

Adaptive Design

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Adaptive Design: Embracing the Nature

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Introduction

According to World Health Organization, on October, 22nd 2021, there have been 242,248,657 confirmed COVID-19 cases globally. Meanwhile, in Indonesia, the cumulative cases reach 4.238.594 per October 22nd, 2021 (World Health Organization, 2021b). Currently, we are entering the phase that offers no choice except adapting all spheres of life. “The new normal” forces people to live in a COVID-19 prevention mode. Wearing a mask properly, maintaining a minimum 1-meter distance, and washing hands properly are preventive measures that we will do continuously in the future.

History has shown that previous contagious diseases impacted the built environment (Ara Dilshad Shangi et al., 2020). It is mainly related to the space’s existence as a container of human activity. The built environment as an architectural product has a significant role in contagious diseases matter. The space accommodates the human activity that whom in some cases also rules as a carrier. For airborne diseases, the indoor air quality may contribute to the prevention action or worsen it. World Health Organization has declared that the SARS-CoV-2 virus can transmit through the air, thus categorizing it as one of the airborne diseases. World Health Organization states that aerosols infectious agent causes airborne disease (World Health Organization, 2020). It is a serious matter as the airborne particle could be inhaled by other building users when it remains suspended in the air and travels to the other part of the building (Ather et al., 2021). Therefore, there is a need to formulate a COVID-19 adaptive design. The adaptive built environment contributes to the preventive measures (Ara Dilshad Shangi et al., 2020) along with other prevention procedures. Amongst other adaptive design ideas, this paper offers a discussion about adaptive design by embracing nature.

A COVID-19 Adaptive Design: Literature Review

Air quality is one of the healthy built environment components besides light, water, waste disposal, cleanliness, density, thermal comfort, and noise (Ho et al., 2004). The poor air

quality leads to the user health problem (Ara Dilshad Shangi et al., 2020; Cincinelli & Martellini, 2017; Ho et al., 2004; Jones, 1999; Megahed & Ghoneim, 2021) particularly respiratory disease (Ho et al., 2004; Megahed & Ghoneim, 2021). In a COVID-19 situation, this is the main reason why the building should modify the building system to improve the indoor air quality. Many researchers have found that COVID-19 transmission often occurs indoor (Lelieveld et al., 2020; Qian et al., 2021; Senatore et al., 2021). An adequate ventilation system is able to circulate the air that can dilute the infectious aerosols from the building (Megahed & Ghoneim, 2021).

Accordingly, World Health Organization has published the roadmap to improve and ensure good indoor ventilation in the context of COVID-19 to reduce disease transmission. This roadmap offers the strategies to achieve a proper ventilation system for a health care setting, a non-residential setting, and a residential setting. It includes both natural and mechanical ventilation. The recommendation is to provide a cross-ventilation system rather than single-side ventilation for all building types (World Health Organization, 2021a) to ensure air circulation.

The explanation above has shown the role of indoor air quality in preventing the spread of COVID-19. A ventilation system is one way to ensure indoor air quality. Hence, the building has to modify the ventilation system or provide it in case it is not available in the existing building. This intervention produces a COVID-19 adaptive design. As far as the author knows, two publications discuss COVID-19 adaptive design so far. Both articles discuss the theoretical framework of building design that leads to adaptive design. Those researches aim to create an adaptive built environment that mitigates COVID-19 transmission.

The ventilation system is one solution to the indoor air quality problem, however, one should consider it as the source of contamination and exposure (Megahed & Ghoneim, 2021). They also point out the role of engineering that could be used as a tool in re-evaluating the building design to prevent disease transmission and provide a healthy indoor environment (Megahed & Ghoneim, 2021). Considering several fields of engineering, Megahed & Ghoneim offers human-centered designs that collaborate those fields to get optimum result (Megahed & Ghoneim, 2021). Image 1 shows a conceptual model to mitigate disease transmission indoors. Along with public health intervention, engineering and construction are used to control indoor air quality. The architect must ensure the implementation of passive design strategies to avoid the spread of infection in the indoor environment. They suggest optimum airflow, building

orientation, openings design, and spatial sequencing and configuration as passive design strategies to be optimized further.

