

Office Design: An Approach towards Sustainable Materials for Healthy Interiors

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Biography-

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I'm an Architecture undergraduate student currently in my Pre-final year passionate about learning this vast field. Knowing and exploring new building materials fascinates me. Throughout my academy, I was always interested in sustainable and green building materials, ways, and relative design techniques. Apart from Architecture, I'm a member of a youth group - YGPT (Youth for Global Peace and Transformation), India. Volunteering under the vertical-Earth Embrace.

Abstract

The actions we take have caused negative effects not only on our environment but also on our health. With global warming, climate change, and the Covid Pandemic that occurred in recent years, people have now started to make their health a priority while adjusting to this new normal. Obtaining productive work in a stressful and poorly planned environment is one of the major problems faced by employees in office spaces which affects not only their health but the overall office productivity rates. This creates problems like absenteeism, lack of interest, and poor and unsatisfied work. Therefore, it becomes necessary to create interiors that are appealing, and refreshing, helping to boost productivity levels and interests without compromising on one's health and our environment. Designing interiors that are sustainable means creating an environment that is user-friendly, functional, and satisfies users' needs without disturbing the interior air quality (IAQ).

One way to achieve sustainability is selecting materials that do not emit any harmful toxins like- CO₂, VOCs, UF, etc. that are green, eco-friendly, recyclable, reusable, or biodegradable. Interior designers must be aware of and know the current market situation while selecting materials. One can also go through the available material certification. Having healthy relationships with clients is beneficial to make them aware that sustainable materials are good alternatives to standard ones.

This paper refers to case studies, sustainable materials which can be good alternatives to traditional ones, and a pilot study with office users to know the current workplace scenario in terms of, material identification, human comfort, etc.

Keywords: Office Interiors, sustainable materials, health and wellbeing, user comfort.

Introduction

Designing interiors with the help of sustainable material choices from paneling to furniture can have huge benefits which help spaces to be highly functional, boosting the overall productivity of the users and thereby having a positive impact on users' health and environment. One way to achieve a sustainable interior environment for offices is through material selection. Sustainable materials are materials that have a positive impact on people and the environment that are used to build products and deliver services and environments such as buildings. (spacey, 2018) [5]. The paper discusses the selection criteria of sustainable materials and various ways to achieve a sustainable interior environment, rating systems, key design elements, and important points to remember while designing sustainable and functional office spaces.

Literature

With the growing effects of climate change, the building and construction industry plays a major role in contributing to climate change and global warming. Many previous studies are showing how these existing and new buildings contribute towards the negative effects on individual's health, overall surrounding, and our planet on a bigger scale. It is a need of the hour for adapting to sustainable methods in construction. Practicing sustainable design approaches for all types of built-in spaces is beneficial to not only our environment but also one's health and helps reduce the overall annual energy costs. The initial construction cost may be higher but has great economic benefits in the long run. The designer should be well aware of all the sustainable methods and the current market for having a brief discussion with its clients.

Review

Ways to Achieve Sustainable Interior Environment-

A successful Office design is designed keeping the user's (employees) needs in mind, spaces planned according to interaction levels and privacies can achieve optimum productivity levels without compromising the user's health.

Rating Systems- Designers must have brief knowledge about the rating systems and try to be updated with the current market situations. By incorporating sustainable certifications and systems like LEED (Leadership in Energy and Environmental Design) BREEAM (Building Research Establishment Environmental Assessment Method), and IAQ (Indoor Air Quality), etc. one can achieve designs with healthy, highly efficient, and cost-saving benefits.

Design Elements- 'A 2016 report by World Green Building Council, states the following elements are essential for healthy and productive office spaces,' - (WGBC, 2016)[8]

1. Natural and Artificial Lighting- It is recommended to get maximum natural lighting (source-sun) during daylight hours as it helps to improve employee performance and reduce energy bills due to artificial lights. Using daylighting techniques like skylights, solar harvesting (façade or roofs), sloped ceilings, light shelves, and shading devices. Positioning of windows with proper glazing and thermal breaks helps to reduce energy loss meeting the required heating/cooling needs. Using self-controlled LEDs in the wee hours.

