication trade-off in open-plan offices. J. Environ. Psychol. 2013, 36, 18–26. [CrossRef]

35. Schiavon, S.; Altomonte, S. Influence of factors unrelated to environmental quality on occupant satisfaction in LEED and non-LEED certified buildings. Build. Environ. 2014, 77, 148–159. [CrossRef]

36. Leder, S.; Newsham, G.R.; Veitch, J.A.; Mancini, S.; Charles, K.E. Effects of office environment on employee satisfaction: A new analysis. Build. Res. Inf. 2015, 44, 34–50. [CrossRef]

37. Choi, J.-H.; Moon, J. Impacts of human and spatial factors on user satisfaction in office environments. Build. Environ. 2017, 114, 23–35. [CrossRef]
38. Baarspul, H.C.; Wilderom, C.P. Do Employees Behave Differently In Public- Vs Private-Sector Organizations? Public Manag. Rev. 2011, 13, 967–1002. [CrossRef]
39. Bysted, R.; Hansen, J.R. Comparing Public and Private Sector Employees’ Innovative Behaviour: Understanding the role of job and organizational characteristics, job types, and subsectors. Public Manag. Rev. 2013, 17, 698–717. [CrossRef]
40. Hansen, J.R. From Public to Private Sector: Motives and explanations for sector switching. Public Manag. Rev. 2013, 16, 590–607. [CrossRef]
41. Monte, P.A.D. Public versus private sector: Do workers’ behave differently? Economia 2017, 18, 229–243. [CrossRef]
42. Steel, B.S.; Warner, R.L. Job Satisfaction Among Early Labor Force Participants: Unexpected Outcomes in Public and Private Sector Comparisons. Rev. Public Pers. Adm. 1990, 10, 4–22. [CrossRef]
43. Lee, Y.S.; Guerin, D.A. Indoor environmental quality differences between office types in LEED-certified buildings in the US. Build. Environ. 2010, 45, 1104–1112. [CrossRef]
44. Li, P.; Froese, T.M.; Brager, G. Post-occupancy evaluation: State-of-the-art analysis and state-of-the-practice review. Build. Environ. 2018, 133, 187–202. [CrossRef]
45. Daish, J.; Gray, J.; Kornohan, D.; Salmond, A. Post Occupancy Evaluations of Government Buildings. Arch. Sci. Rev. 1983, 26, 50–55. [CrossRef]
46. Post-occupancy evaluation correlated with building occupants’ satisfaction: An approach to performance evaluation of government and public buildings. J. Build. Apprais. 2008, 4, 59–69. [CrossRef]
47. Cao, B.; Ouyang, Q.; Zhu, Y.; Huang, L.; Hu, H.; Deng, G. Development of a multivariate regression model for overall satisfaction in public buildings based on field studies in Beijing and Shanghai. Build. Environ. 2012, 47, 394–399. [CrossRef]
48. International Monetary Fund. Labor Market Reforms to Boost Employment and Productivity in the GCC—An Update; IMF Policy Paper; Annual Meeting of Ministers of Finance and Central Bank Governors: Kuwait City, Kuwait, 25 October 2014.
49. Albalkhy, W.; Sweis, R. Assessing lean construction conformance amongst the second-grade Jordanian construction contractors. Int. J. Constr. Manag. 2019, 1–13. [CrossRef]
50. Samara, A.; Sweis, R.J.; Tarawneh, B.; Albalkhy, W.; Sweis, G.; Alhomsi, S. Sustainability management of international development projects by International Non-Governmental Organizations: The case of INGOS working with refugees in Jordan. Int. J. Constr. Manag. 2020, 1–10. [CrossRef]