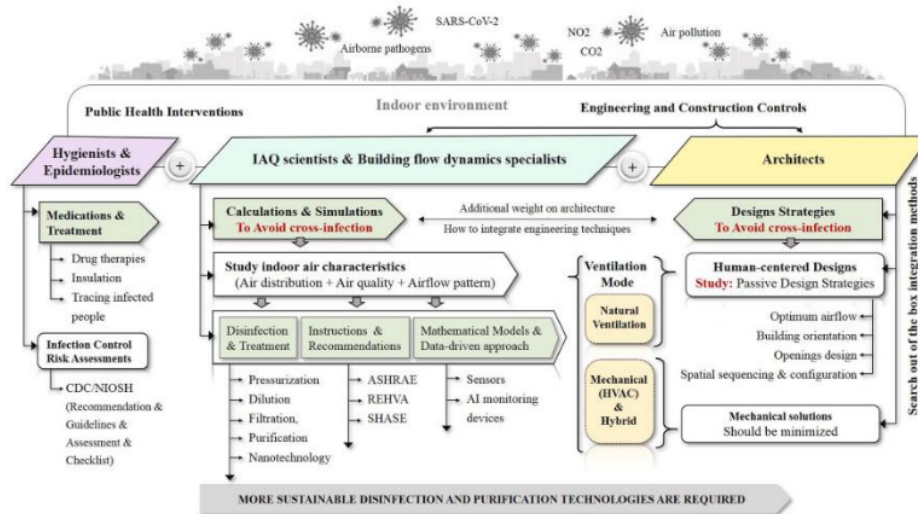


Image 1. The conceptual model in mitigating disease transmission indoor
Source: Megahed & Ghoneim, 2021

While the previous study focuses on an engineering intervention, the second study offers adjustments in the building’s spatial planning. Ara Dilshad Shangi et al suggest adaptive measures for the building to create and maintain hygiene based on the response of the survey conducted (Ara Dilshad Shangi et al., 2020). The suggested adaptive measures are shown in table 1.

Table 1. List of Adaptive Measure and the Impact

Adaptive Measures	Impact
Modification of the entry area with washing facilities	Hygiene level can be maintained at the earliest time
Washing area at the very front of the built form	Keep away germs and viruses
Changing the location or zoning of the washing area	Way of cleaning themselves berfore entering the pther parts of the house
Multi-functional space	Function as workspace or any other space in terms of need
Provision of modification of built form	Easy to turn into isolation space in case of emergency

Providing relaxation space (verandah, terrace, roof, small green corner of house)	Improve both physical and mental health
Sensor based fixtures or devices	Improving the common sahring building services to avoid the touch of switch, button, dooknobs, surface, etc
Placement of wash basin and hand sanitizer	Keep the built environment safe from the contagius diseases
Defensive layers of hygiene precaution	Start from the main entry and end at the washing area of a house

Source: (Ara Dilshad Shangi et al., 2020)

The idea of their architectural suggestion is to provide hygiene by modifying the spatial planning, provision an isolation space, adding a washing area, and the most interesting this is providing a relaxation space. The conducted survey found that the respondents agree to have a relaxation space such as a garden, a small green corner, or even a roof (Ara Dilshad Shangi et al., 2020). These spaces are needed to maintain the connection with nature as during the pandemic humans are limited to spending time outdoors or in nature. The result of this research reveals the role of nature in COVID-19 adaptive design. Maintaining a connection with nature establishes and improves physical and mental health.

Adaptive Design: Embracing the Nature

Nature is believed to have healing power. The studies have stated that it can heal and improve mental health (Huelat, 2008; Zhong et al., 2021) during the pandemic (Soga et al., 2021). Travelling is one way to connect humans and nature that offer psychotherapeutic healing to the people (Bhalla et al., 2021). However, since restricted human mobilization during the pandemic, the existence of nature such as green spaces or green views can decrease mental health issues (Soga et al., 2021).

The relationship between nature and architecture has existed for a long time ago. It appears in Hanging Garden of Babylon, suburban villas such as in *Villa de Castello*, a private garden in apartments, a Falling-water House as one of Frank Lloyd Wright's masterpieces, Mies van der Rohe's Farnsworth House, etc. (Zhong et al., 2021). Thus, it is not a new thing. In fact, from early civilization until modern life, architecture has been embedded with nature in various forms. During the pandemic, the physical distancing as one COVID-19 prevention impacts human mental health (Galea et al., 2020). Therefore, there is a need to ensure nature's

existence in a COVID-19 adaptive design along with the improvement in indoor air quality as it offers healing quality.

