

Perception of Overall Quality of Life Among Occupants of Green and Non-Green Office Buildings in Malaysia

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Received 2023-04-20; Revised 2023-06-06; Accepted 2023-06-26

ABSTRACT

Indoor environmental quality (IEQ) has become an important component of building design because people tend to spend the majority of their time indoors. The main purpose of this study is to investigate the occupants' overall perceived Quality of Life (QoL) experience in two green and two non-green office buildings. All four buildings are situated in Klang Valley, Malaysia, and they are open-plan office buildings. 162 questionnaires were administered to assess the relationship between individuals' perceived QoL and IEQ factors. The IEQ factors, classified into ambient conditions, designed environment, and behavioural environment, are found to impact QoL. Findings from the case studies reveal that the four buildings varied in the aspect of Behavioural Environment, where some of the IEQ factors in the green buildings were perceived as slightly uncomfortable. It was also found that several IEQ categories interact as a system in which improvement of occupants' QoL experiences cannot be accomplished solely through the instrumental components of IEQ, as the designed and behavioural environments have substantial impacts. Several missing factors linked to the Green Building Index (GBI) criteria were significantly correlated with the QoL experience of occupants.

Keywords: quality of life, green buildings, Green Building Index, indoor environmental quality

INTRODUCTION

The role of indoor environmental quality in influencing workers' quality of life

Quality of life (QoL) is a broad concept concerned with overall well-being of a society or one or more individuals in a society. The concept comprises the cumulative contributions of various life domains, such as family, work, housing, religion, social networks, and neighbourhoods (Rice et al., 1985; Sirgy, 2020), and the concept's significance in social research studies has increased since the 1970s (Alber & Fahey, 2004; Fuchs et al., 2020). The quality of each life domain quality can be evaluated separately and will differ according to place, activity, human relations, and social role, as well as individual expectations and cultural values. The quality of life is directly influenced by a person's quality of work-life, which is in turn affected by the quality of the work environment, where a poor quality of work-life leads to increase stress at work (Anandi et al., 2017; Bora, 2015; Varghese & Jayan, 2013).

Moreover, people tend to spend most of their time indoors, and a large proportion of the world's population lives in urban areas, and many of them work in an office environment (Al Horr et al., 2016), where the Indoor Environmental Quality (IEQ) of buildings can impact the QoL of occupants. Indoor Environmental Quality is the quality of the indoor physical environment, including all factors that influence the physical features (Xu et al., 2018). These physical features may be physically felt, or they might convey non-physical meanings to the occupants. Since QoL is influenced by where a person's life is spent, indoor spaces can impact an individual's QoL psychologically, physically, and functionally.

A Humane Work Environment takes into account the human experience by fulfilling and supporting all kinds of human needs whilst offering measurable physical material components, such as temperature, lighting, and air quality, which influence individuals' physical health, task performance, and safety. Moreover, it supports occupants' perceived immaterial and material subjective aspects by affecting their cultural, psychological, and social structures (in other

words, respecting and supporting the needs of individuals in the best manner for them to work and live) (Vischer & Wifi, 2017). Moreover, various studies have illustrated that arranging a proper workplace that motivates workers and supports them by providing psychological and physical directions is a critical aspect that cannot be ignored in the design of a building (Cohen et al., 1986; Hamid & Hassan, 2015). Thus, research on office work environment quality is of high interest to a wide range of research areas involving environmental design, environment-behaviour, architecture, environmental psychology fields, interior design, and approaches to sustainable development.

The effect of buildings on sustainable development is considerable. The construction industry plays a significant role in satisfying society's needs, improving the quality of life (Doan et al., 2017; Kucukvar & Tatari, 2013; Rahman et al., 2013), and contributing to the economic development of a country (Alwan et al., 2017; Chowdhury et al., 2016; Kucukvar & Tatari, 2013; Osei, 2013). The creator of a sustainable office building seeks to design and construct a building that benefits economic, social, and environmental principles simultaneously (Shafaghat et al., 2015); designing a green building, then, is the practice of creating structures and utilising processes that are environmentally responsible as well as resource-efficient throughout the life cycle of the building, including design and construction, maintenance, operation, renovation, and deconstruction (U.S. Environmental Protection Agency, 2016). The social advantages of sustainable office building design include, for instance, improving the comfort and health of the occupants, enhancing the overall quality of life of the occupants, and improving the aesthetic qualities of the building (Shafaghat et al., 2015; U.S. Environmental Protection Agency, 2016). However, some evidence indicates that, while green buildings may meet their energy efficiency goals (World Green Building Council, 2014), they might also have unintended effects that decrease the quality of the indoor environment and reduce the satisfaction of the individuals that occupy them (Elnaklah et al., 2020; Yudelson & Meyer, 2013).

It seems clear that comfortable and healthy employees tend to be more productive and satisfied. Unfortunately, this obvious point is

sometimes missed since it is easier to concentrate on a project's energy consumption and cost than it is to define the benefit of enhanced user health and productivity (Oke et al., 2018). Many renowned scholars in the field of indoor environmental quality and human well-being have proposed that the satisfaction of occupants in office building is related to the IEQ and the building features such as cleanliness, aesthetic appearance, and furniture (Esfandiari et al., 2021; Fisk, 2002; Gawande et al., 2020). Malaysia's Green Building Index (GBI) states its objective as enhancing the quality of life of building occupants through a sustainably designed environment (Greenbuildingindex Sdn Bhd, 2022a). Depending on the time spent indoors, IEQ is the primary factor that affects occupants' QoL which is essential to the success of green building design (Lee & Kim, 2008; López-Chao & López-Pena, 2021). Nevertheless, most studies on sustainable construction and design in GBI-certified buildings focus on issues related to energy and cost; there have not been enough comprehensive studies that explore whether the IEQ of green buildings improves the lives of their occupants (Laiche et al., 2021; Lee & Kim, 2008; Licina et al., 2021). Therefore, it is necessary to examine the causal relationships between IEQ and occupant QoL in office buildings within the context of sustainability.

GBI Assessment (Physical-Objective Indoor Environmental Quality Assessment Measurement)

The Green Building Index (GBI) was developed in May 2009 by the Malaysian Institute of Architects (PAM) and the Association of Consulting Engineers Malaysia (ACEM) as one of the Malaysian sustainable development acceleration measures. The GBI was designed particularly for the Malaysian tropical climate, the country's developmental and environmental context, and social and cultural needs, based on the experiences of Singapore's Green Mark and the Australian's Green Star (which in turn derived from the US LEED) (Isa, 2015). There are various categories presently being utilised in GBI, which are the GBI project for Residential New Construction (RNC), Non-Residential New

Construction (NRNC), Non-Residential Existing Buildings (NREB), Industrial New Construction (INC), Industrial Existing Buildings (IEB), Industrial New Construction (INC), and Township. GBI ratings are given to buildings depending on six criteria, as follows:

1. Energy Efficiency
2. Indoor Environmental Quality
3. Sustainable Site Planning and Management
4. Material and Resources
5. Water Efficiency
6. Innovation

The GBI rating tool was established to rate green buildings through the use of a common standard and language of measurement, boost the practice of integrated entire building design, recognize and reward environmental leadership, transform the built environment to decrease its adverse environmental effects, and guarantee that new buildings are relevant in the future and that existing buildings are properly refurbished and upgraded to remain relevant. Those involved in Malaysian construction are urged to utilise GBI to validate environmental initiatives during the design phase of new construction, base building refurbishment, or the construction and procurement phase of building (Greenbuildingindex Sdn Bhd, 2022a; Greenbuildingindex Sdn Bhd, 2022c). Buildings that meet GBI requirements, as shown in Table 1, receive GBI Malaysia certification awards.

Table 1

Classification of Green Building Index, Extracted From Greenbuildingindex Sdn Bhd (2022c)

Points	GBI rating
86+	Platinum
76-85	Gold
66-75	Silver
50-65	Certified

Note. Adapted from *The GBI tools*, by Greenbuildingindex Sdn Bhd, 2022c, Green Building Index (<https://www.greenbuildingindex.org/gbi-tools/>). Copyright 2022 by Greenbuildingindex Sdn Bhd.

GBI IEQ Category

The GBI-NRNC rating system assesses the sustainability of newly built commercial, industrial, and institutional buildings. These involve offices, factories, hospitals, colleges, universities, shopping complexes, and hotels. Of the six criteria, the existing GBI-NRNC highlights "Energy Efficiency" with a maximum of 35 points. In addition, the six criteria are split into 19 sub-criteria, with pre-requisites for each sub-criterion, for a total of 52 pre-requisites in all (Greenbuildingindex Sdn Bhd, 2022b).

