# Activating the concept of biophilia in administrative spaces to reduce covid 19

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## Abstract:

Between October 2020 and January 2021 and to this day, companies around the world have experienced a 50% drop in their sales on average due to the COVID-19 pandemic. This also led companies to think of alternative solutions to reduce the number of employees within the administrative spaces, to limit the spread of the unknown disease, and through this pandemic, the researcher believes that the designer can find solutions that help the user to deal with Covid 19 through innovative environmental technical solutions, By integrating the Biophilic design into the administrative spaces, as it restores the interior design to its correct environmental path and its role in improving the internal environment, the general health of the user, and the harmony between the user and the space, Biophilia is the way to link many benefits that occur when environmental concepts are applied to improve The design of administrative spaces as it is a vital design linked to nature and its positive impact on human health due to his need that is inherent in his connection with nature, Improving the user's quality of life and technical design using different technologies such as virtual reality and sensors used in the interior space through continuous cleaning with disinfectants, air flow and temperature fluctuations and purification, without resorting to human intervention to reduce the spread of disease.

The research aims to prove that the Biophilic technical design has an impact on the user's quality of life, not just an aesthetic or technological design, but rather it is concerned with the efficiency of the functional perception of the user in administrative spaces, maintaining his physiological and psychological health as much as possible, and limiting the spread of the virus among workers.

The results of the research are to take advantage of technical environmental design by rethinking the design of companies in this way, to preserve the health of workers from global epidemics and to improve employee happiness, and productivity in the workplace, which ultimately leads to the creation of a design through which companies recover economically, and It maintains its sales ratios and the user's psychological and physical health within the administrative space.

## Key words:

Environmental administrative design- Biophilic design- COVID-19 pandemic- Virtual reality- Sensors technology.

**ملخص البحث :**

تعرضت الشركات في جميع أنحاء العالم في الفترة ما بين أكتوبر ٢٠٢٠ و يناير ٢٠٢١ و حتي يومنا هذا ، الي انخفاض في مبيعاتها بنسبة ٥٠٪ في المتوسط وذلك بسبب جائحة كوفيد ١٩.

كما ادي ذلك الي تفكير الشركات في حلول بديلة لتقليل اعداد الموظفين داخل الحيزات الإدارية ، للحد من انتشار المرض المجهول، ومن خلال هذه الجائحة يري الباحث ان المصمم يستطيع ايجاد حلول تساعد المستخدم ليتعامل مع كوفيد ١٩ من خلال حلول تقنية بيئية مبتكرة ، وذلك من خلال الدمج بين التصميم البيوفيلي في الحيزات الإدارية حيث انه يعيد التصميم الداخلي الي مساره البيئي الصحيح و دوره في تحسين البيئة الداخلية و الصحة العامة للمستخدم و الانسجام بين المستخدم و الفراغ ، البيوفيليا هي الطريق لربط الفوائد العديدة التي تحدث عندما يتم تطبيق المفاهيم البيئية لتحسين تصميم الحيزات الإدارية كما انه تصميم حيوي يرتبط بالطبيعة و تأثيرها الإيجابي علي صحة الأنسان لحاجته المتأصلة في ارتباطه بالطبيعة ، تحسين جودة حياة المستخدم و التصميم التقني باستخدام تكنولوجيا مختلفة كالواقع الأفتراضي و الحساسات المستخدمة في الفراغ من خلال التنظيف المستمر بالمطهرات ،تدفق الهواء وتقلبات درجة الحرارة و تنقيته ، بدون اللجوء للتدخل البشري للحد من تفشي المرض.

يهدف البحث لاثبات ان التصميم التقني البيوفيلي له أثر في جودة حياة المستخدم ليس مجرد تصميم جمالي او تكنولوجي ، بل انه يهتم بكفاءة الإدراك الوظيفي للمستخدم في الحيزات الإدارية و الحفاظ علي صحته الفسيولوجية و السيكولوجية قدر الإمكان و الحد من انتشار الفيروس بين العاملين.

نتائج البحث هي الاستفادة من التصميم البيئي التقني من خلال إعادة التفكير في تصميم الشركات بهذه الطريقة ، للحفاظ علي صحة العاملين من الأوبئة المنتشرة عالميا و لتحسين سعادة الموظفين ، والإنتاجية في مكان العمل ، مما يؤدي في النهاية إلى إنشاء تصميم من خلاله تنتعش الشركات اقتصاديا ، و تحافظ علي نسب مبيعاتها و الصحة النفسية و الجسدية للمستخدم داخل الفراغ الإداري.

**الكلمات المفتاحية :**

التصميم البيئي الإداري -التصميم البيوفيلي ـ وباء كوفيد ١٩ ـ تصميم الواقع الإفتراضي ـ تكنولوجيا المجسات .

## Introduction:

Between October 2020 and January 2021 and to this day, companies around the world have experienced a 50% drop in their sales on average due to the COVID-19 pandemic. This also led companies to think of alternative solutions to reduce the number of workers within the administrative spaces, to limit the spread of the unknown disease, and through this pandemic, the researcher believes that the designer can find solutions that help the user to deal with Covid 19 through innovative environmental technical solutions, By integrating the Biophilic design into the administrative spaces, as it restores the interior design to its correct environmental path and its role in improving the internal environment, the general health of the user, and the harmony between the user and the space, Biophilia is the way to link many benefits that occur when environmental concepts are applied to improve The design of administrative spaces as it is a vital design linked to nature and its positive impact on human health due to his need that is inherent in his connection with nature, Improving the user's quality of life and technical design using different technologies such as virtual reality and sensors used in the interior space through continuous cleaning with disinfectants, air flow and temperature fluctuations and purification, without resorting to human intervention to reduce the spread of disease.