How does the architect embrace nature in its design? There are seven patterns in implementing it in the space (Browning & Ryan, 2020) which are

1. Providing visual connection;
2. Providing stimuli (auditory, tactile, olfactory, and so on) that create relation to the nature;
3. Providing non-rhythmic sensory stimuli – unpredicted stimuli that happens in the nature;
4. Providing the variety of temperature that replicates the nature thermal condition;
5. Providing water element;
6. Providing varying light and shadow;
7. Providing natural system experience.

To sum up, the basic concept of embracing nature in design is providing stimuli that has connection with nature. It could be sight stimuli, auditory, tactile, and olfactory. The idea of embracing nature in an architectural design opens the possibility of exploration and needs creativity. Based on the guideline above, nature implementation involves all human sensory systems that are olfactory, auditory, visual, gustatory, and somatosensory. It can be a form of view towards the landscape, the existence of a pond, the sound of the wind, the smell of ripe fruits on the tree, the light through the trees, and so on. As it varies, thus we will find many examples of embracing nature in the design. Some of it is below.

a. Islamic Traditional House

Islamic traditional house has an inner courtyard that functions as the heart of the house. Its existence is based on many considerations and related with several aspects such as religious, social, climatic, and functional factors (Dwidar & Sabry Abowardah, 2017). As many Arab cities are located in the dessert areas, where there is lacks of green space, it is necessary to have an inner courtyard in a residential or public buildings to provide thermal comfort (Dwidar & Sabry Abowardah, 2017). As a courtyard, it has natural qualities such as natural air, natural lighting, the plants and the trees, the water and so on. Basically, the existence of courtyard elements depends on the homeowner. However, generally, it consists of plants, water elements, benches, and some decorative

elements. It accommodates human activities mainly the recreation of a family members. In terms of embracing nature in the space, the inner courtyard has implemented several patterns which are described in table 2 below.



Image 2. Courtyard in Islamic Traditional House
Source: Wikipedia Common

Table 2. Nature in the Space's Pattern of Islamic Traditional House

Number	Patterns	Description
1	Providing visual connection	Watching the plants or the birds in the courtyard, the flower growth, or watching the animal feeds the young.
2	Providing stimuli	Hearing the birds chirping or the sound of leaves in the wind, smelling the flower, and touching the texture of stone or the water.
3	Providing non-rhythmic sensory stimuli	Having a connection with the courtyard and having a good feeling in the space.
4	Providing the variety of temperature	Feeling the air temperature changes day by day.
5	Presence of Water	Touching, hearing, or seeing the water in the courtyard.
6	Providing varying light and shadow	Having experienced different light and shadow in the courtyard that penetrates through the leaves.
7	Providing natural system experience	Having awareness of the natural processes in the different seasons, such as the fall cycle in the autumn or the spring cycle.

Source: Analysis

The courtyard in the Islamic Traditional House has seven patterns of “nature in the space.” It means the courtyard has “a nature quality” same as nature itself. The courtyard represents nature on a smaller scale. Another important thing is the existence of the inner courtyard allows the air circulation from and toward the interior. It will reduce the risk of disease transmission in the building.

b. Green School, Bali

Green School, Bali is one example of green concept building well-applied. The interesting thing about this school’s design is it is wall-less. Therefore, the connection between inside and outside the building is very strong. The openness in the school design also allows the students to move freely, go out of the building, or get into the building. The wall-less feature also allows the smooth air circulation in the building. Furthermore, the natural sunlight can penetrate the interior of the building. Hence, it can minimize the risk of disease exposure.



Image 3. Green School Bali building
Source: IBUKU

Table 3. Nature in the Space’s Pattern of Green School, Bali

Number	Patterns	Description
1	Providing visual connection	Watching the plants or the birds in the landscape, the flower growth, or watching the animal feeds the young.