51. Sweis, R.; Al-Huthaifi, N.; Alawneh, A.; Albalkhy, W.; Suifan, T.; Saa’Da, R. ISO-9001 implementation and critical success factors of the Jordanian consulting engineering firms. Int. J. Prod. Perform. Manag. 2021. [CrossRef]
52. Hatoum, M.B.; El Mustapha, R.; Nassar, C.; Zaheraldeen, H.; Hamzeh, F. Lean Methods to Improve End User Satisfaction in Higher Education Buildings. In Proceedings of the 26th Annual Conference of the International Group for Lean Construction; IGLC: Chennai, India, 2018; pp. 187–198.
53. Sanni-Anibire, M.O.; Hassanain, M.A.; Al-Hammad, A.-M. Post-Occupancy Evaluation of Housing Facilities: Overview and Summary of Methods. J. Perform. Constr. Facil. 2016, 30, 04016009. [CrossRef]
54. Mustafa, F.A. Performance assessment of buildings via post-occupancy evaluation: A case study of the building of the architecture and software engineering departments in Salahaddin University-Erbil, Iraq. Front. Arch. Res. 2017, 6, 412–429. [CrossRef]
55. Olanrewaju, A.A.L. Quantitative analysis of defects in university buildings: User perspective. Built Environ. Proj. Asset Manag. 2012, 2, 167–181. [CrossRef]
56. Karjalainen, S. Gender differences in thermal comfort and use of thermostats in everyday thermal environments. Build. Environ. 2007, 42, 1594–1603. [CrossRef]
57. Karjalainen, S. Thermal comfort and gender: A literature review. Indoor Air 2011, 22, 96–109. [CrossRef] [PubMed]
58. Indraganti, M.; Ooka, R.; Rijal, H.B. Thermal comfort in offices in India: Behavioral adaptation and the effect of age and gender. Energy Build. 2015, 103, 284–295. [CrossRef]
59. Sakellaris, I.A.; Saraga, D.E.; Mandin, C.; Roda, C.; Fossati, S.; De Kluijzenaar, Y.; Carrer, P.; Dimitroulopoulou, S.; Mihucz, V.G.; Szigeti, T.; et al. Perceived Indoor Environment and Occupants’ Comfort in European “Modern” Office Buildings: The OFFICAIR Study. Int. J. Environ. Res. Public Health 2016, 13, 444. [CrossRef]
60. Göçer, Ö.; Candido, C.; Thomas, L.; Göçer, K. Differences in Occupants’ Satisfaction and Perceived Productivity in High- and Low-Performance Offices. Buildings 2019, 9, 199. [CrossRef]
61. Cochran, W.G. Sampling Techniques; John Wiley & Sons: New York, NY, USA, 1977.
62. Abdou, A.; United Arab Emirates University; Al Dghaimat, M. Post Occupancy Evaluation of Educational Buildings: A Case Study of a Private School in the UAE. In Proceedings of the Annual International Conference on Architecture and Civil Engineering (ACE 2016), Singapore, Singapore, 25–26 April 2016.
63. Hassanain, M.A.; Alnuaimi, A.K.; Sanni-Anibire, M.O. Post occupancy evaluation of a flexible workplace facility in Saudi Arabia. J. Facil. Manag. 2018, 16, 102–118. [CrossRef]
64. Hassanain, M.A.; Mudheji, A.A. Post-occupancy evaluation of academic and research library facilities. Struct. Surv. 2006, 24, 230–239. [CrossRef]
65. Hassanain, M.A.; Mathar, H.; Aker, A. Post-occupancy evaluation of a university student cafeteria. Arch. Eng. Des. Manag. 2015, 12, 67–77. [CrossRef]
66. Hassanain, M.A.; Ifitkhar, A. Framework model for post-occupancy evaluation of school facilities. Struct. Surv. 2015, 33, 322–336. [CrossRef]
67. Hassanain, M.A. Post-Occupancy Indoor Environmental Quality Evaluation of Student Housing Facilities. *Arch. Eng. Des. Manag.* 2007, 3, 249–256. [CrossRef]