**Research problem :**
- How to limit the spread of COVID-19 infection in interior spaces of administrative buildings.
- How to find solutions for interior environment that help the user to deal with COVID-19 through creative environmental technology solutions in administrative building .

**The aim of the research :**
The research aims to prove that the  Environmental (Biophilic )technical design has an impact on the user's quality of life, not just an aesthetic or technological design. but rather it is concerned with the efficiency of the functional perception of the user in administrative spaces, maintaining his physiological and psychological health as much as possible, and limiting the spread of the virus among workers.

**Research Methodology :**
The research methodology relied on the analytical approach  for the recommendations of health organizations for the problem of Covid-19, which caused panic around the world and affected the occupants of the administrative space, which led the researcher to think of technical environmental solutions that help to deal with the emerging corona virus in the administrative space.

## first-the quality of environmental administrative interior design:

Environmental office space is concerned with achieving all comforts for the users of the space, such as ventilation, heat, sound, and natural materials to maintain the health of the user and obtain the best performance inside the space.

Biophilic design It is a vital design that is linked to the connection with nature and its positive impact on human health due to its inherent need in connection with nature.

It is a trend that leads to the quality of the internal environment and the connection to the place within an integrated system while improving the general health of the human being.

Biophilia which  used as an aesthetic value is not enough to reach the best environmental quality nor the occupants' expectations in the administrative environment, but  needs technological features with it , all equally well designed for controlling the quality of the indoor environment, such as thermal comfort, air quality, lighting, acoustic comfort, and suitable spatial layout in offices.

the connection between indoor building design and occupants' well-being is complex, Indoor stressors are of many kinds, for example, inapropriate thermal levels, poor lighting and access to daylight, damp, noise sources and vibration , chemical compounds, and fluctuations in particulates, which may have cumulative effects or complicated interactions.

most of people , Nowadays, who work indoors for a long time are exposed to building materials that may contain harmful chemical substances, endure uncomfortable indoor air quality of Biophilic design value , which has been defined as an actual response to the essential human need to connect  indirectly with nature by interior design, using, for example, patterns , natural elements, indoor plants, nature-resembling colours,  and views of greenery .

one of the essential applications in Biophilia is to understand the possible role of plants and green features besides the effect of design planning on social interaction in office space . Social interaction strengthens the sense of community, creating a healthy atmosphere while improving the indoor environmental quality (IEQ) in office building.

Biophilia, can improve everyone's productivity and financial costing because it improves the well-being of the whole community. Hence, inserting some elements of the natural environment into the office space environment creates an absolute advantage in productivity and well-being, as several physiological studies not only feeling luxury.

## 1.1- Flow of air & heat:

the quality of air in the indoor environment , in the (LEED) system ,especially the achievement of air efficiency , purify the air inside the space continuously, to keep office space free from the presence of the virus, and this happens by simulating nature by changing the levels of air flow, whether temperature or humidity, and this happens by measuring temperature fluctuations in nature that helps the employee to rest, Well-being and productivity, Air quality includes feel, flow, and visual appeal according to the direction of the air, and concluded that the performance working increases with temperature up to 21-22°C, and decreases with around 23-24°C, minimum ventilation outdoor air rate in breathing zone for office space per person is 2,5 1/s/pers,while the outdoor air rate per area is 0.3 1/s/m2.

## 1.2- Physiological health:

Health is getting better in contact with nature, as it affects positively on user's body , especially on the auditory, visual and respiratory responses, and how to deal with the virus. Thus, the role of nature in helping the user to maintain comprehensive physical health.
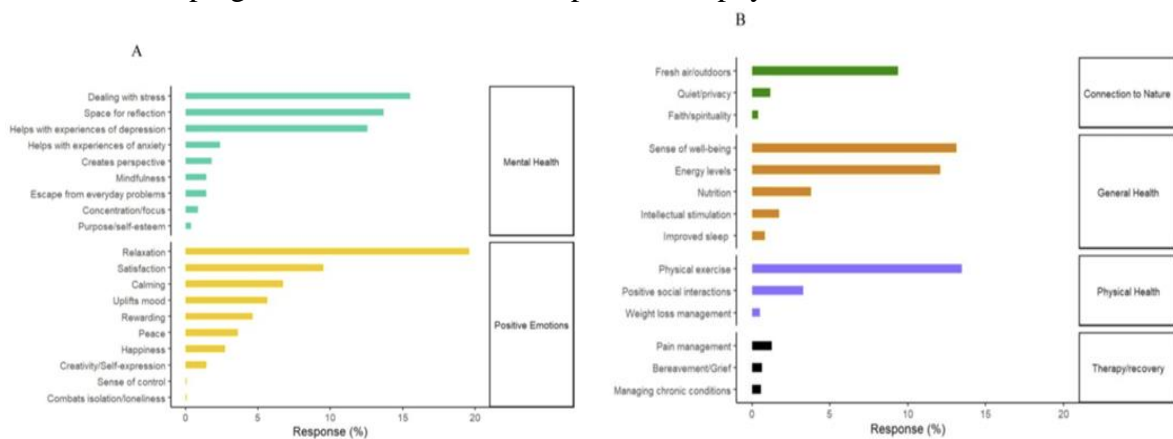


**Fig. (1) statistics of role of nature in helping user physical health**

Fig. (1) People expressing health problems who also considered gardening as therapeutic (%). Specific points being grouped into larger categories of A = positive emotions, mental health and B = therapy and recovery, physical health, connections to nature and general health.