2	Providing stimuli	Hearing the birds chirping or the sound of leaves in the wind, smelling the flower, and touching the texture of stone or the water.
3	Providing non-rhythmic sensory stimuli	Having a good feeling in the building and in the landscape.
4	Providing the variety of temperature	Feeling the air temperature changes day by day.
5	Presence of Water	N/A
6	Providing varying light and shadow	Having experience different light and shadow in the building.
7	Providing natural system experience	Having awareness of natural process in the different season, such as rice planting season

Source: Analysis

The nature in the spatial patterns of Green School Bali is applied in 6 patterns except the existence of water. The openness in the building allows the user to experience the nature surrounding. Therefore, the pattern expands to form the building's space into the landscape surrounding that enriches the natural quality of the building.

c. High Rise Apartment Building in Milan, Italy



Image 4. Apartment Building in Milan, Italy

Source: <https://www.detail-online.com/article/complete-facade-greening-high-rise-apartment-building-in-milan-16673/>

The third example is an apartment in Milan, Italy. The concept of the building is bring nature into daily life by planting trees in the balcony of each apartment's unit. By doing so, the apartment unit gains many advantages, such as reducing indoor temperature, filtering the direct sunlight, filtering the dust, producing more oxygen into indoors,

changing the carbon dioxide to be oxygen that circulated in the room, and filtering the noise. As the air circulation becomes the main concern in a COVID-19 adaptive design, this apartment's design allows fresh air produced by the trees circulates in the unit. Thus, it may reduce the risk of exposure. Meanwhile, the patterns of nature in the space is shown in table 4.

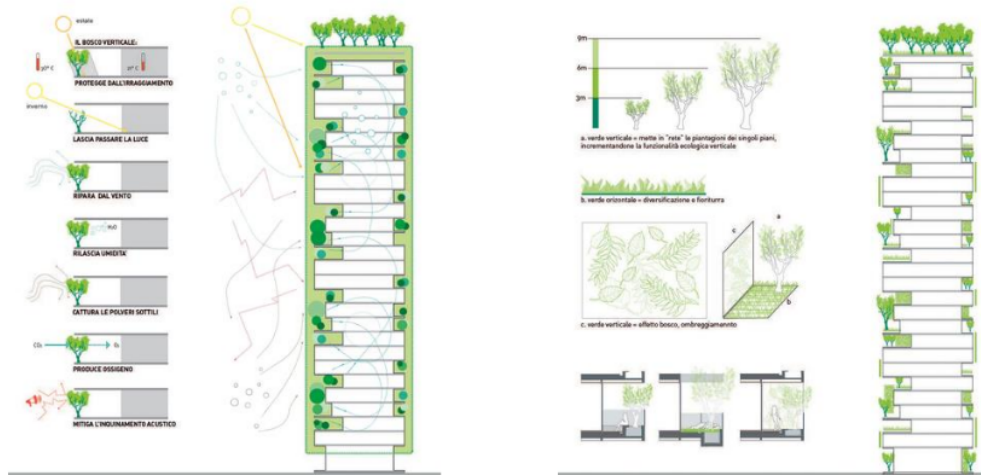


Image 5. The advantages of trees balcony in the apartment
 Source: <https://www.detail-online.com/article/complete-facade-greening-high-rise-apartment-building-in-milan-16673/>

Table 4. Nature in the Space's Pattern of Apartment Building in Milan, Italy

Number	Nature in the Space's Patterns	Description
1	Providing visual connection	Watching the plants, or the flower growth.
2	Providing stimuli	Hearing the birds chirping or the sound of leaves in the wind, smelling the flower, breathing fresh air and touching the texture of the leaves.
3	Providing non-rhythmic sensory stimuli	Having a good feeling in the space because more fresh air.
4	Providing the variety of temperature	Feeling the air temperature changes day by day.

5	Presence of Water	N/A
6	Providing varying light and shadow	Having experienced different light and shadow in the balcony that penetrates through the leaves.
7	Providing natural system experience	Having awareness of the natural processes in the different seasons, such as the fall cycle in the autumn or the spring cycle.

Source: Analysis

Conclusion: Lesson Learned

The three examples above have shown that the existence of nature in any form contributes to establishing connection either visual, non-visual, or natural systems. It will gain optimum benefit if the connection between inside and outside is available in the building. It could be a form of an inner courtyard, roof garden, or private garden. A COVID-19 adaptive design should cover the physical and mental aspects. The physical aspect is covered by spatial planning and engineering, while the mental aspect can be done by embracing nature in the building. At least, providing a small green corner in the house can impact the psychology of the user. However, it should bear in mind that other preventing modes have to be carried out for a better result. In terms of the built environment, ensuring a cross-ventilation system and added by the idea of embracing nature could be one alternative.

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