68. Hassanain, M.A. On the performance evaluation of sustainable student housing facilities. *J. Facil. Manag.* 2008, 6, 212–225. [CrossRef]

69. Omari, S.; Woodcock, A. Post occupancy evaluation of primary schools in Saudi Arabia. *Work* 2012, 41, 881–887. [CrossRef] [PubMed]

70. Ali, H.; Alfallah, G. Sustainable Architectural Applications in the Gulf States—Post Occupancy Evaluation Case Study of Kingdom of Saudi Arabia. In Proceedings of the 17th Symposium for Improving Building Systems in Hot and Humid Climates, Austin, Texas, USA, 24–25 August 2010; pp. 1–16.

71. Danielsson, C.B.; Bodin, L.; Wulff, C.; Theorell, T. The relation between office type and workplace conflict: A gender and noise perspective. *J. Environ. Psychol.* 2015, 42, 161–171. [CrossRef]

72. Choi, J.; Aziz, A.; Loftness, V. Investigation on the impacts of different genders and ages on satisfaction with thermal environments in office buildings. *Build. Environ.* 2010, 45, 1529–1535. [CrossRef]

73. Choi, J.-H.; Loftness, V.; Aziz, A. Post-occupancy evaluation of 20 office buildings as basis for future IEQ standards and guidelines. *Energy Build.* 2012, 46, 167–175. [CrossRef]

74. de Dear, R.; Fountain, M. Field experiments on occupant comfort and office thermal environment in a hot-humid climate. *ASHRAE Trans.* 1994, 100, 457–475.

75. Donnini, G.; Molina, J.; Martello, C. Field study of occupant comfort and office thermal environments in a cold climate. *ASHRAE Trans.* 1996, 103, 795–802.

76. Cena, K.; de Dear, R. Thermal comfort and behavioural strategies in office buildings located in a hot-arid climate. *J. Therm. Biol.* 2001, 26, 409–414. [CrossRef]

77. Nakano, J.; Tanabe, S.-I.; Kimura, K.-I. Differences in perception of indoor environment between Japanese and non-Japanese workers. *Energy Build.* 2002, 34, 615–621. [CrossRef]

78. Schellen, L.; Loomans, M.; de Wit, M.; Olesen, B.W.; Lichtenbelt, W.V.M. The influence of local effects on thermal sensation under non-uniform environmental conditions—Gender differences in thermophysiology, thermal comfort and productivity during convective and radiant cooling. *Physiol. Behav.* 2012, 107, 252–261. [CrossRef]

79. Kräuchi, K.; Gasio, P.F.; Vollenweider, S.; Von Arb, M.; Dubler, B.; Orgül, S.; Flammer, J.; Stutz, E.Z. Cold extremities and difficulties initiating sleep: Evidence of co-morbidity from a random sample of a Swiss urban population. *J. Sleep Res.* 2008, 17, 420–426. [CrossRef] [PubMed]

80. Erlandson, T.; Cena, K.; De Dear, R.; Havenith, G. Environmental and human factors influencing thermal comfort of office occupants in hot—humid and hot—arid climates. *Ergonomics* 2003, 46, 616–628. [CrossRef]

81. Erlandson, T.; Cena, K.; De Dear, R.; Havenith, G. Environmental and human factors influencing thermal comfort of office occupants in hot—humid and hot—arid climates. *Ergonomics* 2003, 46, 616–628. [CrossRef]

82. Lan, L.; Lian, Z.; Liu, W.; Liu, Y. Investigation of gender difference in thermal comfort for Chinese people. *Graefe's Arch. Clin. Exp. Ophthalmol.* 2007, 102, 471–480. [CrossRef] [PubMed]

83. Hwang, R.-L.; Lin, T.-P.; Kuo, N.-J. Field experiments on thermal comfort in campus classrooms in Taiwan. *Energy Build.* 2006, 38, 53–62. [CrossRef]

84. Hwang, R.-L.; Lin, T.-P.; Kuo, N.-J. Field experiments on thermal comfort in campus classrooms in Taiwan. *Energy Build.* 2006, 38, 53–62. [CrossRef]

85. Hussein, I.; Rahman, M.H.A. Field study on thermal comfort in Malaysia. *Eur. J. Sci. Soc.* 2009, 37, 134–152.

86. De Carli, M.; Olesen, B.W.; Zarrella, A.; Zecchin, R. People’s clothing behaviour according to external weather and indoor environment. *Indoor Environ. Build.* 2013, 42, 3965–3973. [CrossRef] [PubMed]

87. Choi, J.-H.; Aziz, A.; Loftness, V.; Aziz, A. Post-occupancy evaluation of 20 office buildings as basis for future IEQ standards and guidelines. *Energy Build.* 2012, 46, 167–175. [CrossRef]