## 1.3- Psychological health:

Good mental health resulting from contact with nature to reduce stress, anxiety, confusion, and fatigue to overcome the virus.

impact of environmental (biophilic) design elements upon the individual when they first enter their workspace. The results show clearly that workers entering environments that welcome workers with natural greenery are much happier and inspired. This places emphasis on the importance of creating as natural a work environment as possible in order to evoke these positive feelings among employees. In contrast, we also find that workers who do not have greenery within their work environment feel more anxious and sometimes bored when they enter the workplace.



**Fig. (2) statistics of negative impacts of work- related stress and bored workplace ,due to lack of greenery zones.**

## 1.4- Dynamic glazing technology:

The user can control the glass sides of the building to obtain the maximum amount of natural light and the connection of the building with nature, through the use of electrical technology that controls the degree of opacity of the glass to avoid the entry of harmful and unwanted sunlight.

Building occupants continue to push for more daylight and views from their buildings. Designers increasingly need to understand the basics of daylight

 in order to deliver. However, daylighting can come with

risk of glare and thermal discomfort in office space, which also needs to be managed to satisfy occupants.

This presentation will provide a primer on daylighting along with guidance on how dynamic glazing can help deliver proper daylight.

**Pic (1) break area of workplace using dynamic glazimg**

### 1.5- green area in workplace:

Plants are the most successful strategies within office design as they reduce stress, contribute to physical health, enhance performance and productivity.
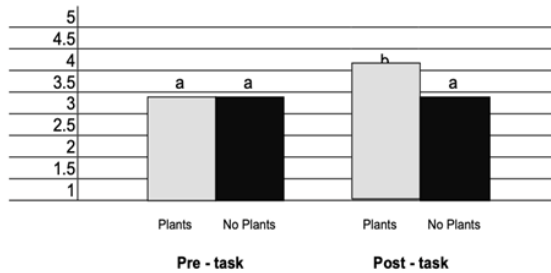


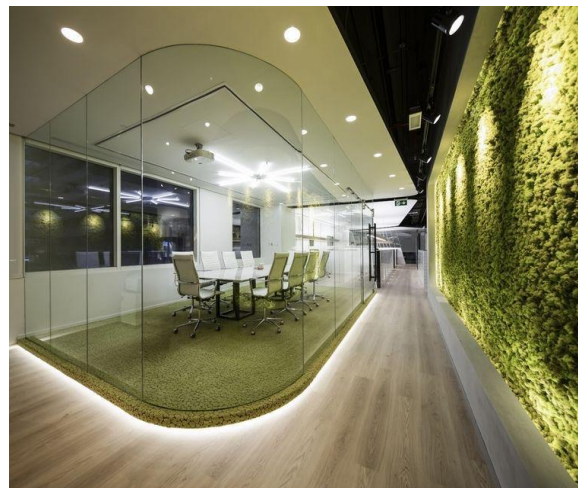**Pic (2) green walls in corridor of workplace**



**Fig.(3) Plants are one of the most successful strategies within office design as they reduce stress, contribute to physical health, enhance performance and productivity**

As Man is exposed to different levels of noise and air pollutants that harm his health, so green spaces came to help maintain his health by providing clean air, maintaining coolness to isolate heat and maintaining peace and psychological balance to transfer an important part of nature as a green space from outside to inside.

The green wall consists of carefully selected plants to purify the air such as spathyllum, ivy, three types of ferns. so, some considerations must be taken in implementing the living wall system
 as:

• select the right types of plants for the office design.

• When installing the green wall inside the spaces, the direction and quantity of light must be considered, as it is preferable to direct the light from top to bottom, to ensure the good growth of plants.

• Determine the appropriate irrigation systems for plants.

• Choosing the appropriate environment for plant growth in terms of food, light quantity and irrigation method for its sustainability.

• Providing trained labor during installation and maintenance to ensure the sustainability of the plants in the design.

**Types of living wall system:**

There are many systems used to implement Living walls in the interior space, according to the specific data, for their systems and growth methods.

| Species of Living wall system | Biological filtration system | Agricultural Container System | Climbing plant system |
|---|---|---|---|
| Definition |  The wall is designed for the purpose of purifying the air in the interior spaces. It also acts as a thermostat. It depends on the hydroponics system that does not depend mainly on the soil, where the plant is fed with water rich in minerals. The natural photosynthesis process of plants purifies the air that is drawn in through systems that distribute the air throughout the space. |  It depends on agricultural containers within the wall to be planted with plants, considering the live loads later for the plants growth. This system requires a special irrigation system and a maintenance method to follow up. |  It is a system divided into two types: without a supporting structure, and it depends on the type of climbing plants, and the second type is the presence of a supporting structure through which the plants are climbed. |
| Disadvantages | -high cost | - It requires constant maintenance. -Soil change. | -Tree branches affect the structure of the space wall as a result of direct adhesion between plants and walls. |
| Advantages | -Prefabricated off-site. -many choices of plants. | -Variety of plants choices. -Can be replaced for different types in a short time and easily way. | -Easy to install -Choose many kinds of plants -saves economically |

**Table(1) illustrate types of living wall system**

## second- Concept of healthy office spaces:

over the past few decades, Definitions of a healthy workplace have evolved, Where the World Health Organization defines a healthy workplace as, "a place where everyone works together to achieve an agreed vision for the health and well-being of workers and the surrounding community, that provides all members with physical, psychological, social, and organizational conditions that protect and promote health, safety and sustainable work space, It enables managers and employees to increase control over and improve their health, and to become more active, positive and contented. The workplace has a significant impact on its users, as its design affects the health, well-being and productivity of its occupants, and despite of the negative effects of the Corona virus, it has brought about a positive change. The focus has shifted heavily on people and health in the office space  and deepening the understanding of how health and well-being can be supported in workplace design while taking advantage of technical advances, and an increasing awareness that there is a difference between harmless work environments and environments that positively encourage health and well-being and productivity.