The NRNC Tool has 15 assessment categories for the Indoor Environmental Quality (IEQ) item. Each of these 15 categories contributes a specific number of points to the overall score of the IEQ item. Moreover, these 15 categories are split into four factors namely, factor 1: air quality, factor 2: thermal comfort, factor 3: lighting, visual and acoustic comfort, and factor 4: verification, which can be measured utilising objective measurements on-site (with the exception of the post-occupancy evaluation (POE), which is included in verification), as shown in Table 2. Other aspects, such as layout, spatial organisation, and privacy, appear to be lacking.

Table 2

Indoor Environmental Quality Parameters for Non-Residential New Construction (NRNC), extracted from Greenbuildingindex Sdn Bhd (2022c)

EQ	INDOOR ENVIRONMENTAL QUALITY		
Air Quality			
EQ1	Minimum IAQ Performance	1	6
EQ2	Environmental Tobacco Smoke (ETS) Control	1	
EQ3	Carbon Dioxide Monitoring and Control	1	
EQ4	Indoor Air Pollutants	2	
EQ5	Mould Prevention	1	
Thermal Comfort			
EQ6	Thermal Comfort: Design & Controllability of Systems	2	3
EQ7	Air Change Effectiveness	1	
Lighting, Visual and Acoustic Comfort			
EQ8	Daylighting	2	8
EQ9	Daylight Glare Control	1	
EQ10	Electric Lighting Levels	1	
EQ11	High Frequency Ballasts	1	
EQ12	External Views	2	
EQ13	Internal Noise Level	1	
Verification			
EQ14	IAQ Before & During Occupancy	2	4
EQ15	Post Occupancy Comfort Survey: Verification	2	
Total			21

Note. Adapted from *The GBI tools*, by Greenbuildingindex Sdn Bhd, 2022c, (<https://www.greenbuildingindex.org/gbi-tools/>). Copyright 2022 by Greenbuildingindex Sdn Bhd.

Post-occupancy evaluation (POE) comparison

Post-occupancy evaluation (POE) is the most commonly used occupant assessment of the environment. The significance of this method of evaluation is a crucial component in the present sustainable building movement, primarily owing to a lack of information on how well occupants' work performance and personal satisfaction are actually affected by buildings that are designed and constructed in accordance with sustainable building guidelines and standards. Occupant assessment is viewed as a more effective technique for evaluating the effectiveness of designed environments or determining the strengths and weaknesses of existing sustainable design practices and improving them in the future (Elliot et al., 2019; Lee & Kim, 2008).

IEQ is recognised as an evaluation category in various green building certification systems worldwide, including the Building Research Establishment Environmental Assessment Method of the UK (BREEAM), the Leadership in Energy and Environmental Design of the US (LEED), and the Green Building Index of Malaysia (GBI). However, little is known regarding the effectiveness of IEQ through POE in green certified buildings (Fisk et al., 2011; Haynes, 2008; Liang et al., 2014). Some research, such as that undertaken by Huizenga et al., (2006), Armitage et al., (2011), Issa MH et al. (2011), and Lee et al., (2019), have indicated improvements in people's IEQ satisfaction in response to green building design. Others, however, did not discover a positive correlation between green buildings and occupants' satisfaction with the IEQ. For example, Altomonte et al., (2016) found no significant differences between individuals' satisfaction levels in BREEAM-certified and non-green buildings, especially regarding sound privacy, cleanliness, ease of interacting with coworkers, and workplace satisfaction. In comparison with occupants' responses in conventional buildings, the study also found that occupants of BREEAM-certified buildings had lower levels of satisfaction with respect to visual privacy. Paul and Taylor (2008) compared the responses of occupants regarding their IEQ perception between a conventional building and a green building in Australia, and found that occupants of the green

building did not have a higher level of comfort; in fact, responses from occupants of the green building indicated less satisfaction regarding the air quality and indoor temperature compared to those in the conventional building. Leaman and Bordass (2007) examined questionnaire responses from occupants of 177 buildings in the UK and found a high satisfaction level in terms of air quality and ventilation when compared to the responses of occupants in non-green buildings. Nonetheless, the indoor environment of these green buildings was found to be more humid, warmer, and stuffier throughout the summer. Dodo et al., (2012) conducted a comparative study using a survey to analyse the influence of psychological factors on visual comfort in conventional and GBI-Platinum office buildings in Malaysia. In this study, the responses from occupants of the GBI-certified building revealed that they were slightly more comfortable in comparison with the occupants of the conventional building in terms of IEQ.

This research emphasizes the significance of understanding how individuals perceive the IEQ of sustainable green buildings, as well as assessing whether green buildings are better perceived by their users, and whether they perform better environmentally. Therefore, it is necessary to examine the causal relationships between IEQ and occupant QoL in office buildings within the context of sustainability. It is essential to conduct such a study to provide additional knowledge that can affect investment decisions without compromising the quality of work life for occupants. Thus, this study provides an alternative to the existing sustainable design practices, particularly the IEQ criteria for occupant satisfaction and performance in tropical office buildings. Findings from this study will benefit the professional built environment design by incorporating more efficient design strategies.

Purpose of the study

The main objectives of this study are to (i) investigate occupants' overall perceived QoL in both green and non-green office buildings in the Klang Valley area; and (ii) to identify implications for future GBI-certified office buildings design. The criteria of IEQ concerning occupants' comfort were used in the assessment. The research is

important in that it examines the weaknesses and strengths of present sustainable building practice conformity with GBI criteria and proposes changes and guidelines for future practice.

METHOD

Research design

This study used a cross-sectional study design to test and measure the cause and effect relationship between occupants' perceived quality of life descriptors and IEQ factors in GBI-certified and non-green office buildings. A survey was utilised in this study to explore the strength and significance of IEQ factors on the participants' perceived overall quality of life and quality of life descriptors. The IEQ factors were derived from the literature and suggested as a list of IEQ factors in the built environment that could influence how employees perceive their own quality of life. The variables were classified into independent and dependent variables in the questionnaire. Dependent variables are those whose results can change when the data changes for the independent variables. The categorisation appears as follows:

Independent variables:

- IEQ factors: each of the (latent, symbolic, and instrumental) factors of IEQ that are divided into designed, ambient, and behavioural environments; examples include acoustics, lighting, thermal comfort, indoor air quality (IAQ), furniture, layout, etc.
- Workspace features: proximity to windows, location, enclosure, operable windows, presence of blinds and their controllability, views, illumination colour, and task lighting.
- Job-related information: type of task or job, the number of years at the company, commuting time, transportation method.
- Demographic information of occupants: gender, age, and educational background.
- Knowledge and expectations concerning green buildings: awareness (or lack of

awareness) of working in a green building, preferring (or not preferring) to work in a green building.

Dependent variables:

- Overall perceived comfort;
- Perceived health;
- Participants' overall quality of life experience;
- Perceived productivity;
- Meeting needs (encompasses various aspects of the occupants' requirements, preferences, and expectations related to their work environment, including the availability of resources and amenities that contribute to fulfilling the needs of the occupants);
- Overall satisfaction with the work environment.

Data collection methods and instrument

This study used a survey, in the form of a self-reporting questionnaire containing both closed-ended questions, representing the quantitative method, and open-ended questions, which comprise a qualitative approach embedded in the quantitative method (Terrell, 2012; Woolsey & Narruhn, 2020). These questions utilise the IEQ factors list obtained from the literature to examine the relationships between the experience of occupants and IEQ factors. The open-ended questions offer a way to better comprehend occupants' evaluations of each IEQ factor and to explain the reason for their perceptions. The questionnaires were distributed online via Google Form in both English and Malay versions. Five surveys in the field were used as the basis for the questionnaire design: the Building Use Studies (BUS) occupant survey (Leaman, 2010); the Center for the Built Environment (CBE), Berkeley survey (Centre for Built Environment [CBE], 2006); the Building-In-Use Assessment questionnaire (Vischer, 2005); the Physical Work Environment Satisfaction Questionnaire (PWESQ) (Carlopio, 1996); and the Workplace comfort performance questionnaire (Woo, 2010). A copy of the questionnaire is provided in

Appendix A. Table 3 depicts the questions and scales utilised to collect information on the personal workspaces and demographics of respondents, whereas Table 4 shows the QoL and IEQ design criteria, and the measuring method utilised in this study.

In the ambient conditions, behavioural environment and designed environment, each factor of IEQ contains sub-qualities, which might have influenced the overall evaluation. For

instance, lighting quality involves sub-qualities such as the amount, glare, reflections, colour, shadows, etc.