2. Indoor Air Quality and Ventilation- Offices must have low emissions of CO₂ and avoid materials having VOCs, UF, UFFI, and other such pollutants. The office space must be sufficiently ventilated. Using air purifiers and planting trees indoors (biophilic designs) forms

a positive impact on the overall interior environment boosting productivity.

3. Noise and Acoustics- Proper measures must be taken to control noise. Sound Insulation on walls and ceiling helps to lower the sound levels without creating disturbance to other workers. Soundproofing walls, tiles, or ceilings must be installed for special rooms like meeting rooms, cell cabins, etc. where there's a need to stop the sound to pass through.

4. Interior Layout- Creating flexible spaces and well-distinct spaces according to functional needs like meeting rooms, quiet zones, stand-sit desks, interactive areas, etc. are the points that cannot be ignored while designing the office spaces.

5. Thermal Comfort- Offices must have a comfortable temperature range that staff can control. If the interior temperature does not provide the necessary comfort it may affect the quality of work and many studies have shown that they are interdependent. While achieving thermal comfort designers must inspect if there are any energy losses or gains that may affect the energy usage bills and in turn hurt the environment.

6. Energy- The goal of any sustainable design must be to reduce overall energy consumption, reducing carbon emissions and wastage. Using energy-efficient equipment, and practicing energy-saving measures can be helpful to control the impact and less energy wastage.

7. Interior Materials and Furniture- Designers must look for eco-friendly materials, easily maintained, recyclable, upcycled, non-toxic, durable, locally available, optimum functional, reusable, and if possible also biodegradable. Designers must know and be updated on the market materials. Materials (for fabrics, window treatments, surface materials, flooring, walls, and ceilings) and furniture are one of the main parts of Interiors for any space. Selecting them without considering their sustainable aspects may lead to an unhealthy interior environment.

Avoid using materials having toxins like:

- Formaldehyde (carcinogen): Carpentry, cabinets, glue
- Volatile organic compounds (VOCs): paints, plywood, varnishes, glues, particleboard
- Polybrominated Diphenyl Ethers: plastics, fabrics
- Perchloroethylene (PCE): polishes, rubber coatings, aerosols, adhesives, sealants, and lubricants.
- Perfluorinated compounds: stain-resistant furniture.
- Phthalates: air fresheners, vinyl, wood varnishes.

1. While selecting wooden furniture designers and clients must go for furniture that is created with sustainably certified wood.
2. Some sustainable alternatives for fabrics include Recycled synthetic fabrics, Organic Cotton, Organic Linen, Bamboo, Agave, Nettle, Hemp, Soy fiber, Lyocell, Barkcloth, Wool, Cashmere, Alpaca, Camel hair, Leather, and Silk. However, it is better to not use fabrics coming from animal origin without the certification. One must check if those fabrics are the product of causing harm to animal life.
3. Window treatments can be done with fabrics, Natural grasses like flax and hemp that have high resistance to UV rays, bamboo, etc.

- Flooring can be of FSC wood, reclaimed wood, cork, bamboo, recycled rubber, natural stone, recycled tile, or terrazzo. Carpets can be of wool, organic cotton, bamboo, hemp, jute, and refurbished/ recycled materials.
- One must select paints that do not have any VOC content, can be water-based or clay paints, etc.
- Using environment-friendly glue/ adhesives.
- Use eco-friendly wall covers and wall panels that are recyclable, and non-toxic.

Sustainable design process and points to remember for designing any Office Space-

- Before starting any project, designers must understand the type of office space and clients' and employees' needs.
- Designers must have healthy discussions with the client and also the workers/employees that are going to use the office space to understand the problems faced and must try to find out the necessary solution during the planning stage.
- Instead of following a traditional linear design process where only the space is looked at from the aesthetic point of view, it becomes easy to achieve sustainability, functionality, and resilient spaces with the help of the SSO method that follows a circular process wherein the planning/layout are done according to the required users needs with ongoing discussions at various design stages to obtain office spaces that are comfortable, flexible, efficient, where the employees can have maximum productivity, less absentee es, more focused environment without compromising on one's health and well-being.
- Planning should be done thoughtfully and it should meet the required spatial needs.

