Application of Green Design based on Smart Living on Redesign Office of Notary in Malang, East Java

C Avida, T I W Primadani, H Kurniawati, S Chrysilia, I A Agustina
Interior Design Department, School of Design, Bina Nusantara University, Indonesia 11480
Corresponding author: christina.vida@binus.ac.id

Abstract. In the hustle of economic activity in modern urban lifestyle, require employees to work indoor from morning until evening. It could rise the stress level and affecting their work performance. This study aims to determine the basic aspects for redesigning a notary office interior with the green design concept and smart living features that support confidentiality and professionalism. This research methods used in this redesign are data collection, data analysis, synthesis phase, and design development. After conducting all stages of research, it is concluded that green-design with smart living concept planned for a notary office could bring a positive effect such as reduces global warming and employee’s stress level, this type of design can also stimulate visitors to apply the same concept in their residences.

Keywords: interior, green design, office of the notary, smart living

1. Introduction
Sustainable design, as a part of implementation in sustainable development, consider factors such as: physical objects; the built environment; and service facilities that comply with social, economic, and ecological principles as an integrated component for comprehensive sustainability. Sustainable development is a concept that properly needed for nowadays environmental issues without compromising the ability, that has a significant role in the field of construction and the built environment to contribute to the concept of sustainable design (AKTAS, 2013). Sustainable interior design is not just focusing on the aesthetic and ergonomics, but also pays attention to social, economic aspects and most importantly on the effects of its existence to surroundings environments.

Good interior design is becoming a necessity to increase employee's productivities in both manufacturing and services sector [1]. The interior design concept of a company’s office will be immensely helpful to show company’s character and condition and communicate a good image to visitors [2]. Interior design is the main way to brand concept that support Notary’s services quality. One of the general criteria that determine the quality of a service provider is physical evidence (tangible aspect) through physical appearance of service facilities and equipment [3].

The global issue that humanity faces this century are ways to balance development and improvement in people’s life while preserving natural resources as much possible. Incorporating eco-friendly concept will be an important matter for sustainability in building environment [4]. Three sustainable developmental pillars are ecology, social and economic. Socialization stage and the sustainable development implementation are needed to develope and adapt consistently with ecological, social and economic context in each setting [5]. According to Widyawati (2018),
sustainable development can be achieved if both the government and the private sector shows concern in planning and managing urban development, by repairing or reducing environmental damage without sacrificing the needs for economic development and social justice.

Green design or eco-design is a sustainable development movement that pays attention to environmental sustainability in a design that has been implemented starting from the planning stage, implementation and when the design is used. The concept of eco-design in buildings and interiors create a building that can optimize the role of natural resources to support human activities in it. Interior is the environmental object closest to human, a place where the dominant human activities direct-interface intensity takes place in a long time, thus interior space will be an important media in affecting the quality of human activities conducted in it [5]. By considering its sustainability, interior design can improve the quality of human life and remain important towards environmental sustainability.

A good interior design office is one factor to improve service quality. By delivering a message with its design that an office will provide a good service to its customer, it can lead to a level of customer trust and satisfaction with the service providers. One of the problems with the quality of notary services is the weakness in the physical dimensions of the office, namely the availability of comfortable rooms and minimal waiting rooms [3]. Physical evidence (tangibles), require re-arrangement of spatial layout to encourages employee morale and provides comfort for visitors. The other crucial factor is the office’s cleanliness for visitor's comfortability when having an appointment [3].

### 1.1 Global Warming

Global warming is a term that describe a long-term climate system since pre-industrial period (1850-1900) that tend to become warmer and show increasing of temperature level in global scope due to human activities, particularly because of fossil fuels combusting, that increases the level of heat-trapping greenhouse gases in the Earth's atmosphere [6]. Currently burning fossil fuels are still being carried out for power generation and vehicle fuel. According to Finahari (2007), the use of electricity power supply in Indonesia mostly still rely on fossil fuels energy such as coal, oil, and gas, and the largest is from coal power supply. That will be in terms of CO₂ emissions, coal combustion emits far more CO₂ than oil and gas. While the electricity acceleration program launched by the Indonesian government policy indicates that coal in large quantities will be required in the future [7]. Saving the use of electrical energy is an effort to reduce CO₂ emissions as a cause of global warming. The emergence of new technologies in electronic equipment used in everyday life with sensor systems or energy-saving features also supports the efforts to reduce global warming. Smart living concept is useful for helping people in their daily lives [8]. The existence of smart living technology makes it easier for people who are still not used to implement an environmentally friendly lifestyle in their daily life.

### 1.2 Smart Living

Smart living is a part of the Internet of Things, where people can utilize the connectivity of internet and technology development to create an integrated and affordable home security solution [9]. Smart living is a system of integrated technology that enables human interaction with external elements and has access to controlling and manipulating it in the built environment [8]. In general, smart living is a way of life in organizing, good planning and modern living space involving wireless technology from the place of residence to some other place. Smart living is the latest technology available in a product that can reduce energy costs, carbon emissions, save energy, and extend the life of a product. Smart living technology can be controlled via smartphones [8]. Examples are monitoring CCTV, building locking systems, turning on/off lights or household electronics all done with a touch of a smartphone. it can be done even when the building owner is far from the site-building if the gadget must be connected to an internet connection.
The green design based on smart living can be started from public spaces so that peoples can experience it first-hand on how to implement it. That aims to stimulate people to implementing this system in their own respective property. While in public space the economic aspect become a major consideration, it will be a necessity to explain the advantages of sustainable interior design [10]. According to Kusumarini, Ekasiwi and Fatih [5], Bonda and Sosnowchik [10], the biggest advantage of implementing a smart living concept in commercial spaces is to form a perception as a company that pays attention to nature preservation, adaptable to technology development and thus increase marketing opportunities.