The questionnaire underwent a validation process, and received ethics application approval (JKEUPM 2021-242) prior to the pilot testing. Cronbach's alpha shows all items to be above 0.70, suggesting acceptable reliability, as shown in Table 5.

Table 3

Workspace and Demographics Characteristics and Measurement

Demographics Characteristics	Demographic Information	Measurement
	Age	30 or under (1); 31-40 (2); Over 40 (3)
	Gender	Male (1); Female (2)
	Type of work	Technical (1); Administrative support (2); Managerial (3); Professional (4); Other (5)
	Duration at the workplace per week	10 or less (1); 11-30 (2); More than 30 (3)
	Duration at the present workplace	Less than 6 months (1); 7-12 months (2); More than 1 year (3)
Workspaces Characteristics	Office Type	Cubicles with low partitions (less than 1.5 m height) (1); Cubicles with high partitions (1.5 m height or more) (2); Open-plan (with no partitions) (3); Enclosed shared office (4); Other (5)

Table 4

QoL and IEQ Factors and Measurement

IEQ Category	IEQ Factor	Measurement
Ambient Conditions	Lighting Quality	Likert-type scale. from Uncomfortable to Comfortable (1-5)
	Indoor Air Quality	
	Acoustical Quality	
	Thermal Comfort	
Designed Environment	Personal Workspace	
	Office Layout	
	Hygiene and Cleanliness	
	Aesthetics and Indoor Décor	
	Ergonomics and Furniture	

Table 4 (Continued)

IEQ Category	IEQ Factor	Measurement
Behavioral Environment	Sound Privacy	Likert-type scale. from Disagree to Agree (1-5)
	Visual Privacy	
	Personalization	
	Pride	
	Crowding	
	Cultural Identity	
	Image and Value	
	Status	
	Connectivity with Nature	
	Wayfinding	
	Safety and Security	
	Territoriality /Personal Space	
	Views	
	Personal Control	
Overall QoL	Comfort	
	Health	
	Productivity	

Table 5

Cronbach's Alpha Score for Each Category of IEQ Factors

IEQ Factors Category	Number of Items	Cronbach's Alpha Score
Ambient Conditions	4	$\alpha = 0.72$
Designed Environment	9	$\alpha = 0.74$
Behavioural Environment	20	$\alpha = 0.83$
Overall Quality of Life experience	5	$\alpha = 0.72$

Surveyed buildings

Office workers of eighteen office buildings in the Klang Valley were approached for the survey. Due to the movement control order (MCO) in Malaysia related to the COVID-19 pandemic, third-party occupancy evaluation visits were prohibited from March 2020 to September 2021. The survey was resumed in September 2021 after the MCO was relaxed.

The management of four buildings granted access to the researcher, namely, two GBI-certified office buildings (GBI1 and GBI2) and two

non-GBI office buildings (NGBI1 and NGBI2) (Figure 1). Both groups (GBI and NGBI) were compared with respect to differences and similarities in occupant comfort to determine the strength and significance of IEQ factors on individuals' perceived overall QoL. All four buildings are situated in Klang Valley, Malaysia, and each is an office building that utilizes an open-plan layout and modern work environment. Table 6 provides an overview of each building, while Table 7 presents an overview of the systems utilised for ambient conditions in each building.

Figure 1

Interior Layout and Exterior Appearance of the Four Buildings (GBI1, GBI2, NGBI1, NGBI2)

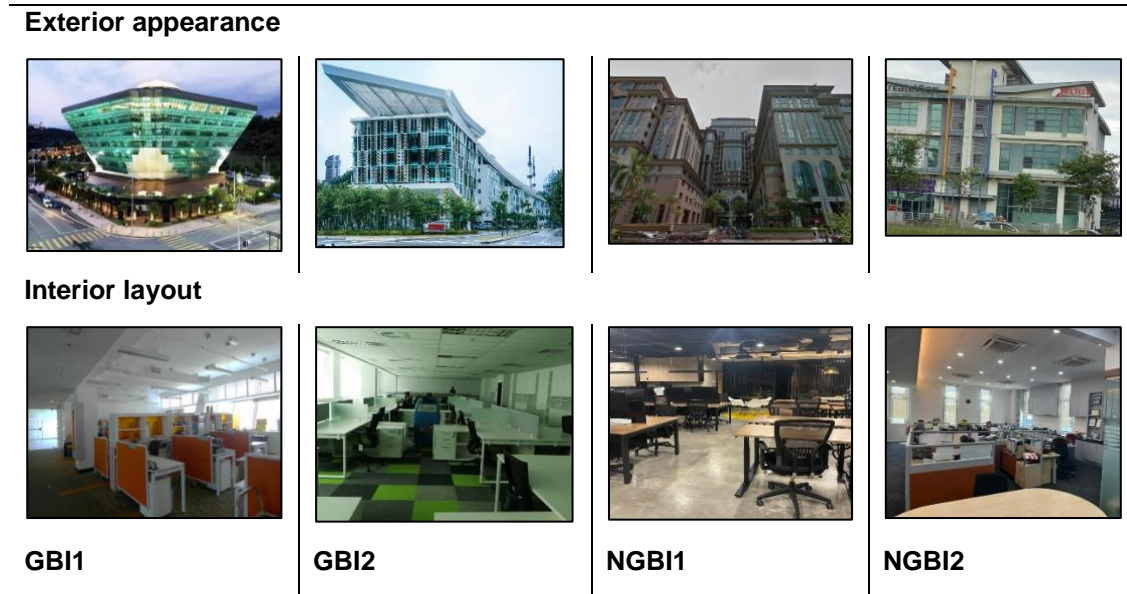


Table 6

Buildings in the Research Sample

Target population:	GBI and non-GBI office buildings in Klang Valley, Malaysia			
Setting:	GBI1	GBI2	NGBI1	NGBI2
Building type:	Green office building	Green office building	Conventional building	Conventional building
Certifications & Awards:	<ul style="list-style-type: none"> •Malaysia’s Green Building Index (GBI) •Singapore’s BCA Green Mark 	<ul style="list-style-type: none"> •Malaysia’s Green Building Index (GBI) •FIABCI Malaysia Property Award 	None	None
Architect:	NR Architect & Interior Design	VERITAS Design Group	Unknown	Unknown
Construction start year/ completion date	13th September 2007 / 15th March 2010	February 2012/ 13th February 2016	Opened 1998	Opened 1996
Type of building:	GBI Platinum Green Office Building	GBI Platinum Green Office Building	Non-green Office building	Non-green Office building
Location of building:	Precinct 2 Putrajaya, Malaysia.	Section 14, Shah Alam, Malaysia	Jalan Yap Kwan Seng, Kuala Lumpur, Malaysia	Taman Perindustrian Tiong Nam, 40200 Shah Alam, Selangor

Table 6 (Continued)

Setting:	GBI1	GBI2	NGBI1	NGBI2
Number of floors:	Eight-story	From four to eight storeys	Twenty-five-story	Four-story
Building area:	158,075 ft ² /14.000 m ²	500,000 ft ²	N/A	N/A
Workplace design:	Open-plan	Open-plan	Open-plan	Open-plan
Workstation types:	High and low partitioned cubicles	High and low partitioned cubicles	Low partitioned cubicles	High and low partitioned cubicles
Number of occupants:	400	600	100	150

Table 7

The Systems Utilised for Ambient Conditions in the Four Buildings

Thermal Comfort (cooling)	Radiant cooling system via floor slab cooling, which is complimented by a conventional cold air supply system	Thermally-efficient building envelope along with double glazed windows, a green roof, a custom-designed exterior/spandrel wall, and additional insulation with mechanically ventilated floors and a solar air-conditioning system.	HVAC system	HVAC system
Ventilation	Variable air volume (VAV) system with a default minimum airflow setting and the dehumidified ventilation system	Operable windows and Under Floor Air Distribution with mechanically ventilated floors.	Operable windows and HVAC system	Operable windows and HVAC system

Table 7 (Continued)

Illumination	Facade daylighting, reflected roof light, and atrium daylight (different sizes of windows on each floor and also reflective aluminum panels)	Natural Daylight and artificial lighting.	Natural Daylight and artificial lighting.	Natural Daylight and artificial lighting.
Noise Control	White noise	Acoustic panels (sound masking)	N/A	N/A

DATA ANALYSIS

From the questionnaire, answers to the closed-ended questions were analysed employing descriptive statistical analysis, utilising mean values and the inferential statistical analysis (correlational analysis) employing two-tailed Pearson correlations, using SPSS version 25.