88. Burse, R.L. Sex Differences in Human Thermoregulatory Response to Heat and Cold Stress. *Hum. Factors: J. Hum. Factors Ergon. Soc.* 1979, 21, 687–699. [CrossRef]

89. Zalejska-Jonsson, A.; Wilhelmsson, M. Impact of perceived indoor environment quality on overall satisfaction in Swedish dwellings. *Build. Environ.* 2013, 63, 134–144. [CrossRef] [PubMed]

90. Stenberg, B.; Mild, K.H.; Sandstrom, M.; Sundell, J.; Wall, S. A Prevalence Study Of The Sick Building Syndrome (SBS) And Facial Skin Symptoms In Office Workers. *Indoor Air* 1993, 3, 71–81. [CrossRef]

91. Skov, P.; Valbjorn, O.; Pedersen, B.V. Influence of personal characteristics, job-related factors and psychosocial factors on the sick building syndrome. Danish Indoor Climate Study Group. *Scand. J. Work. Environ. Health* 1989, 15, 286–295. [CrossRef]

92. Brasche, S.; Bullinger, M.; Morfeld, M.; Gebhardt, H.J.; Bischof, W. Why do Women Suffer from Sick Building Syndrome more often than Men?—Subjective Higher Sensitivity versus Objective Causes. *Indoor Air* 2001, 11, 217–222. [CrossRef]

93. Stenberg, B.; Wall, S. Why do women report ‘sick building symptoms’ more often than men? *Soc. Sci. Med.* 1995, 40, 491–502. [CrossRef] [PubMed]

94. Ooi, P.L.; Goh, K.T.; Phoon, M.H.; Foo, S.C.; Yap, H.M. Epidemiology of sick building syndrome and its associated risk factors in Singapore. *Occup. Environ. Med.* 1998, 55, 188–193. [CrossRef] [PubMed]
95. Lenvik, K. Sick building syndrome symptoms—Different prevalences between males and females. *Environ. Int.* **1992**, *18*, 11–17. [CrossRef]

96. Kim, J.; Jang, M.; Choi, K.; Kim, K. Perception of indoor air quality (IAQ) by workers in underground shopping centers in relation to sick-building syndrome (SBS) and store type: A cross-sectional study in Korea. *BMC Public Health* **2019**, *19*, 1–9. [CrossRef]

97. Bakke, J.V.; Moen, B.E.; Wiersland, G.; Norbäck, D. Gender and the Physical and Psychosocial Work Environments are Related to Indoor Air Symptoms. *J. Occup. Environ. Med.* **2007**, *49*, 641–650. [CrossRef]

98. Wolkoff, P. “Healthy” eye in office-like environments. *Environ. Int.* **2008**, *34*, 1204–1214. [CrossRef]

99. Bildt, C.; Michelsen, H. Gender differences in the effects from working conditions on mental health: A 4-year follow-up. *Int. Arch. Occup. Environ. Health* **2002**, *75*, 252–258. [PubMed]

100. Reynolds, S.J.; Black, D.W.; Borin, S.S.; Breuer, G.; Burmeister, L.F.; Fuortes, L.J.; Smith, T.F.; Stein, M.A.; Subramanian, P.; Thorne, P.S.; et al. Indoor Environmental Quality in Six Commercial Office Buildings in the Midwest United States. *Appl. Occup. Environ. Hyg.* **2001**, *16*, 1065–1077. [CrossRef]

101. Kinman, G.; Griffin, M. Psychosocial factors and gender as predictors of symptoms associated with sick building syndrome. *Stress Health* **2008**, *24*, 165–171. [CrossRef]

102. Yoshihara, Y.; Ohnaka, T.; Nagai, Y.; Tokuda, T.; Kawashima, Y. Physiological responses and thermal sensations of the elderly in cold and hot environments. *J. Therm. Biol.* **1993**, *18*, 355–361. [CrossRef]

103. Frank, S.M.; Raja, S.N.; Bulcao, C.; Goldstein, D.S. Age-related thermoregulatory differences during core cooling in humans. *Am. J. Physiol. Integr. Comp. Physiol.* **2000**, *279*, R349–R354. [CrossRef]