Case Studies

Case Study 1- (IGBC Green Interior Case studies)[6]

Name of the Project –
 Location –
 The rating level – Is platinum
 Occupancy: 55



Concept – Architect and Interior design offices in this building are located on the 4th and 5th floor with approx. 5200 sq. ft. The building is finished in RCC both inside & outside and to allow daylight a 450- mm ribbon window at the top & bottom of each floor on 3 sides. The office won a platinum award from Indian Green Building Council.

Materials Used- Salvaged materials



Salvaged Materials – Old timber is used for conference table tops without any polishing to avoid VOCs. The room is well-lit and ventilated by natural lighting and ventilation. Fig.3



The reinforcement steel pieces left over from construction have been welded and used as railing for the internal staircase on all the floors. Fig.4



The waste of old paint cans has been innovatively used as pigeonholes at the reception. Fig.5



100% of the floor plate is fully daylight through the top & bottom ribbon windows. The ceiling is not painted and is left in RCC finish. Fig.6



In the visitor's lounge area, the columns are decorated with a rope that was left over at the construction of this site. The ceiling & wall are exposed with RCC finish (left unpainted.)fig7



The central portion is used as storage space and all the services run behind these magnet partitions, which can be easily removable in the case of repairs or alterations. Fig.8



All partitions and doors are made from shuttering timber which was used during the construction of the roof. Fig.9



Water Efficient Plumbing Fixtures – Taps fitted with aerators, dual flush toilet 6/3, shower fitted with aerators, and able to give more than 20% water savings over baseline. Fig.10



Lighting is uniquely connected through GI pipes without compromising on the lux levels.
Fig.11



In all spaces, unitary air-conditioners are provided with BEE 5 Star rating. Fig.12

Case Study 2- (IGBC Green Interior Case studies)[6]

Name of the Project	–	AW	Design
Location	–		Ahmedabad
The rating level	–	Platinum,	New interiors
Occupancy:			10
An Architect's Workspace. Area- 700 sq. ft			

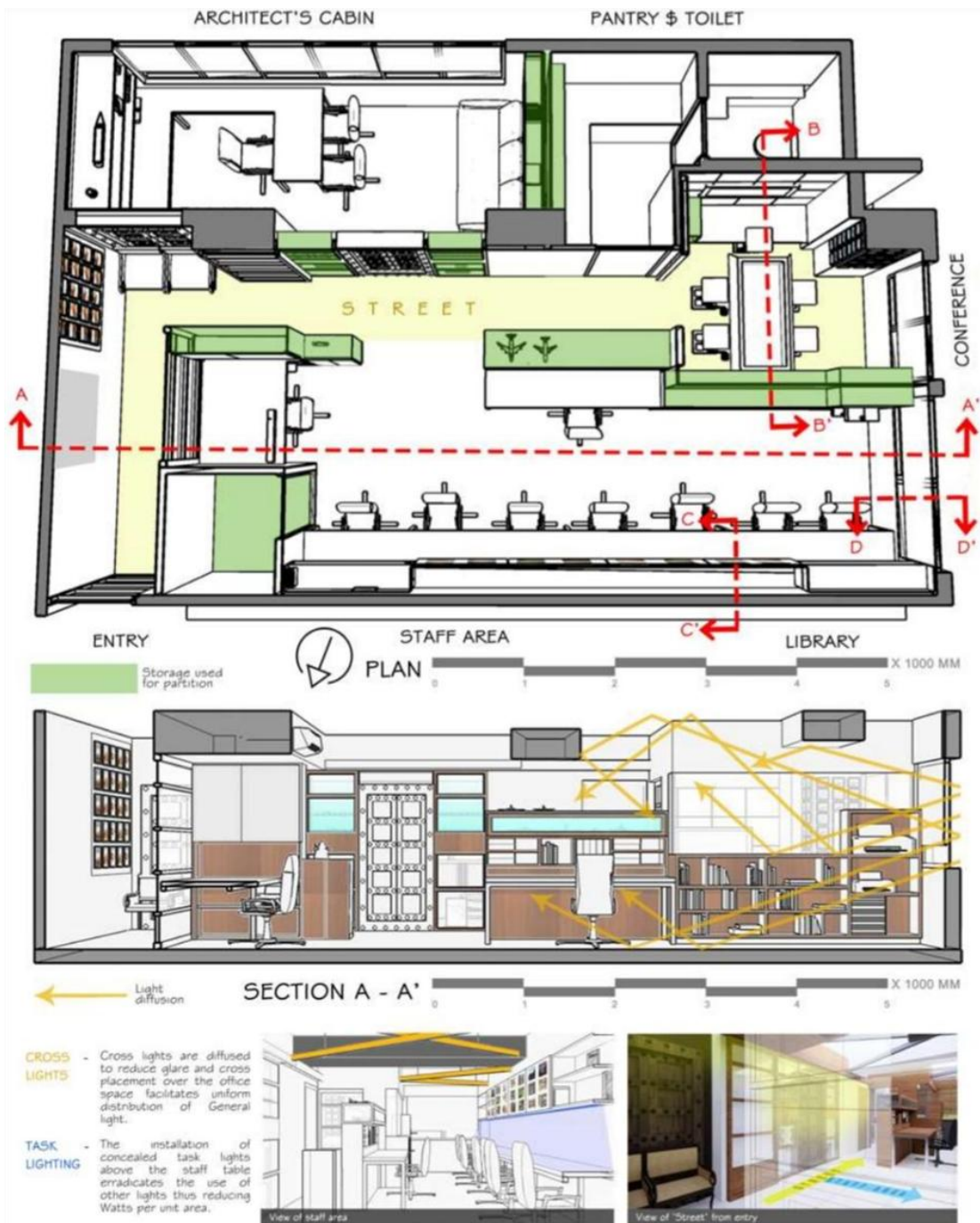
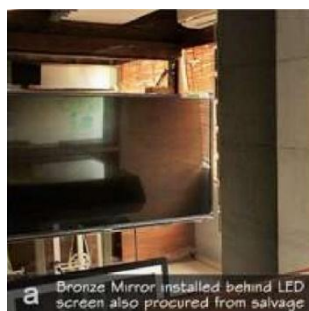