The evaluation results of each IEQ were correlated with the overall QoL experience of occupants (overall comfort, health, and productivity), and with their overall satisfaction with the work environment as well as with meeting needs, using two-tailed Pearson correlations. The sub-question results for each IEQ factor were utilised to better understand which indicators are linked to the overall evaluation of the relevant IEQ factor. In this study, we are seeking aspects that can be discovered and explained in light of occupants' experiences and perceptions. Consequently, the IEQ factor rating is not determined by the average of these sub-qualities' sums and correlated with the quality of life or as the overall satisfaction level with the work environment. This is because utilising a prescribed indicators list might restrict each factor of IEQ to those sub-qualities or prescribed measuring indicators, although there may be additional indicators for individuals' experiences that can be identified through the answer to open-ended questions in the questionnaire. Therefore, the overall evaluation value could be more accurate, and the

researcher would be able to have a better understanding of what basis should be used in the overall evaluation. In other words, the goal is to determine if the proposed indicators provide a complete evaluation, or whether there are certain qualities that are missing and which need to be taken into account in the analysis.

RESULTS

Respondents' demographic characteristics

There was similarity in the respondents' demographic information. Most respondents of all four office buildings were between the ages of 31 and 40; there were more females than males; they had worked at their current personal workplace for more than a year, and worked more than 30 hours weekly.

There were some differences, however, respondents from the GBI-certified office buildings primarily worked as technical staff (45%), while for non-GBI-certified office buildings, the majority worked as professionals (51%).

Table 8 shows the demographic characteristics of participants in the two types of office buildings. The researchers collected 101 valid responses from the GBI-certified office buildings and 61 from the conventional office buildings.

Table 8*Occupants' Demographics and Their Workspaces*

Demographic Characteristics					
Personal Characteristics	Answer	GBI-certified Office Building		Non- GBI-certified Office Building	
		GBI-1 (%)	GBI-2 (%)	NGBI-1 (%)	NGBI-2 (%)
Gender	Male	34	47	45	40
	Female	66	53	55	60
Age	<30 years	26	14	33	24
	31-40 years	61	45	51	28
	> 40 years	13	41	16	48
Job Category	Administrative	9	17	13	26
	Professional	18	42	51	14
	Technical	45	-	11	17
	Managerial	-	7	-	12
	Other	28	34	25	31
Time spent at the workplace/ weekly	< 10 hours	5	7	17	10
	11-30 hours	20	11	19	12
	>30 hours	75	82	64	78
Employment Duration at the present workplace	<6 months	4	7	11	9
	7-12 months	12	5	10	16
	> 1 year	84	88	79	75
Workspace Characteristics					
Personal Workspace	Cubicles with low partition	63	76	20	31
	Cubicles with high partition	31	24	54	45
	Open-plan (with no partitions)	6	-	26	24
	Enclosed shared office	-	-	-	-
	Other	-	-	-	-

Descriptive analysis of the survey: Mean values

Table 9 shows the mean values for each IEQ category. Mean value scores above '4' indicates comfortable; those between '3' and '4' indicate somewhat comfortable, while scores between '2' and '3' indicate somewhat uncomfortable, and those below '2' indicate uncomfortable.

With respect to the ambient conditions, all measured buildings were perceived as somewhat comfortable (i.e., 3 and 4). Lighting quality and IAQ were rated higher than 4 (comfortable) only in GBI2. Acoustical Quality received the lowest ratings from occupants in both GBI and non-GBI office buildings compared to other IEQ factors.

With regard to the designed environment, the highest mean score for the evaluation of comfort was hygiene and cleanliness in GBI2, followed by ergonomics and furniture in both GBI2 and

NGBI2, where they were rated higher than 4 and perceived as comfortable by occupants. On the other hand, all the other IEQ factors were perceived as somewhat comfortable (rated between 3 and 4) in both GBI and conventional buildings.

In relation to the behavioural environment, the highest mean scores for the evaluation of comfort, all of which were rated higher than 4 (comfortable) were safety and security in both GBI office buildings, followed by views in GBI2 and personalization in NGBI2. By contrast, crowding received the lowest ratings from occupants in GBI1, GBI2, and NGBI2 office buildings, followed by personal control in both GBI office buildings; all of which were rated between 2 and 3, indicating that they were perceived as somewhat uncomfortable by occupants. All the other IEQ factors had mean values between 3 and 4 in both GBI and conventional buildings.

Table 9

Mean Values for IEQ Categories Between GBI and Conventional Office Buildings

Category	IEQ Factor	GBI-certified		Conventional	
		GBI1	GBI2	NGBI1	NGBI2
Ambient Conditions	Indoor Air Quality	3.73	4.09	3.74	3.67
	Lighting Quality	3.98	4.17	3.81	3.6
	Thermal Comfort	3.59	3.96	3.71	3.77
	Acoustical Quality	3.34	3.63	3.65	3.83
Designed Environment	Layout	3.56	3.87	3.81	3.8
	Personal Workstation	3.68	3.8	3.68	3.73
	Ergonomics & Furniture	3.63	4.15	3.9	4
	Hygiene & Cleanliness	3.76	4.18	3.77	3.8
	Aesthetics & Indoor Décor	3.51	3.9	3.71	3.73
Behavioral Environment	Personalization	3.71	3.8	3.81	4
	Visual Privacy	3.24	3.55	3.74	3.83
	Sound Privacy	3.34	3.43	3.71	3.67
	Crowding	2.78	2.55	3.32	2.8
	Cultural Identity	3.32	3.6	3.48	3.4

Table 9 (Continued)

Category	IEQ Factor	GBI-certified		Conventional	
		GBI1	GBI2	NGBI1	NGBI2
Behavioral Environment	Pride	3.76	3.72	3.77	3.83
	Status	3.59	3.73	3.77	3.6
	Safety and Security	4.22	4.13	3.77	3.83
	Connectivity with Nature	3.2	3.45	3.32	3.37
	Image and Value	3.71	3.68	3.35	3.6
	Wayfinding	3.39	3.48	3.39	3.67
	Personal Control	2.8	2.9	3.26	3.4
	Views	3.76	4.09	3.45	3.63
	Territoriality /Personal Space	3.88	3.73	3.65	3.83

Descriptive analysis of overall QoL

Figure 2 depicts the mean values results for the overall QoL evaluation, shown in bar charts. The results indicate that GBI2 had the highest mean value (4.07), followed by NGBI2 (3.83), NGBI1 (3.7) and then GBI1 (3.63). Mean value scores between '3' and '4' indicate somewhat comfortable, while as score above '4' indicates comfortable.

Inferential analysis of the survey: Correlational analysis

Two-tailed Pearson correlations were performed utilising SPSS version 25, and the results are presented in this section. Correlations test the relationship between individuals' perceived quality of life and IEQ factors. A single asterisk (*) indicates correlation significance at the 0.05 (2-tailed) level, whereas two asterisks (**) are utilised to indicate correlation significance at the 0.01 (2-tailed) level, implying a stronger correlation, while no asterisk indicates that the correlation between the variables is not statistically significant. Moreover, the minus or plus signs show the correlation direction, which can be either negative or positive. The results are divided into two categories: non-green office building (NGBI) results and green office building

(GBI) results, with IEQ factors divided into ambient conditions, behavioural environment, and designed environment for each building type.

(i) IEQ factors related to the ambient conditions:

In non-green buildings, IAQ is shown to be a significant condition that is positively correlated with overall QoL and meeting needs. Acoustical quality and noise control and lighting quality are also shown to be significant, and they have positive correlations with overall QoL, overall satisfaction, and meeting needs. Thermal comfort is found to be significant, and has positive correlations with overall QoL and overall satisfaction.

Moreover, IAQ, thermal comfort, acoustical quality, and lighting quality are shown to be significant and have positive correlations with overall QoL, overall satisfaction, and meeting needs in green buildings. Significance values and Correlation coefficients are presented in Table 10.

(ii) IEQ factors concerning the designed environment:

In relation to the non-green buildings, aesthetics and indoor décor, layout, and ergonomics and furniture qualities are shown to be significant and to have positive correlations with overall QoL,

overall satisfaction, and meeting needs. Hygiene & cleanliness and personal workspace are shown to be significant and have positive correlations with meeting needs and overall QoL. Furthermore, maintenance quality is shown to be significant and has positive correlations with overall QoL and overall satisfaction.

In green buildings, the layout is shown to be significant and has a positive correlation with

overall QoL. Ergonomics and furniture, personal workspace, aesthetics and indoor décor, and hygiene and cleanliness are shown to be significant and have positive correlations with overall QoL, overall satisfaction, and meeting needs. Maintenance is shown to be significant and has positive correlations with overall QoL and overall satisfaction. Significance values and Correlation coefficients are presented in Table 11.