Pic (3) the main principles of healthy office workspace

### 2.1- decrease stress and tension:

They traded blank walls and artificial furnishings for a design that connected people with

nature through potted plants, furnishings made from natural materials, and a colorful wall mural of plants. An absence of greenery both within the workspace and in the immediate outdoor environment was associated with higher levels of employee stress. The result, A significant decrease in stress and aggressive behavior among patients.

Pic (4) workplace connecting accupants with nature – headquarters architecture company in sao paulo

Not only did the results of this study give us a glimpse of the power of a nature connection, it showed that indirect or representational forms have an impact too.

It was found that workers who had a window that afforded a view of a nature scene recovered from low -level stress at a much quicker rate than those only had a blank wall view.
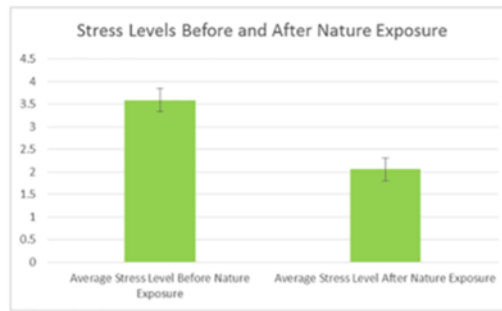
**Fig.(4) the graph depicts the average stress level of the individual before and after their nature exposer**

## 2.2- Creativity, productivity & concentration:

The results showed that office environments incorporating natural elements such as internal green spaces, natural light and an abundance of plants ensure higher levels of employee creativity, motivation, and wellbeing. Nature views: Viewing external nature scenes from the office space had a positive impact on workers' productivity. A seminal 2015 study undertaken by professor of organizational psycology and health sir cary cooper surveyed a sample of 3600 office workers across Europe and the middle-east , we found that for those working in environments that incorporate these natural elements, such as daylight and live plants, reported levels of creativity are 15% higher than the levels reported by those who work in environments devoid of nature Greenery in the office, such as plants and green walls, was associated with higher levels of creativity.



**Pic (5) meeting table work- space**

## 2.3-Motivation & wellbeing:

 when people were connected to nature in both their internal and external environment, they reported much greater levels of well-being Workers in office environments with greenery and sunlight reported a 15% higher level of wellbeing. This study undertaken by professor of organizational psycology and health sir cary cooper, surveyed across Europe and the middle east.

This point emphasizes the impact of nature on our cognitive capabilities, suggesting that by providing nature contact within the workspace, organizations can ensure consistent levels of job performance within their workforce.



**Pic (6) break-area , meditation space**

## 2.4- Psychological Wellbeing:

In an era filled with high-stress jobs and technology fatigue, recharge rooms are a growing trend in workplace wellness programs. a quiet room for focused bursts of concentration and productivity, as a chill- out meditation space or even a games area (break-area), recharge rooms are somewhere for workers to recharge their batteries during the workday.

## 2.5-Implementing Biophilic office Design:

Biophilic design takes this architectural concept into interiors that not only respect the difficulties toward the world but also actively contribute user wellness mentally and physically, By rethinking office design in this way, there is scope to improve staff happiness, productivity, and levels of mental wellbeing in the workplace, ultimately creating a scenario where both the company and employees prosper.

A method of designing places in which we live and work in such a way that satisfies our deep and fundamental need to relate to nature which called biophilic design .

the positive benefits of environmental design in supporting multiple organizational outcomes, including well-being, productivity, and creativity.

You can create office space that are imbued with positive emotional experiences.

If your office has limited natural light, harsh halogen ceiling bulbs, noise pollution from outside, poor air quality due to the traffic below and a severe lack of plants there is every chance of it having a negative impact on you and your co- workers' performance.

Well executed biophilic design therefore avoids dissonance between the visual, sonic, tactile, and olfactory by aligning behind a consistent, natural approach that is defined upfront at the start of the project and then delivered in every details.

Our findings emphasize the dramatic impact that even simple changes to incorporate nature in the work-space can have ? on how employees feel when they work, and how happy, creative, and productive they feel in work area .

| | |
|---|---|
| **INDOOR ENVIRONMENT QUALITY** | • Indoor Environment Quality include : <br> • Ensure high quality indoor air by meeting or exceeding ASHRAE 62-1999 as a basis of design. <br> • Ensure thermal comfort by meeting or exceeding ASHRAE 55-1992 as a basis of design. <br> • Provide building occupants access to daylight, views and operable windows where appropriate. <br> • Provide user controls for airflow, temperature, light (integrated with daylighting - see also Energy section). <br> • Provide carbon dioxide monitoring system to provide feedback on space ventilation performance. <br> • Install permanent entryway systems (e.g., grates) to trap dirt and particulates. <br> • Specify low VOC / low toxic finishes and materials, such as Green Seal-certified paints; composite wood and agrifiber products with no added urea-formaldehyde resins; carpet systems certified |