Figure 13 Plan and Section of Architects Office by AW design. Source: IGBC.in

Materials used-



A bronze mirror was installed behind an LED screen to cover an entire wall of the meeting room, this gives the illusion of the space being much larger. also procured from salvage. Fig.14



Bicycle stool made from MS frame (salvage) Fig.15



Meeting room's inspiration corner. Fig.16



Thermocol is used as an insulation material in windows with reused ply framing. Fig.17

Salvaged materials used:

1. Display veneer from retail shops.
2. Salvage lumber merchant.
3. Salvage wood logs.
4. Salvaged MS frame from the shed.
5. Members from salvage MS frames were later used to make Desk and stool frames for office

6. Phenol bonded ply sourced from trade shows.
7. Soft boards reused from the old office.
8. Glass, mirrors, and tiles procured from salvage dealers. Softboard and sofas are reused extending their usage cycle and reducing energy consumption, and disposal steps.
9. Damaged Quota stone and tiles.
10. Old blinds, sofas, and doors were reused.
11. Reused 10 years old Chick Blinds.
12. Reusing procured painted glass.

Overview of materials:

1. Materials chosen were wood-based finishes for worktop support, Ivory flooring.
2. Reused and procuring materials from salvage were veneer, plywood, MDF, MS pipes, Upholstery, soft boards, glass, mirror, back painted glass, paints, thermocouples, tiles, sofas, doors, light fixtures, etc all locally sourced to reduce transport.
3. Entire fittings were done from waste / reused/salvaged materials (except ACs, Computers, and seating systems).
4. Ply from salvage vendors, veneer lot is of showroom displayed sheets, tiles from factory rejects, glass from salvage dealer, upholstery from fabric catalogs, Table MS frames and meeting room seating from Metal scrap, insulation from the common thermocouple, blinds and soft board reused, Mirror from salvage, ceilings unpainted, paint and polishes VOC free & from site leftovers, doors salvaged from timber scrap, light fittings from ply waste, scale markings from waste MDF cut-outs.
5. Results were extended in the useful life of products with improvement in environmental, social, and financial conditions.