Figure 2

Bar Charts for Quality of life Descriptive Assessment

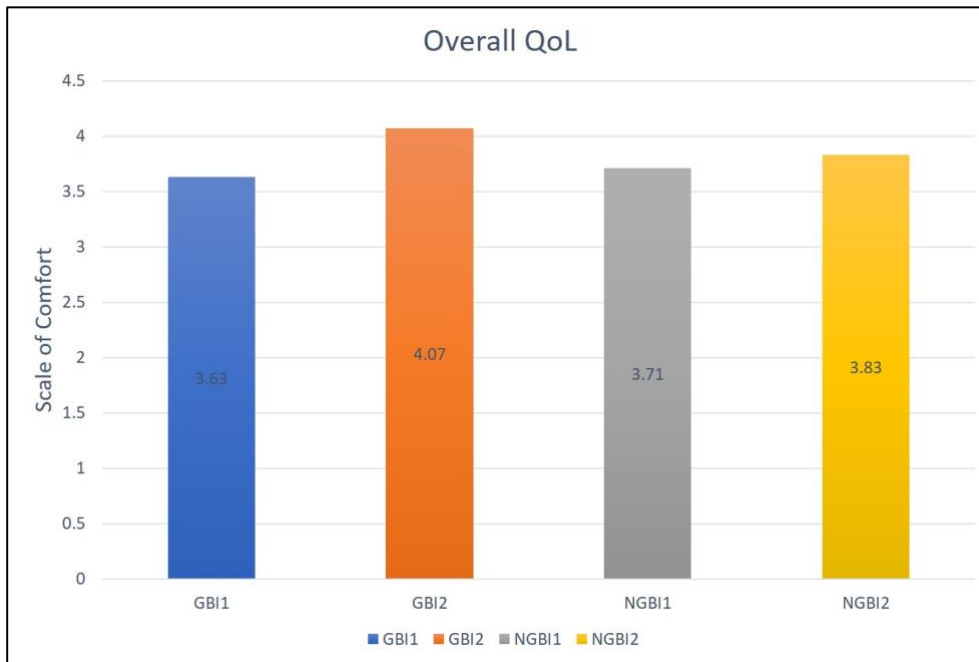


Table 10

The Pearson Correlation Between IEQ Factors (Related to the Ambient Conditions) and the Overall Experience of Occupants in Measured Two Green and Two Non-Green Office Buildings.

Ambient	Overall Satisfaction		Meeting Needs		Overall QoL	
	Non-green	Green	Non-green	Green	Non-green	Green
Indoor Air Quality	0.12	0.32**	0.34**	0.21*	0.48**	0.39**
Lighting Quality	0.27*	0.38**	0.28*	0.42**	0.38**	0.45**
Thermal Comfort	0.31*	0.22*	0.21	0.23*	0.30*	0.34**
Acoustical Quality and Noise Control	0.27*	0.36**	0.45**	0.40**	0.39**	0.37**

Note. * Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

(iii) IEQ factors concerning the behavioural environment:

With respect to the non-green buildings, personalisation, sound privacy, cultural identity, connectivity with nature, wayfinding, territoriality, and personal control are shown to be significant and have positive correlations with overall QoL, overall satisfaction, and meeting needs. Visual privacy, pride, status, and safety and security are shown to be significant and have positive correlations with overall QoL. Crowding is shown to be significant and has a positive correlation with meeting needs. Views and image and value are shown to be significant and have positive

correlations with overall QoL and overall satisfaction.

In green buildings, personalisation, cultural identity, and personal control are shown to be significant and have positive correlations with overall QoL. Visual privacy, sound privacy, crowding, pride, status, connectivity with nature, wayfinding, territoriality, image and value, and views are shown to be significant and have positive correlations with overall QoL, overall satisfaction, and meeting needs. Safety and security is shown to be significant and has positive correlations with meeting needs and overall QoL. Significance values and Correlation coefficients are presented in Table 12.

Table 11

The Pearson Correlation Between IEQ Factors (Related to the Designed Environment) and the Overall Experience of Occupants in Measured Two Green and Two Non-Green Office Buildings.

Designed	Overall Satisfaction		Meeting Needs		Overall QoL	
	Non-green	Green	Non-green	Green	Non-green	Green
Office Layout	0.37**	0.13	0.30*	0.13	0.52**	0.36**
Personal Workspace Quality	-0.02	0.34**	0.31*	0.34**	0.39**	0.29**
Ergonomics & Furniture	0.25*	0.35**	0.27*	0.30**	0.25*	0.47**
Hygiene and Cleanliness Quality	0.24	0.46**	0.30*	0.31**	0.29*	0.39**
Maintenance Quality	0.31*	0.32**	0.20	0.07	0.42**	0.30**
Aesthetics and Indoor Décor	0.31*	0.26**	0.49**	0.24*	0.27*	0.38**

Note. * Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 12

The Pearson Correlation Between IEQ Factors (Related to the Behavioural Environment) and the Overall Experience of Occupants in Measured Two Green and Two Non-Green Office Buildings.

Behavioural	Overall Satisfaction		Meeting Needs		Overall QoL	
	Non-green	Green	Non-green	Green	Non-green	Green
Personalisation	0.36**	0.13	0.30*	0.09	0.31*	0.20*
Visual Privacy	0.19	0.39**	0.25	0.31**	0.46**	0.43**
Sound Privacy	0.27*	0.37**	0.25*	0.41**	0.38**	0.32**
Crowding	0.18	-0.03	0.28*	-0.01	0.15	-0.18
Cultural Identity	0.35*	0.14	0.30*	0.16	0.26*	0.26**
Pride	0.02	0.32**	-0.03	0.29**	0.34**	0.38**
Status	0.06	0.38**	0.05	0.31**	0.38**	0.29**
Safety and Security	0.08	0.19	0.17	0.28**	0.33**	0.20*
Connectivity with Nature	0.27*	.25*	.38**	.20*	.32**	.27**
Image and Value	0.40**	.28**	.23	.30**	.38**	.32**
Wayfinding	0.35**	0.39**	0.42**	0.46**	0.50**	0.37**
Personal Control	0.31*	0.17	0.28*	0.14	0.40**	0.29**
Views	0.31*	0.54**	0.23	0.43**	0.35**	0.43**
Territoriality/Personal Space	0.30*	0.28**	0.36**	0.41**	0.54**	0.18

Note. * Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Differences in perceptions of IEQ factors between green and non-green buildings

Table 13 compares the significant IEQ factors influencing individuals' quality of life in green and non-green office buildings. Twenty-two IEQ factors were found to have a significant correlation with occupants' QoL in green buildings, compared to twenty-three significant IEQ factors identified in the non-green office buildings. The descending sequence is built on the descending Pearson correlation values

derived from the overall QoL pooled from the ambient conditions, behavioural environment, and designed environment.

Ergonomics and furniture, an IEQ factor in the designed environment, is shown to be the most significant factor correlated with individuals' perceived QoL in green buildings (as shown in Table 13). It is followed by lighting quality in the ambient conditions, and then views and visual privacy from the behavioural environment, and afterwards hygiene and cleanliness from the designed environment.

With regard to the non-green office building, territoriality in the behavioural environment is the most significant factor of IEQ and individuals' perceived QoL. It is followed by office layout in the designed environment, wayfinding from the behavioural environment, indoor air quality from the ambient conditions, and visual privacy from the behavioural environment.

When the five most significant factors of IEQ in non-green and green office buildings are compared, it is discovered that two of the top five

factors in green buildings come from the behavioural environment, two from the designed environment, and only one from the ambient conditions. In non-green office buildings, however, three factors are associated with the behavioural environment, one factor with the ambient conditions, and one factor with the designed environment. These results highlight the significance of IEQ factors related to the behavioural environment for the occupants' perceived QoL in the office buildings, whether conventional or green.

Table 13

The Rank of IEQ Factors Significant With the Individuals' QoL in Non-Green and Green Office Buildings Shown in a Descending Sequence.