| | |
|---|---|
| | by Carpet & Rug Institute Green Label Program; adhesives meeting South Coast Air Quality Management District guidelines; flooring, ceiling wall covering, paints and other interior finishes and materials meeting Washington State indoor air quality guidelines.<br>• plants combined with dedicated air purifiers to improve indoor air quality (IAQ) to reduce  pollutant particle counts and remove other pollutants, helping to reduce allergies and promote cognitive function. |
| **INDIRECT BIOPHILIA** | using elements that are merely representational—still holds a lot of benefits like direct biophilia (natural green areas). |
| **LEED MATERIAL** | efficient use of  leed Material Resources include :<br><br>• Specify materials free from ozone depleting substances.<br>• Specify materials free from toxic chemicals .<br>• Key materials to avoid include mercury (switching equipment), arsenic (pressure treated wood), urea formaldehyde (engineered wood), and asbestos, which are so harmful on humsn being health.<br>• Specify materials and products that are:<br><br>1-Recycled (preferably with high post consumer content), reused, remanufactured or from rapidly renewing sustainable sources.<br><br>2- Sustainably  harvested  (e.g.,specify FSC  certified  wood products).<br>3-          Obtained          from          local          sources.<br>4-          Low          in          embodied          energy.<br>5-                                                                          Durable.<br>6-Low    in    VOC    and/or    other    chemical    emission.<br>7- Low maintenance and not require in toxic materials to maintain and /or operate .<br><br> 8-Easily reusable, recyclable . |
| **LEED ENERGY (LIGHTING)** | Strategies for Energy and Environment include :<br><br>• Design for appropriate daylighting strategies that reduce heat gain and control glare and  light contrast.<br>• Specify efficient lighting suitable for office space.<br>• Specify user controls of lighting  integrated with daylighting.<br><br>follows the body's natural rhythm can help improve productivity by day . Lighting can essentially be used to skew relaxation or energy in your favor, it's just a matter of using the right hue at the right time. Fill  your office  with  natural light  whenever possible, |

| | |
|---|---|
| | especially first thing in the morning, workers who reported working in environments that were light and spacious had higher levels of well-being, motivation, productivity, and creativity. Light and spacious workspaces: Those who report that their work environment provides a sense of light and space report greater levels of well-being in comparison to those who do not feel that their work environment is light and spacious. |
| **INDOOR ENVIRONMENT QUALITY (SOUND QUALITY)** | Strategies for Indoor Environment Quality include : <br><br> • Specify materials, products, mechanical systems and design features to attenuate sound and vibration,can easily recreate these positive sensations of calm in a office or reception by using nature playlists. It is a small detail but one that has an undeniable impact on our experience. |
| **COLOR SCHEME** | Color one of the most influencers of mood and is certainly the one that most people will connect with first upon arrival. While bright tones color can suggest energy, neutrals will help offices feel grounded in nature. For instance, viewing green color from dark to medium can lower the heart rate and blood pressure to alleviate stress, whereas orangey, weakly yellowed, or brownish greens, which are typically found in stressed or dying vegetation, are the least desired. In addition, red color can support human mentality and attention ,necessary for cognitively intense tasks, blue color and some medium greens can support human mentality for tasks requiring creativity. |

**Table (2) illustrate impliminting office workspace**

providing workers with an environment that they are comfortable and happy within is likely to go a long way in increasing well-being and productivity, as well as contributing to the retention of staff and reducing employee turnover.

## Third- Workplaces design after the spread of covid-19 virus:

The new Corona virus pandemic imposed social distancing between people according to the instructions of the World Health Organization, so the implementation of everything remotely has become the prevailing way of dealing between individuals, including workplaces, and with the continuous technological development, this crisis has been exploited to become a major turning point in the design of administrative buildings and workplaces in the future , Since the main force for most of the new innovations has always been the search for solutions that keep pace with the aspirations of society, so without a doubt, in light of these exceptional circumstances in which the world is living, designers need new creative solutions to design their workplaces to provide a work environment that enhances the health, well-being and productivity of its occupants. So, office building used Internet and smart building technologies

to enable office environment with healthy, comfortable, and attractive mood. Now, the pandemic is rapidly accelerating this trend globaly .

To the extent that people yearn to go back to their workplace, they are faced with the enormous unknowns of current reality. Several questions are on our minds, are construction areas sterilized as frequently as needed? Has indoor air quality been improved? How can spacing be ensured? These are just a few of many questions are thinking about. When companies start making plans to reopen, they are given a difficult task - restoring confidence in the environmental building for each individual user. So, the health and well-being of the occupants, including a safe and healthy work environment, is critical to the success of the business.

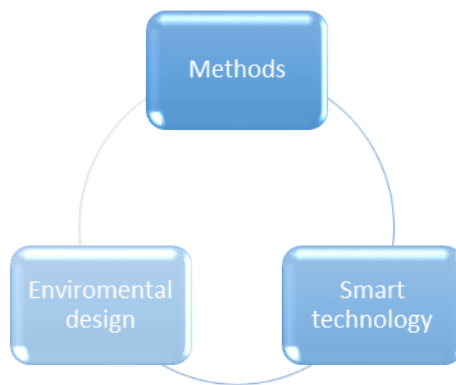Fifth Methods used to reduce infection transmission of covid-19 virus in administrative buildings:



**Fig. (5) illustrate methods used in office building to reduce covid-19 virus infection**

**3-1-Smart technology:**

New technologies can create additional difficulties, but they can reduce the need for traditional physical spaces through virtual digital spaces that can be accessed from smart devices, The increasing reliance on digital technologies in the  environmental work may continue long after the pandemic and  affects design, through artificial intelligence as touch technologies ,voice and facial recognition technology can impact on office design , the post-pandemic verified the importance
 of looking forward to innovations in

building technologies Relying on smart technologies at work represented in the widespread use of touchless automated technologies – such as voice-operated elevators Instead of pressing many buttons, hands-free light switches, and mobile controlled room entryin public places to mitigate infection. In addition to ventilation systems to remove polluted air. The use of antibacterial materials in forms that can be easily disinfected has also been adopted.