The following benefits were achieved:

1. Average temperature difference on external and internal wall surface reduced by 15 degrees, by use of 18mm thermocol sheets on the interior side.
2. 95 % material used was manufactured locally
3. 75% of construction waste was used within the site.
4. Light fixtures built out of waste plywood cut-outs.
5. 55% cost savings by the adaptive reuse of salvaged, repurposed, and construction waste material.

Comparative Analysis of Case Study 1 & Case Study 2

Given below table 1.1 mentions the alternative sustainable materials that are used in the Interiors of the AW Design office of Ahmedabad and the ESSTEAM office of Surat.

	PURPOSE	AW DESIGN	ESSTEAM
1	Table Tops	Bought from Salvage lumber merchant.	Old timber without any surface treatment
2	Staircase Railings		Leftover steel reinforcement from the site.
3	Pigeon holes (Reception)		Old paint cans.

4	Ceiling	Unpainted	RCC finish (unpainted)
5	Walls	Painted with VOC-free paints and polishes	RCC finish (unpainted)
6	Columns		Reused fabric (rope) from site leftover.
7	Partitions		Shuttering timber (leftover from roof construction)
8	Doors	Bought from Salvage lumber merchant.	Shuttering timber (leftover from roof construction)
9	Taps and shower fixtures (sanitary fixtures)		Fitted with aerators
10	Lighting		GI pipes
11	Glass/ mirror	Procured from salvage dealers	
12	Tiles	Procured from salvage dealers. Reused defective tiles.	
13	Soft boards	Reused from the old office	
14	Blinds/sofa	Reused	
15	The insulating material in windows	Reused ply framing, thermocol	
16	Flooring	Ivory flooring	

Table 1.1 Comparative Analysis of case study 1 and case study 2

Pilot Study-

A survey was conducted for Office Employees through Google forms. The main objective was to know about the current interior environment scenarios in Indian offices. In total 24 entries were collected from Pune, Bangalore, and Gujarat cities. The questions considered are given below with an analysis of the survey.

Questions-

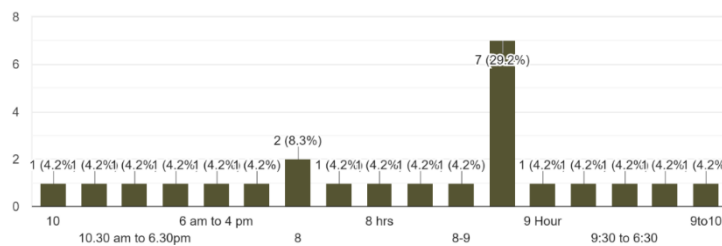
1. What is your daily working hour?
2. If compared to the office and home, where do you feel most productive?
3. Do you feel fresh and motivated in your office environment?
4. Can you rate your office productivity level between 1-10? (1-being least,10-maximum)
5. Do you have any health issues like Skin Allergy, Eye Irritation, Sneezing, Throat Irritation, or asthma?
6. Select the materials you can identify that are used in your office interiors.
 - a) Painted walls
 - b) Wood
 - c) Laminates
 - d) Marble (flooring)
 - e) Granite (flooring)
 - f) Terrazzo tiles (flooring)
 - g) Brick wall (exposed)

- h) Glass
 - i) Concrete finish walls
 - j) Fabric (used in carpets, curtains, mats)
7. Do you think the materials you are surrounded with are somewhat responsible for your above health conditions?
 8. What are your views on the lighting and ventilation of your office space?
 9. Does your surrounding furniture accumulate dust? Do you face any dust issues?
 10. How do you feel about the indoor temperature?
 11. Can you point out a few good or bad things about your office interior space?