Green	Non-Green
Ergonomics and Furniture (The most significant)	Territoriality (The most significant)
Lighting Quality	Office Layout
Views	Wayfinding
Visual Privacy	Indoor Air Quality
Hygiene and Cleanliness Quality	Visual Privacy
Indoor Air Quality	Maintenance Quality
Aesthetics and Indoor Décor	Personal Control
Pride	Acoustical Quality and Noise Control
Acoustical Quality and Noise Control	Personal Workspace Quality
Wayfinding	Sound Privacy
Office Layout	Image and Value
Thermal Comfort	Status
Sound Privacy	Lighting Quality
Image and Value	Views
Personal Workspace Quality	Pride
Status	Safety and Security
Personal Control	Connectivity with Nature
Connectivity with Nature	Personalisation
Cultural Identity	Thermal Comfort
Maintenance Quality	Hygiene and Cleanliness Quality
Personalisation	Aesthetics and Indoor Décor
Safety and Security	Cultural Identity
	Ergonomics and Furniture

DISCUSSION

The study results reveal that occupants in GBI1 (GBI-platinum green building) perceived their overall QoL, and all the factors of IEQ from the designed environment and ambient conditions, as slightly comfortable and similar to both conventional buildings. In the GBI2, the overall QoL was perceived as comfortable, as were the factors of IEQ in the designed environment and ambient conditions. Results of the four buildings differed in the behavioural environment, as the majority of IEQ factors in the GBI1 and GBI2 were perceived as slightly comfortable, excluding crowding and personal control (slightly uncomfortable). This supports the hypothesis that a building's certification does not necessarily imply a better experience for the occupants.

Correlational analyses were performed by combining the GBI1 and the GBI2 results together to examine the association of occupants' QoL experience with IEQ factors in relation to green buildings. The five most significant factors were identified as Ergonomics and Furniture, Lighting Quality, Views, Visual Privacy, and Hygiene and Cleanliness. These results have some relationship to the GBI1 and GBI2 rankings, highlighting the importance of Ergonomics and Furniture; nevertheless, not all of the IEQ factors were corroborated. The occupants' experiences varied greatly, which explains why the significance of IEQ factors varied between these two green buildings. This means that the findings were not confirmatory with respect to the building's certification; instead, qualities were missing and the needs of building occupants were not met.

In comparing IEQ factors in non-green and green buildings, it was revealed that acoustical quality was found to be more significant in non-green buildings as compared to green buildings. This is because of the open-plan layout and the low partitions in the workstations that allow noises to distract an occupant's nearest neighbours. It is suggested that implementing a sound privacy procedure in the office, in conjunction with acoustical treatment on sound-absorbing walls and ceilings (or sound masking systems), could considerably improve acoustic comfort in the workplace (Cheung et al., 2021).

Lighting quality was revealed to be of more significance in green buildings than in conventional ones. This may be owing to a higher reliance on natural lighting, which delivers adequate daylight to the occupied spaces (Mohd Mustafa et al., 2022). The factor of aesthetics and indoor décor was revealed to have higher significance in green office buildings than in conventional ones. This could be because green buildings are newer; therefore, they use more updated and modern materials, such as, metal, curtain walls, and glass (Paul & Taylor, 2008).

Visual Privacy was perceived as slightly comfortable in both conventional and green buildings. The majority of employees working in open-plan offices, whether in conventional or green buildings, complained about the absence of Visual Privacy. In NGBI1, the GBI2, and the GBI1, complaints mostly arose from employees situated near the entrance or on corridors. Occupants suffered the most in NGBI2 were those who worked in low-partitioned cubicles. Design innovations that enhance Visual Privacy and Sound Privacy should be incorporated. For instance, a credit for layout innovations that enable controlled privacy when necessary or transparent partitions that provide Visual Privacy but still permit some illumination would likely lead to increased comfort (Mohezar et al., 2021).

Pride is also revealed to be more significant in green buildings compared to non-green buildings. This may be related to the symbolic component of being green, which indicates individuals' belief in the value of taking more responsibility toward the environment and protecting the planet. Moreover, the results reveal that individuals in conventional and green buildings have similar needs, thus there were similarity in the findings related to IEQ factors and QoL, though the order of significance varied due to differences in building features and conditions.

Implications of this research involve encouraging the integration between sustainable building design and workplace design in GBI IEQ criteria, where this integration contributes to improved human QoL and a more sustainable environment. Moreover, the research findings outline how GBI and other Green Building Rating Systems (GBRSs) might integrate IEQ credits relevant to occupant QoL.

CONCLUSION

The study considers wide range of potential IEQ factors, categorised into the designed environments, ambient conditions, and behavioural environments. The QoL experience of occupants in both green and non-green work environments was examined comprehensively. Study findings indicate that various IEQ categories interact as a system, with changes in one affecting the others. This also means that an enhancement in the experience of occupants' QoL cannot be accomplished just through the instrumental factors of IEQ (mostly considered in GBI criteria) as the designed environments and behavioural environments also have significant impacts.

This research documents the perceived QoL of occupants in green and non-green office buildings. The study findings demonstrate that the GBI criteria are still insufficient to help designers offer an optimally humane environment for occupants to work and live in. Various factors that were discovered to be significant with the QoL experience of occupants were found to be missing from the GBI criteria. This implies that green buildings are not always optimally humane, and that they might have issues similar to conventional ones. Overall, when it comes to the experience of occupants, when the building is not humane enough, it is immaterial if the office building is green or not; people will have a poor QoL experience.

This study identified it to identify the weaknesses and strengths in the IEQ criteria of present GBI-certified buildings, and has discovered new factors that had not previously been addressed, therefore, offering the opportunity to enhance the designs of future GBI-certified buildings. Besides the determination of IEQ factors, the present study examined a variety of measuring indicators to explore each significant IEQ factor. The findings can be used to support and improve the decisions of designers during the design phase, and facility managers in the operation phase.

Finally, it's critical to carry out an evaluation of the effectiveness of the indoor environment with occupants of buildings when complying with the present GBI standards. Only building occupants can determine whether or not the built environment is conducive to their needs. A

comprehensive occupant evaluation of GBI-certified buildings is required for a future investigation. There has been criticism of the present building professionals' dependence on technology and their lack of understanding of how individuals actually work and live inside their buildings (Leaman & Bordass, 2007). Similarly, the comprehensive occupant evaluation of the physical indoor environment is a supplement to the present IEQ assessment trend, which primarily focuses on the mechanical components of IEQ to assure the occupants' quality of life.

ACKNOWLEDGMENTS

The authors would like to acknowledge the invaluable contribution of the Ethics Committee for Research Involving Human Subjects (JKEUPM) for their approval of our research project. This study was conducted in accordance with the principles outlined in the Ethics Committee for Research Involving Human Subjects (JKEUPM) guidelines for research involving human subjects.

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Appendix A

Questionnaire of the Survey



Indoor Environmental Quality in Malaysia's Green Office Buildings: A Quality of Life Investigation.

IEQ-QoL Questionnaire Draft 1

You are invited to participate in a research study of “**indoor environmental quality assessment of workspace**” which designed to develop comprehensive criteria for evaluating indoor environments for work through proposing a more occupant-oriented framework. This research is being conducted by Bousbia Laiche Abdelfatah; a PhD candidate in the Faculty of Design and Architecture at the Universiti Putra Malaysia. This study will use feedback from building occupants to define how people's quality of life (QoL) is influenced by their indoor environments. Your answers to the questionnaire will assist improve building design criteria as well as ways of assessing indoor environments.

In the following pages, you will find a set of questions on the quality of your work environment. The majority of the questions are in the form of a scale starting from 1 to 5, where 1 is uncomfortable or unsatisfactory, and 5 is comfortable or satisfactory. The questionnaire takes 10-15 minutes to complete.

kindly note that your participation in this study is voluntary. You are free to pose any questions regarding the study and the information you provide.

Your right to stop is guaranteed at any time. Every effort is being made to protect the privacy and confidentiality of your information.

The researcher will use a code for individual identification to protect the identity of participants and no names will be used. The data collected through your responses will not be connected to individual respondents nor to place of employment.

For any questions or concerns, please contact the researcher, Bousbia Laiche Abdelfatah on gs51793@student.upm.edu.my

Thank you for your time. I appreciate your participation.

Bousbia Laiche Abdelfatah
Ph.D. Candidate
Faculty of design and architecture
Universiti Putra Malaysia

PLEASE PROVIDE YOUR: Building's Name:

At which floor is your workstation located?

CODE:

Code composed of the initials of your name (three or two letters if you have only two) and numbers of your date of birth. Please add zero if your birthday numbers are composed of one digit.

e.g: **Sarah George Ken 15 October: SGK1510**
Phillipe John 7 August: PJ0708

Section 1: Background Information

Please check the appropriate answer or indicate other.

1.1 Demographic Information:

- Gender:** Male Female
- Age:** < 20 31-40 51-60
 20-30 41-50 > 60

1.2 Health related Information:

a) Which of the following symptoms that you have experienced at work in the past one month? (You can choose more than one symptom)

- Eye strain Itchy, red, burning, dry, eyes
- Headache Skin dryness, redness, or itchiness days)
- Coughing Nausea
- Back or neck pain Sore throat
- Irritated, stuffy or runny nose Stress
- Lack of concentration Lack of motivation
- Depression Other.....