**Pic (7) hands-free light switches by using sound sensors control**



**Pic (8) voice- operated elevators**



**Pic (9) mobile controlled office room lighting**

Intensifying Touchless technology Although there is an additional cost, it will be a convenience and will pay off for developers who integrate it into their office buildings.



**Pic (10) mobile controlled office room touchless doors**
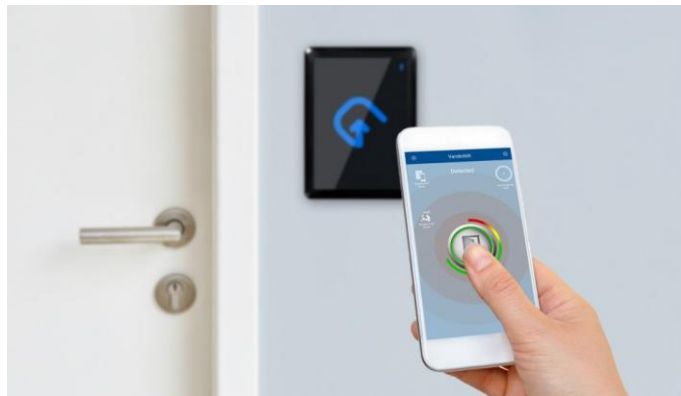
Using virtual reality technology in office workspace, Creating environments that resemble real environments or may be completely imaginary by using computer, and the user can co-exist in them and deal with them sensually, and the purpose of it is to design human environments with high efficiency and reshape the lifestyle to satisfy the desires of users for these technologies, and in another definition" it is a more specific form a virtual environment It provides the user with a feeling of being in it, and presence is the feeling of the user being occupied in the virtual environment".

**Pic (11) virtual training room, in office workspace**



**Pic (12) virtual meeting room, in office workspace**

An applied example of using virtual reality in workplaces to limit gatherings in one room, virtual meeting room, and virtual lecture and training rooms to prevent employees from gathering in one place to limit the spread of the epidemic.

### 3-2-Enviromental office design:

Returning to nature with its healing effects is done through "refocusing on green spaces where we need a physical interaction with living plants. In addition to the importance of better air quality as it is necessary to take an approach to improving health through strategies as increasing natural light, improve natural ventilation bypass random window openings and can be designed to achieve ventilation strategies that reduce the risk of infectious air from the virus, And also by using intensive ventilation systems that purify the air even more, or even add ultraviolet lamps to disinfect the office even more deeply.



**Pic (13) office workspace interact with living plants and natural lighting**

Research and expert opinions suggest that "the most unfavorable microorganism for survival" is when relative humidity is between 40% and 60%, a somewhat higher range than in many buildings today, while the UV spectrum Entire UV can kill or inactivate microorganisms, UV-C energy at wavelengths from 200 to 280 nanometer provides as the most bactericidal effect.

### 3-3-Natural & antimicrobial materials:

Choosing healthy building materials have ability to clean and sterilize easily, using antimicrobial fabrics and materials, by adding things
 like copper fittings, and fabrics that keep fewer germs on.
designers are fundamentally responsible for providing office
 environment that focuses on stress reduction, safety, well being, and high-quality indoor spaces for occupants. The first step in creating a building that does no harm is to start with a selection of materials that supports healthy environments and allows occupants to work and be productive.

scientific studies recently seen the positive impact of design elements such as daylighting ,nature views and the effects of materials specified beyond durability, ease of cleaning, and appearance. examples of natural antimicrobial materials used on flooring, Linoleum is made from all-natural biodegradable materials and typically lasts between 20 and 40 years. It is stained resistant, fire retardant, antimicrobial, and hypoallergenic. Rubber is non-toxic , durable, resilient, and does not release noxious fumes in the event of a fire, lasts more than 20 years.



**Pic (14) natural antimicrobial flooring material -  Linoleum**



**Pic (15) natural antimicrobial flooring material -  Rubber**

It is also soft material underfoot, making it an ideal option for a space where users are on their feet all day. Some natural materilas used in furniture as polyester (recommended product: Carnegie's Xorel). Although polyester can be costly, Xorel's options are low-VOC, antibacterial, and free of PVC, plasticizers, heavy metals, chlorine, and ozone-depleting chemicals. Polyester can also be cleaned with strong chemicals without negatively affecting the material, color, or texture. and polyurethane is highly resilient, flexible , and durable. Not only is it PVC-free, breathable, stain resistant, and durable against strong cleaning agents, it is also burns safely.

Natural painting as Low- or no-VOC paints contain less than five grams of VOCs per liter of paint. They also produce no odor, which makes it possible to paint in an occupied space. There is little to no impact on air quality, and they are less likely to cause allergy issues; however, they are more costly, and colors may be limited. No-VOC paints are also less durable than low-VOC or standard paints . In the evolution of work-place design, the typical workspace will no longer play a role in emitting asthmagens, carcinogens, or other harmful toxins into healthy environment.

**3-4-Social distancing strategy:**
Following the social distancing strategy by designing partion between individuals who use the administrative space, by designing the interior office units and spaces to make workers feel safe, by following the procedures for converting congestion points, And the design of the office unit filled with partion.