The following responses were collected-

1. What is your daily working hour?

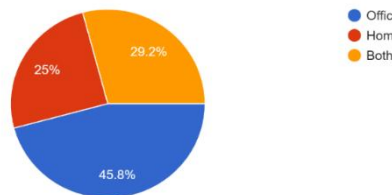
24 responses



1. On average majority of participants spend 7 to 9 hrs of their day in offices.

2. If compared to office and home, where do you feel most productive?

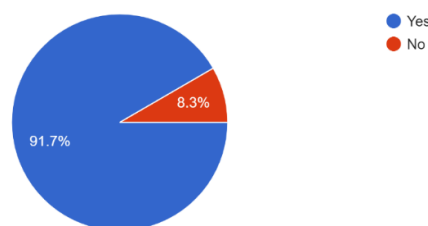
24 responses



2. 45% of participants produce more productive work in offices followed by 30% of them being productive in both places, office and home.

3. Do you feel fresh and motivated in your office environment?

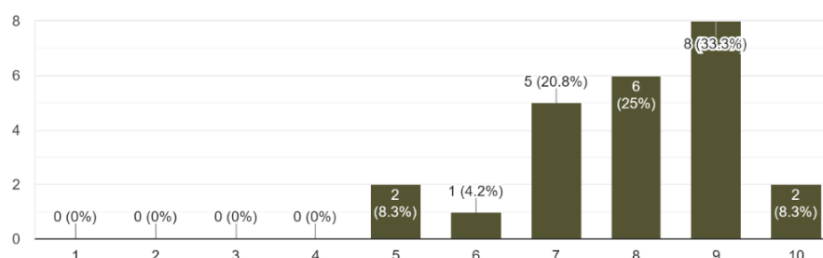
24 responses



3. 91.7% of participants felt more motivated to work in the office.

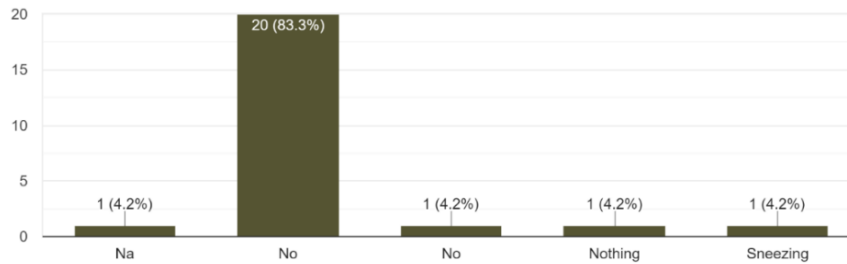
4. Can you rate your office productivity level between 1-10? (1-being least, 10- maximum)

24 responses



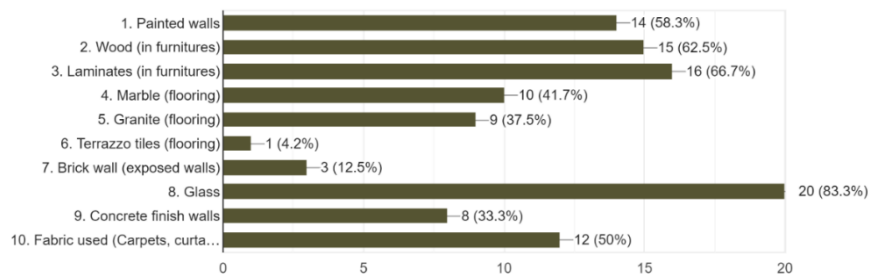
4. The productivity level of the majority of participants ranged from 7 to 9.

5. Do you have any health issues like Skin Allergy, Eye Irritation, Sneezing, Throat Irritation, Asthama? (If yes, please mention)
24 responses



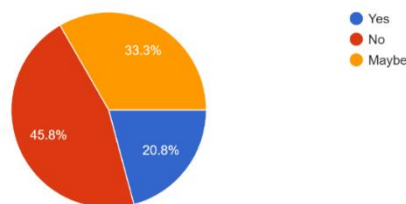
5. Some health issues identified were sneezing whereas the issues like skin allergy, eye irritation, or asthma were not identified.