Indicate the number of working days in a month that you feel any of the following symptoms at work?

.....

b) Do you smoke? Yes Never

If your answer is yes, please indicate the amount of cigarettes consumed in one day.

- More than one box of cigarettes One box of cigarettes
- Half a box of cigarettes 5 - 10 cigarettes 0 - 4 cigarettes

1.3 Job related Information

1. For how long have you been working in the company?

..... Years MonthsDays

2. Please mark which category best describes your job

- Administrative Client related (sales, marketing)

- Technical/professional Managerial/supervisory
- Research/development Field work Other, please specify:

3. Please indicate on average the time you spend at your work office every day?

.....HoursMinutes

4. Your tasks require (Please mark all that apply)

- Presentation on screens Working at desk (reading, writing,..... etc.)
- Working on computer Collaboration with colleagues/ team work
- Meeting with clients Communication via telephone
- Field work not on office Other, please specify:

5. What mean of transportation do you usually take to and from your work on a typical workday?

- Car Bicycle Public transportation Walking
- Other, please specify:

6. How long does it take you to arrive at your work?

- Less than 10 min Less than 20 min
- Less than 30 min Less than 1 h
- More than 1 h

1.4 Do you know whether your office building is a green building or not?

- Yes, it is a green building No, it is not a green building I don't know

1.5 Based on your experience, which of the following items best represents your preference towards working in a green building?

- Acceptable place to work Neutral
- Fairly not acceptable place to work Not acceptable place to work

Green Buildings are environmentally responsible, profitable, and healthy places to live and work. They have environmentally responsible design features such as to maximise the use of natural resources in the most efficient way by reducing negative impacts on the environment and the occupants.

PERSONAL WORKSPACE/WORKSTATION FEATURES

1. Please choose what type best describes your personal workspace/workstation

- Cubicle with high partitions (1.5 m height or more) Cubicle with low partitions (less than 1.5 m height)
- Open-plan (desks in the office with no partitions) Enclosed shared office (shared with other people)
- Other: *please specify*

2. Which of the following best describe the location of your workstation?

- Located at corner

- Located at the external walls beside windows
- Located on internal corridors
- Other: *please indicate*

3. Do you think the distance between you and the closest window is within 15 feet/ 4.6 meters?

- Yes
- No
- Not Sure

4. Do you have window blinds in your office? Yes No

If yes, can you adjust the blinds yourself?

- I cannot adjust the blinds in my office.
- I can adjust the blinds in my office.
- Not sure

5. Do you have operable windows at your office?

- Yes the windows can be opened
- No the windows cannot be opened
- I don't know

6. What can you see outside your window?

- Trees and lots of green landscape
- Traffic, buildings, streets
- My office has no window
- Other: *please specify*

7. Do you have task lighting on your desk? Yes No

8. What colour is the light from the artificial lights at your workstation?

- White illumination
- Bluish illumination
- Yellowish illumination
- Other

Please indicate the type of bulbs if you know it (incandescent, fluorescent, spotlights etc.)

Section 2: THE INDOOR ENVIRONMENTAL QUALITY

2.1 The Ambient conditions

Based on your lived experience in this building over the previous year, please assess the following aspects of your work environment on a scale of 1-5, where **1** means **uncomfortable/poor** quality, **5** means **comfortable/good** quality, and **3** means **average/neutral** quality.

Please check one response on the scale for each of the questions that follow.

2.1.1. Indoor Air Quality

a) What is your assessment about the Overall Ventilation in your workplace?

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Please explain the reasons for your rating

.....

b) What is your assessment regarding the following elements of the indoor air quality?

Air movement/circulation	Stagnant	1	2	3	4	5	Circulated
---------------------------------	----------	---	---	---	---	---	------------

Air Dryness	Dry	1	2	3	4	5	Comfortable
--------------------	-----	---	---	---	---	---	-------------

Air Freshness	Stuffy	1	2	3	4	5	Fresh
----------------------	--------	---	---	---	---	---	-------

Air Odors

Smelly/stinky	1	2	3	4	5	Odorless
---------------	---	---	---	---	---	----------

Comment: Please add any comments you may have for the **Indoor Air comfort** and what steps you might take to feel **more** comfortable:

.....

.....

2.1.2. Lighting Quality

(a) What is your assessment of the Overall Lighting quality in your workplace (how well it suits your tasks)?

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Please explain the reasons for your rating

.....

.....

(b) What is your assessment regarding the following elements of lighting quality, or mark on not available (N/A) if you don't have?

Overall amount of light in personal workspace suiting your tasks.

Insufficient	1	2	3	4	5	Sufficient
--------------	---	---	---	---	---	------------

Reflections/Glare on computer screens from artificial lighting

Uncomfortable	1	2	3	4	5	Comfortable	<input type="checkbox"/> N/A
---------------	---	---	---	---	---	-------------	------------------------------

Reflections/Glare on desk surface from artificial lighting

Uncomfortable	1	2	3	4	5	Comfortable	<input type="checkbox"/> N/A
---------------	---	---	---	---	---	-------------	------------------------------

Flicker from electric lighting

Uncomfortable	1	2	3	4	5	Comfortable	<input type="checkbox"/> N/A
---------------	---	---	---	---	---	-------------	------------------------------

Colour of artificial/electrical lighting (bluish, yellowish, white...etc.)

Uncomfortable	1	2	3	4	5	Comfortable	<input type="checkbox"/> N/A
---------------	---	---	---	---	---	-------------	------------------------------

Daylighting

Uncomfortable	1	2	3	4	5	Comfortable	<input type="checkbox"/> N/A
---------------	---	---	---	---	---	-------------	------------------------------

Reflections/Glare from windows (natural daylighting) on computer screens

Uncomfortable	1	2	3	4	5	Comfortable	<input type="checkbox"/> N/A
---------------	---	---	---	---	---	-------------	------------------------------

Reflection/Glare from windows (natural daylighting) on desk surface

Uncomfortable	1	2	3	4	5	Comfortable	<input type="checkbox"/> N/A
---------------	---	---	---	---	---	-------------	------------------------------

Shadows in the workplace

Uncomfortable	1	2	3	4	5	Comfortable	<input type="checkbox"/> N/A
---------------	---	---	---	---	---	-------------	------------------------------

Comment: Please add any comments you may have for the **lighting comfort** and what steps you might take to feel **more** comfortable:

.....

.....

2.1.3. Thermal Comfort

(a) What is your assessment of the Overall Thermal comfort in your workplace?

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Please explain the reasons for your rating

.....

.....

(b) What is your assessment regarding the following elements of thermal comfort in your workplace?

Room temperature

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Temperature shifts

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Humidity

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Air speed

Draughty/drafty	1	2	3	4	5	Comfortable
-----------------	---	---	---	---	---	-------------

Comment: Please add any comments you may have for the **thermal comfort** and what steps you might take to feel **more** comfortable:

.....

.....

2.1.4. Acoustical Quality (Noise and auditory comfort)

(a) What is your assessment of the Overall level of background sounds in your workplace?

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Please explain the reasons for your rating

.....

.....

(b) What is your assessment regarding the following aspects of office sound levels:

Sounds from colleagues or visitors

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Sounds from mechanical system, ventilation, printers and lighting

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Sounds from outside

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Comment: Please add any comments you may have for the **acoustical comfort** and what steps you might take to manage **noise** and feel **more** comfortable:

.....

.....

2.2 THE DESIGNED ENVIRONMENT: WORKPLACE DESIGN

Based on your lived experience in this building over the previous year, please provide your assessment of your work environment qualities on a scale of 1-5, where **1** means **uncomfortable/poor** quality, **5** means **comfortable/good** quality, and **3** means **average/neutral** quality

Please check one response to each question.

2.2.1. Office/workplace layout

a) What is your assessment regarding the Overall workplace Organisation/layout (the zone where your personal workstation is located)

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Please explain the reasons for your rating

.....

.....

(b) What is your assessment regarding the following elements of your workplace layout, or mark on not available (N/A) if you don't have?

Places for social gathering (lounge, coffee break...etc.) in your workplace

Insufficient N/A

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Places for communication and collaborative work

Insufficient N/A

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Places for working or meeting in privacy

Insufficient N/A

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Access to job related resources: papers, printers, tools ...etc.