"Arup" has developed digital tools to help building owners think about what changes they should make. One, called Mass Motion, which tracks how people move within certain
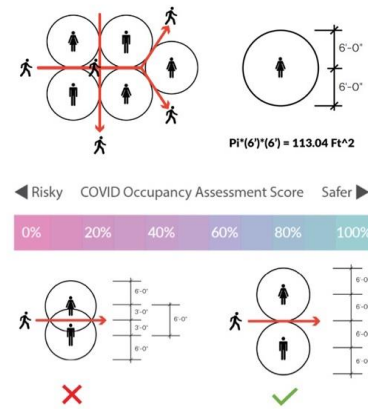


**Pic (16) social distancing to reduce covid-19 virus**

spaces in office space, and can be used to measure social distancing and to identify people who may be sick.

## Fourth-Health organization recommendations for office workplace:

Enforce strict planning guidelines that prioritize air quality and public health; Where the design of offices must be reconsidered to provide good ventilation systems, obtain clean air, and allow natural ventilation. Steps should be taken to improve ventilation in the building by increasing the total air flow to the occupied spaces, And using of natural ventilation to increase the attenuation of outdoor air to indoor air.

The use of germicidal ultraviolet radiation is also used as a complementary method to inactivate potential airborne virus in room air in occupied spaces, according to industry guidelines. The importance of linking the office building with nature, as it has been proven that, incorporating some form outdoor space improves physical and mental health, And the need to follow new technology by using techniques such as anti-microbial finishing and filtration systems to reduce virus between accupants. The World Health Organization confirmed on the importance of social distancing, so clear requirements must be established regarding social distancing, clean air and hygienic practices in workplaces where even small adjustments can lead to a significant reduction in infection.

## Fifth-case study second home coworking, lisbon, Portugal:

the 'Second Home' office building has presented aspects of Environmental (Biophilia) design perfectly, because the building included most of the natural elements such as the large amount of plants, the presence of water.

it treats office spaces quite differently from other office environments where accupants are used to spend most of their time every day. They design in which thousands of plants grow directly out of the floor, because the firm is enthusiastic to promote Biophilia, which essentially means humanity's inherent love of nature.

envirement design plays with the human biological affinity to connect with nature, creating environments with higher levels of creativity and well-being. At the same time, the plants in Second Home Lisbon act as a noise reducer and space divider, all for improving air quality, good ventilation improves health and thus

productivity. Improving indoor air quality contributes to reducing risks and the spread of



**Pic (17) workstation -Second home office space**



**Pic (18) using of plants to purify indoor air and noise reducer**

indoor pollutants in the office building. The World Health Organization has stated that clean air needs to be provided in all workplaces, where the lung and respiratory diseases caused by poor indoor air quality and recommended ,

"increasing the ventilation rate through natural ventilation or Artificial ventilation preferably without air recirculation".we evolved in environments full of seasonality, plants, trees, natural light, and variations in temperature, and all the evidence suggests that being in environments that reflect our natural world is better for our well-being, so good for productivity and creativity and this explained  Rohan Silva, co-founder and CEO of Second Home.
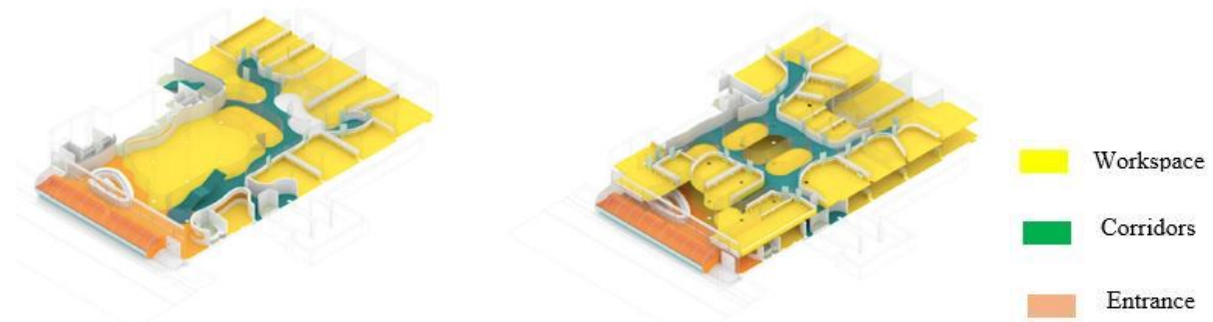


**Fig. (6) ground and first floor with analyzing color, the percentage of every workspace**

Using natural and antimicrobial materials, organic furniture that have been managed or extensively improved, workspace tops  covered with  wooden planks and granite.

Fig. (6) shows the ground floor and first-floor plans of the building; the yellow areas are the workspaces, and the green are the corridors; all the interior walls are curvilinear.

 rest areas  was surrounded by many green plants where occupants can read or chat with each other. A number of the curved plastic materials form small office spaces , All the offices are both transparent and soundproof, through the insulating power of the acrylic walls. Unlike glass, which reflects sounds, it works perfectly to absorb sounds of different types and thus add to the occupants' acoustic comfort. the existence



**Pic (19) acrylic curvilinear partition form small workspaces**

of many plants and greenery features was one of the most important things that made them feel in touch with nature indoor and helped to refresh the air inside the building which in turn helped to maintain the workers' health and to reduce infection of virus.

the open-plan design for the office space, with the transparent walls, encouraged communication between accupants , and increased the interaction as well . first , normally observes standard comfort, safety and health guidelines for thermal comfort, acoustics, light, and ventilation. The second identifies that people choose to have a degree of 'personal control' over their conditions.