6. Select the materials that you can identify that are used in your office interiors.
24 responses



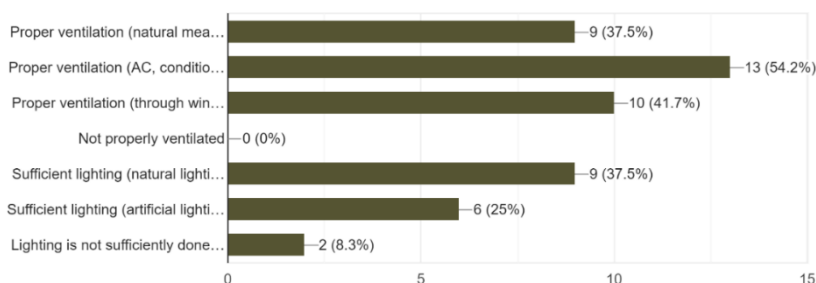
6. Out of the 10 materials identified, the majority of them were glass, laminates in furniture, wood, and painted walls.

7. Do you think the materials you are surrounded with are somewhat responsible for your above health conditions?
24 responses



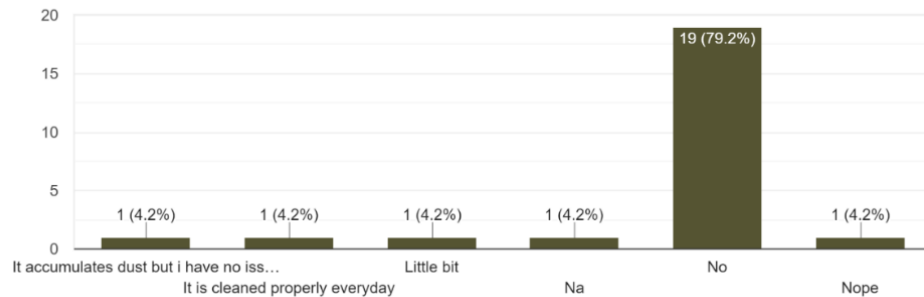
7. Participants were not surely aware of whether there was a link between their issues and with surrounding materials.

8. What are your views on lighting and ventilation of your office space?
24 responses



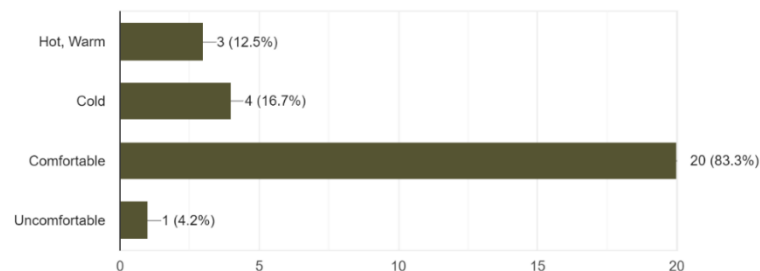
8. Most of the offices had mechanical ventilation systems and sufficient lighting (natural and artificial). Few of them not had sufficient lighting.

9. Does your surrounding furniture accumulate dust? Do you face any dust issues?
24 responses



9. Few cases were noted where there was dust accumulating on furniture.

10. How do you feel about the indoor temperature?
24 responses



10. 17% of participants felt uncomfortable about the indoor temperature of their respective offices.

11. The participants had equal opinions on their working spaces. The lack of functional spaces like informal seating areas was pointed out.

Methodology

This research paper explains various ways to build a sustainable interior for office spaces with the help of data collected from previous papers and the necessary steps to be taken while processing the design stage. Few case studies were studied to understand the ways they used materials to achieve sustainability and their impact on office interiors. Further, a pilot study was conducted which involved sampling of individuals who worked in offices as employees. They were assigned to answer 11 relevant questions through google forms. The survey comprised various questions related to work productivity, health, interior environment, materials, and interior spaces. Through this research, it was found that materials like glass, wood, laminates, paints, and fabrics were majorly identified. By thoughtful selection designers and owners can take one step towards acquiring sustainability.

Conclusion

The majority of materials identified by the participants were glass followed by laminates, wood, painted walls, and fabrics. Considering them as the most common materials used in office space, the selection criteria become important. Choosing eco-friendly and toxin-free options helps to achieve a healthy environment for people and at the same time takes care of our Earth by reducing waste, production, and energy savings related to manufacturing products. Along with the aesthetic and look factor, designers must choose materials that are functional, good-looking, free from toxins, and materials that can either be reused or recycled. Choosing sustainable/green alternatives for interior materials is not only beneficial for the environment but also for users' health by creating healthy indoors.

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