Difficult	1	2	3	4	5	Comfortable
-----------	---	---	---	---	---	-------------

Comment: Please add any comments you may have for the **Office/workplace layout** and what steps you might take to feel **more** comfortable:

.....

.....

2.2.2. Personal workspace/workstation quality

a) What is your assessment regarding the Overall workspace quality (personal workstation)

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Please explain the reasons for your rating

.....

.....

(b) What is your assessment regarding the following elements of your personal workspace quality?

Size of personal workstation (to accommodate your work, materials, and visitors...etc.)

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Amount of desk space available for your daily tasks

Inadequate	1	2	3	4	5	Adequate
------------	---	---	---	---	---	----------

Amount of space for storage in your personal workspace

Insufficient	1	2	3	4	5	Sufficient
--------------	---	---	---	---	---	------------

Location of your personal workspace in the space/office layout

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Distance between you and other colleagues

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

The degree of your enclosure created by your workstation via walls, partitions, furniture...etc.

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Comment: Please add any comments you may have for your **personal workspace quality** and what steps you might take to feel **more** comfortable:

.....

2.2.3. Ergonomics & Furniture

a) What is your assessment regarding the Overall quality of ergonomics & furniture

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Please explain the reasons for your rating

.....

(b) What is your assessment regarding the following elements of furniture quality?

Comfort of personal workspace furniture

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Adjustability of personal workspace furniture

Fixed	1	2	3	4	5	Adjustable
-------	---	---	---	---	---	------------

Flexibility of personal workspace furniture for different work requirements or working in collaboration with colleagues:

Inflexible	1	2	3	4	5	Flexible
------------	---	---	---	---	---	----------

Comment: Please add any comments you may have for your **ergonomics & furniture quality** and what steps you might take to feel **more** comfortable:

.....

2.2.4. Hygiene and Cleanness Quality

a) What is your assessment regarding the level of hygiene and cleanness of the work environment

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

Please explain the reasons for your rating

.....

.....

Comment: Please add any comments you may have for the **hygiene and cleanness quality** and what steps you might take to feel **more** comfortable:

.....

.....

2.2.5. Maintenance

a) What is your opinion of Overall maintenance in this building?

Uncomfortable	1	2	3	4	5	Comfortable
---------------	---	---	---	---	---	-------------

 N/A

Please explain the reasons for your rating

.....

.....

Comment: Please add any comments you may have for the **maintenance** and what steps you might take to feel **more** comfortable:

.....

.....

2.2.6. Building Features in Connection with Nature

If you have experienced any of the following building features, please assess your experience:

Daylighting Uncomfortable Comfortable N/A

Indoor Plants Uncomfortable Comfortable N/A

Views Dislike Like N/A

Other Please specify

.....

Comment: Please add any comments you may have for the above **building features** and what steps you might take to feel **more** comfortable:

.....

.....

2.2.7. *Image and Indoor décor*

(a) How satisfied are you with the overall image and décor of your workplace:

Uncomfortable Comfortable

Please explain the reasons for your rating

.....

(b) Please rate how much do you like each of the following elements:

Colours:

Ceilings Dislike Like
 Floors Dislike Like
 Walls Dislike Like
 Furniture Dislike Like

Textures and finishing materials:

Ceilings Dislike Like
 Floors Dislike Like
 Walls Dislike Like
 Furniture Dislike Like

Interior décor:

Ceilings Dislike Like
 Floors Dislike Like
 Walls Dislike Like
 Furniture Dislike Like

Comment: *Please add any comments you may have for the **image and indoor décor** and what steps you might **take or add** to feel **more** comfortable:*

.....

2.3 SOCIAL, PSYCHOLOGICAL BEHAVIOURAL ENVIRONMENT

2.3.1 Please rate how much do you agree with the following statements on a scale of 1-5, where **1** means DISAGREE, **5** means AGREE, and **3** means NEITHER AGREE NOR DISAGREE. **Please check one response to each question.**

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree

	1	2	3	4	5
1. I can personalize my personal workspace through personal photos, quotes ...etc.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I am comfortable with the amount of visual privacy between me and co-workers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I am comfortable with having personal or private conversations at my desk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I find the office space is too crowded	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I find my work environment represents and respects the culture of the city/region (through symbols, icons, logos, proverbs, pictures... other)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I am proud of how this office looks to visitors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. the location of my personal workspace represents and respects my status at work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I feel in harmony with the Proverbs, logos, pictures, and beliefs of my Organisational culture	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I find the workplace image highly aesthetical	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I have confidence in the safety & security systems in this building	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. The security system responds quickly in cases of emergencies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. The alarm systems and other safety and security systems are well-maintained	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I can change the ambient conditions such as lighting and temperature to suit my comfort needs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I can adjust my own furniture to suit my body comfort and work needs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I can adjust my workspace to work in collaboration with colleagues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. This work environment makes me feel connected with nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. Background noise caused by people in this building hinders my ability to focus on work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Background noise caused by building systems in this building hinders my ability to focus on work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. Visitors and new employees can easily find their way around the building using existing signage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. This current work environment satisfies my quality of life during work hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2.3.2 Please estimate how often you:

1	2	3	4	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Always	Usually	Sometimes	Few times	Never

(a) Experience any of the following:

	Always Never	
1. Open the windows near your workstation	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
2. Adjust the blinds at the windows	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
3. Adjust the lighting at your desk?	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
4. Use your desk task lighting	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
5. Leave your workstation to work alone in a private room	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
6. Adjust your furniture size, location, heights ...etc.	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
7. Get disturbed by unwanted noise interruptions from people	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
8. Get disturbed by unwanted noise interruptions from building systems and equipment (lighting, printer, HVAC...etc.)	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A

(b) WISH/NEED to do any of the following actions?

	Always Never	
1. Change the location of your Workstation	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
2. Have self-expression in the design of your personal workstation	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
3. Change the interior décor of this office building	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A
4. Work in a green building	<input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="checkbox"/> N/A

1.3.3 Personal Control

a) In your workstation: Please rate the degree of your personal ability to control, change or modify each of the following

Ventilation	No control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Full control	<input type="checkbox"/>	N/A
Artificial/electric Lighting	No control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Full control	<input type="checkbox"/>	N/A
Daylighting	No control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Full control	<input type="checkbox"/>	N/A
Noise from people	No control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Full control	<input type="checkbox"/>	N/A
Noise from building system/equipment	No control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Full control	<input type="checkbox"/>	N/A
Temperature	No control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Full control	<input type="checkbox"/>	N/A
Workstation Furniture	No control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Full control	<input type="checkbox"/>	N/A

b) In your workstation: Please rate the degree of personal accessibility to reach the location of:

Light switches Difficult Easy N/A

c) In your workstation: Please rate how easy these items are to personal adjust and use:

Light switches Difficult Easy N/A

Workstation furniture Difficult Easy N/A

d) **Do you use any of the following items in work environment?** Please mark all what apply or indicate other

<input type="checkbox"/> Personal fan	<input type="checkbox"/> Ear plugs
<input type="checkbox"/> Desk task lighting	<input type="checkbox"/> Back or neck cushions
<input type="checkbox"/> Other: please specify.....	

e) **Do any of the following factors affect your feeling of safety and security?** Please mark all that apply and indicate the reasons below.

- Lighting Office layout
- Indoor air Personal workspace
- Indoor temperature Furniture
- Daylighting Cleanliness
- Noise Maintenance

Reasons:

.....

2.4: OVERALL EXPERIENCE

2.4.1 Based on your daily working experience do you find any of the previously MENTIONED (in this questionnaire) or other UNMENTIONED factors related to your work environment that interact positively or negatively with: Please indicate those factors and how they affect you if available.

a. Your physical health (eyes, neck, back, ears...etc.)

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b. Your general mood, satisfaction, and mental health (feeling of content, stress, tranquility, anxiety, good concentration, lack of concentration, motivation, depression, ...etc.)

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c. Your general physical environmental comfort (comfort with temperature, light, noise, odors...etc.)

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d. Performing your work tasks in a functionally comfortable way (ability to get the work done).

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2.4.2 Please rate how do you perceive your workspace in each of the following, based on your working experience in this building

Perceived health inside the building	Unhealthy	1	2	3	4	5	Healthy
Overall comfort with the workplace	Uncomfortable	1	2	3	4	5	Comfortable
Perceived work performance (ability to get the work done)	Work hindering	1	2	3	4	5	Work enabling
General satisfaction with the workplace	Unsatisfied	1	2	3	4	5	Satisfied
Meeting personal needs for living and working	Unsatisfied	1	2	3	4	5	Satisfied

You have reached the end of this questionnaire. Thanks for taking the time to respond.

Your participation is extremely valuable to us.