104. Kim, J.; Candido, C.; Thomas, L.; de Dear, R. Desk ownership in the workplace: The effect of non-territorial working on employee workplace satisfaction, perceived productivity and health. *Build. Environ.* **2016**, *103*, 203–214. [CrossRef]

105. Yıldırım, K.; Akalin-Baskaya, A.; Celebi, M. The effects of window proximity, partition height, and gender on perceptions of open-plan offices. *J. Environ. Psychol.* **2007**, *27*, 154–165. [CrossRef]

106. Kwon, M.; Jang, M.; Choi, K.; Kim, K. Perception of indoor air quality (IAQ) by workers in underground shopping centers in relation to sick-building syndrome (SBS) and store type: A cross-sectional study in Korea. *BMC Public Health* **2019**, *19*, 1–9. [CrossRef]

107. Shahzad, S.S.; Brennan, J.; Theodosopoulos, D.; Hughes, B.; Calautit, J.K. Building-Related Symptoms, Energy, and Thermal Control in the Workplace: Personal and Open Plan Offices. *Sustainability* **2016**, *8*, 331. [CrossRef]

108. De Croon, E.M.; Sluiter, J.K.; Kuier, P.P.F.M.; Frings-Dresen, M.H.W. The effect of office concepts on worker health and performance: A systematic review of the literature. *Ergonomics* **2005**, *48*, 119–134. [CrossRef]

109. Raaschou-Nielsen, O.; Nissen, S.E.; Sorensen, H.; Schünemann, H.; Pellegrino, V.; Kromhout, D.; Mészáros, I.; Eriksson, K.; de Jager, M.; Stolk, P.; et al. Occupational exposure to indoor pollutants and incident diabetes: The InterAct case-control study. *Diabetologia* **2018**, *61*, 763–771. [CrossRef]

110. Kaarlela-Tuomaala, A.; Helenius, R.; Keskinen, E.; Hongisto, V. Effects of acoustic environment on work in private office rooms. *Ann. Occup. Hyg.* **1987**, *31*, 493–504. [CrossRef]

111. Haynes, B.; Suckley, L.; Nunnington, N. Workplace productivity and office type. *J. Corp. Real Estate* **2017**, *19*, 111–138. [CrossRef]

112. Wajcman, J.; Rose, E. Constant Connectivity: Rethinking Interruptions at Work. *Organ. Stud.* **2011**, *32*, 941–961. [CrossRef]

113. Evans, G.W.; Johnson, D. Stress and open-office noise. *J. Appl. Psychol.* **2000**, *85*, 779–783. [CrossRef]

114. Rasila, H.; Rothe, P. A problem is a problem is a benefit? Generation Y perceptions of open-plan offices. *J. Environ. Psychol.* **2002**, *22*, 163–172. [CrossRef]

115. Brand, J.L.; Smith, T.J. Effects of Reducing Enclosure on Perceptions of Occupancy Quality, Job Satisfaction, and Job Performance in Open-Plan Offices. *Proc. Hum. Factors Ergon. Soc. Annu. Meet.* **2005**, *39*, 279–299. [CrossRef]

116. Kupritz, V. Accommodating privacy to facilitate new ways of working. *J. Archit. Plann. Res.* **2003**, *20*, 122–135. [CrossRef]

117. Kwon, M.; Jang, M.; Choi, K.; Kim, K. Perception of indoor air quality (IAQ) by workers in underground shopping centers in relation to sick-building syndrome (SBS) and store type: A cross-sectional study in Korea. *BMC Public Health* **2019**, *19*, 1–9. [CrossRef]

118. Kim, J.; Jang, M.; Choi, K.; Kim, K. Perception of indoor air quality (IAQ) by workers in underground shopping centers in relation to sick-building syndrome (SBS) and store type: A cross-sectional study in Korea. *BMC Public Health* **2019**, *19*, 1–9. [CrossRef]

119. Rasila, H.; Rothe, P. A problem is a problem is a benefit? Generation Y perceptions of open-plan offices. *Prop. Manag.* **2012**, *30*, 362–375. [CrossRef]

120. Samani, S.A. The impact of personal control over office workspace on environmental satisfaction and performance. *J. Soc. Sci. Humitat.* **2015**, *1*, 163–172.