| | |
|---|---|
| **Office layout** | • Acrylic partitions with curvilinear shapes to transmit natural light from the windows.<br>• increase the accupants interaction .<br>• Encouraged communication. |
| **Air quality** | • Controlled by sensors, based on plants need ,most of the air in the office space was fresh from presence of plants inside the space.<br>• purify the air inside the space continuously, to keep office space free from the presence of the virus, and this happens by simulating nature by changing the levels of air flow, whether temperature or humidity. |
| **Thermal environment** | • The building was highly exposed to sunlight, with no shading elements, so the temperature became hotter in the summer at work ,but presence of huge amount of plants creating balance with humidity in office place. |
| **Lighting environment** | • The building was very exposed to daylight, by designing large spaces of windows to connect directly with nature. |
| **Acoustic environment** | • Using insulating acrylic material, that can absorb different sounds.<br>• Using plants as natural insulating system for sounds, noise reducer. |
| **Automatic sensors** | • some automatic sensors are adding for shading, controlling the temperature , humidity and regulating the amount of lighting, would be more satisfied for workers and their health . |

**Table (3) illustrate comfort standard used in office space for accupants to reduce spread of covid-19 from design point of view**

working in  a high levels of comfort  environment affected  workers productivity and performance. This healthy environment reduced issues of absenteeism as well as presentism. Second Home is simply designed to support creativity and effectiveness.

SWOT analysis for the case study office building indicating its strengths, weaknesses, opportunities, and threats.

| | **Strengths** | **Weaknesses** |
|---|---|---|
| **SWOT ANALYSIS** | 1.Using several of Environmental Biophilia design applications that affect the occupants' with positive productivity, based on the interviews, such as:<br><br>• The visual connection with nature, by adding many sorts of plants.<br>• Use of natural materials.<br>• organic forms,shapes and patterns.<br><br>2.Most of the workers admit that the presence of indoor nature affected their wellness positively. | 1. plants used to help the Indoor improvement with environmental quality had not been studied; instead most of plants chosen for aesthetic reasons.<br><br>2. The workers said that the offices had no privacy between office rooms because of the fully transparent walls.<br><br>3. Some of the rooms which were directly exposed to the sun were not occupied in the summertime because no shading elements had been incorporated in the office building. |
| | **Opportunities** | **Threats** |
| | 1.'Second Home' is one of the few office buildings that started the concept of indoor nature to office buildings.<br><br>2. this type of building was agreed by workers as  their health was affected, wellbeing, creativity all in a positive way, which in turn affected their productivity. | 1. The lack of smart technology inside the office building.<br><br>2. The Environmental design was not fully integrated in the context of smart application. |

**Table (4) swot analysis for the case study office space ,"second home" company**

'Second Home' company is a case study of the influence Environmental design features in office space . In this case study three main points clearly emerged from the occupants' responses. The first one is that using Environmental design as an aesthetic value is not enough to attain the highest environment quality or even the occupants' wants in their office. The second point is needing to add technological features as well . Workers want to control the quality of the indoor environment in such matters as acoustic comfort, thermal comfort ,air quality, lighting, and suitable spatial layout of their offices as Environmental buildings that use advanced technology depend on (the idea of integration between different systems) through the participation of the various elements and systems of the building in order to increase the efficiency of the building and achieve the maximum possible comfort and safety for the users of the administrative building, as the building is not determined by the extent of the advanced technologies used in The building systems are each separately, but they are established through the integration of different systems and this is the difference between the traditional administrative building and the technical environmental administrative building that provides a healthy work environment that meets the different needs of users, which increases their production capacity.third one using Natural & antimicrobial materials in flooring , painting , eco furniture to reflect positively on accupants of office space. As a result, All the environmental (Biophilic) studies present evidence of indoor environmental quality affects occupants' health, wellbeing and reduce spreed of virus and in turn increase of productivity.

## Sixth -Research Result:

Inspite of negative effects of covid-19 pandemic, it has brought about a positive change. The focus has shifted more heavily to people and health in office space and a deeper understanding of how health and well-being can be supported in workplace design with the benefit of technological advances, and an increasing awareness that there is a difference between harmless work environments and environments that actively encourage Positive for health and well-being and stimulates productivity.

1- Connecting the natural environment with the office building environment supported by smart technologies and using of the Internet to benefit from the relationship with nature and its continuity in inspiring innovative smart response systems in buildings, as the use of smart strategies and technologies have a direct impact on building and the preservation of the environment by modifying and operating ventilation systems as well as achieving comfort and luxury for building users.

2- Social distancing by means of (interior design, which lies in modifying the layout of the interior furniture of offices, as it allows workers to modify the office space to be ready for COVID).

3- Maintaining air quality by using healthy and anti-microbial materials and taking steps to improve building ventilation and maintain public health.

4- Achieves environmental (biophilic) design by using green walls a solution that includes basic standards for human comfort, psychological and visual comfort, as it transfers nature inside and works to reduce psychological stress, increase interaction with others, enhance happiness,

manage pain and anxiety, improve health through the influence of the mind on the body, raise the status moods.

As a result, this research can present building over view, both physical and psychological; the impact of the indoor environment on the occupants' wellness and conveys the importance of understanding environmental design application , Rapid digital transformation and virtual reality, its effects on occupants to reduce infection of covid -19 virus.

## Seventh -Research Recommendations:

### 1-State recommendation:

Conducting awareness seminars on how to take precautionary measures to limit the spread of any disease in the workplace.

### 2-scientific and reaserch recommendation:

Encouraging and directing scientific research directed at environmental design (biophilia) and the benefits of the green wall functionally, psychologically, and visually in administrative spaces to improve the health of the occupants of the space.

### 3-interior designers recommendation:

interior designers responsibility is investigating the materials that we specify in office building, and to urge manufacturers to offer more natural antibacterial material options that will help us as an industry to do no harm.

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