121. Danielsson, C.B.; Chungkham, H.S.; Wulff, C.; Westerlund, H. Office design’s impact on sick leave rates. *Ergonomics* **2014**, *57*, 139–147. [CrossRef]

122. Motlagh, M.S.; Golmohammadi, R.; Aliabadi, M.; Faradmal, J.; Ranjar, A. Empirical Study of Room Acoustic Conditions and Neurophysiologic Strain in Staff Working in Special Open-Plan Bank Offices. *Acoust. Aust.* **2018**, *46*, 329–338. [CrossRef]

123. Kupritz, V. Accommodating privacy to facilitate new ways of working. *J. Archit. Plann. Res.* **2003**, *20*, 122–135. [CrossRef]

124. Lansdale, M.; Parkin, J.; Austin, S.; Baguley, T.; Baguley, T. Designing for interaction in research environments: A case study. *J. Environ. Psychol.* **2011**, *31*, 407–420. [CrossRef]

125. Newsham, G.R.; Veitch, J.A.; Charles, K.E. Risk factors for dissatisfaction with the indoor environment in open-plan offices: An analysis of COPE field study data. *Indoor Air* **2008**, *18*, 271–282. [CrossRef]

126. Aries, M.B.; Veitch, J.A.; Newsham, G.R. Windows, view, and office characteristics predict physical and psychological discomfort. *J. Environ. Psychol.* **2010**, *30*, 533–541. [CrossRef]
127. Lottrup, L.; Stigsdotter, U.K.; Meilby, H.; Claudi, A.G. The Workplace Window View: A Determinant of Office Workers’ Work Ability and Job Satisfaction. *Landscape Res.* 2013, 40, 57–75. [CrossRef]

128. Veitch, J.A.; Galasiu, A.D. The Physiological and Psychological Effects of Windows, Daylight, and View at Home: Review and Research Agenda. *PsycEXTRA Dataset* 2012. [CrossRef]

129. Candido, C.; Zhang, J.; Kim, J.; deDear, R.; Thomas, L.E.; Strapasson, P.; Joko, C. Impact of workspace layout on occupant satisfaction, perceived health and productivity. In Proceedings of the 9th Windsor Conference: Making Comfort Relevant, Windsor, UK, 7–10 April 2016.

130. Chang, C.-Y.; Chen, P.-K. Human Response to Window Views and Indoor Plants in the Workplace. *HortScience* 2005, 40, 1354–1359. [CrossRef]

131. Vischer, J.C. *Workspace Strategies: Environment as a Tool for Work*; Springer: Berlin/Heidelberg, Germany, 2012.

132. Day, J.K.; Futrell, B.; Cox, R.; Ruiz, S.N.; Amirazar, A.; Zarrabi, A.H.; Azarbajani, M. Blinded by the light: Occupant perceptions and visual comfort assessments of three dynamic daylight control systems and shading strategies. *Build. Environ.* 2019, 154, 107–121. [CrossRef]

133. Charles, K.E.; Veitch, J.A.; Newsham, G.R.; Marquardt, C.J.G.; Geerts, J. Satisfaction with ventilation in open-plan offices: COPE field findings. In Proceedings of the Healthy Buildings 2006: Creating a Healthy Indoor Environment For People, Lisboa, Portugal, 4–8 June 2006; pp. 93–98.

134. Kim, J.; de Dear, R. Impact of different building ventilation modes on occupant expectations of the main IEQ factors. *Build. Environ.* 2012, 57, 184–193. [CrossRef]

135. Paul, W.L.; Taylor, P.A. A comparison of occupant comfort and satisfaction between a green building and a conventional building. *Build. Environ.* 2008, 43, 1858–1870. [CrossRef]

136. Zhang, Y.; Barrett, P. Factors influencing occupants’ blind-control behaviour in a naturally ventilated office building. *Build. Environ.* 2012, 54, 137–147. [CrossRef]

137. Gou, Z.; Prasad, D.; Lau, S.S.-Y. Impacts of green certifications, ventilation and office types on occupant satisfaction with indoor environmental quality. *Arch. Sci. Rev.* 2014, 57, 196–206. [CrossRef]