This study aims to describe the concept of sustainable design based on smart living concept in the built environment of notary office. Ecological, economic, and social interior design approaches in the notary office interior space will be discussed. Organization of space, energy conservation and emissions in the interior space of a notary office through a smart living approach to lighting, thermal comfort, indoor pollution, and its contribution to ecological and green concepts will be discussed further in this paper.

2. Methodology

2.1 Literature Studies

Literature data consist of journal reference of sustainable design in interior spaces, global warming issues, and smart living concept in commercial space. The literature will build the research foundation concept.

2.2 Field Studies

Field study is conducted to provide data of existing case-study object. Data collection obtained through:

- Observation, of activity and existing object
- In-Depth interviews, with owner, employees, and visitor

The data will be analyzed by using design thinking method and the results will then enter the synthesis stage. At the synthesis stage, the problems and deficiencies found at the analysis stage will be the base for the formulation of concepts and basic themes following the conditions and needs of the design object. Furthermore, these basic concepts and themes will become the base for developing interior designs and facilities for design objects.

3. Case Study

The case-study object for this research is Ita Kristiana, S.H., M.Kn. Notary Office that located in St. Kawi 23rd, Malang City, East Java. As an inheritance object from owner’s parent, the building first serve as a house building, but now converted into office building. Based on the field study data gathering, obtained the following data:

- Space Organization : The usability change from residential to office building without changing its structure and exterior makes employee circulation and space zoning less effective. The separation of the first and second employee's office space requires employees to go through the waiting room, thereby disrupting circulation and client comfort. Lack of room for reading the certificate which obstructs the employees' work, so they have to use another room as a place to read the certificate.
- Lighting : Natural lighting in the office space is still relatively minimal, so they have to use artificial lights during the day.
- Material : The office building maintains the existing material of the old house, from marble flooring, gypsum ceiling and walls using bricks and cement with paint finish.
- Environmental Quality: The condition of the office doors that are always open and the absence of acoustic treatment on the office walls creates noise disturbance that lowers employees work performance and clients who are sensitive to loud noises.
• Humidity: Natural air circulation is still lacking, because the organization of office space is different from that of a residential house.
• Visual Comfort: Because it is an old building, the walls have lots of black spots and look dull because they haven't been refurbished.
• Indoor Pollution: Offices are located on the side of the highway, so air pollution will easily enter the office space.

4. Result and Discussion

4.1. Main Themes and Design Concepts in Notary Office
The classic modern theme is preferred to be applied to the interior design of this notary office, considering maintaining the old impression but also giving it a modern impression. The design concept chosen is Mid-Century Modern. This concept describes a style in the 20th century, from the 1950s to the 1980s. This concept is very suitable to be combined with the natural concept, with lighting that seems warm and presents wood materials. Smart living-based facilities are also applied to the redesign of the notary’s office to take advantage of current technological developments to support environmentally friendly designs.

4.2. Eco-Interior Application in Notary Office Interior Design
Green design is a sustainable concept that affecting each design steps from planning, implementation, materials to achieve effectiveness and efficiency of energy and resources usability (Hawari, 2016). To achieve it, there are 3 aspects that must be fulfilled, namely the eco-interior, socio-interior, and Econo-interior aspects [5]. Applied eco-interior deals with environmental conditions that affect design decisions including aspects: space organization, material selection, lighting systems, ventilation systems, water sanitation, indoor pollution, electromagnetic emissions, waste management. The socio-interior application is a relationship between buildings and their users that influence each other, covering aspects of cultural identity, universal design, participation and social interaction between humans. The Econo-interior application is oriented to the economic aspect and relates to the local community which includes the efficiency aspects of the development process and its operations, empowerment and community economic development, has potential and useful values.

To design environmentally friendly interior design, several eco-interior applications that are applied to the interior design of the notary's office are:

4.2.1. Space Organization
The space organization in the office’s interior must be considered because of its relation to work system and office management. The division of public and private zones must be clear because it will relate to important and restricted documents in the notary office. Space organization and security, filing systems are needed to ensure integrated document management. The layout of an office must not only make the workers comfortable in carrying out their duties, but also be able to show the self-image that the company wants to display. To achieve the ideal space organization for this notary office redesign are:

• Rearrange the placement and area of space according to the results of interviews about the space requirements of users (owners, employees, and visitors) which will also suit zoning of privacy, semi-privacy, and public areas. The purpose of rearranging this layout is so that the circulation of visitors and employees does not cross each other so that the staff and notary rooms can be guaranteed safety in storing files.
• Spatial planning is based on Feng Shui guidelines according to the owner's date of birth. The implementation of this feng shui guide helps provide insights in classifying areas needed such as the owner's work area, employees, waiting rooms, and so on.
• Adjusting the size of the furniture used so that it maintains user comfort (normal and special needs) when on the move, according to ergonomic size, as well as universal design's anthropometry.
• Adding special facilities for users with disabilities (such as ramps, guides for the visually impaired,
etc.) to improve accessibility.

![Figure 1. The design result based on space organization (View 1)]
![Figure 2. The design result based on space organization (View 2)]

4.2.2. Material Selection

Some of the materials used in the design of the Notary Office use environmentally friendly materials to fulfil the green design concept that is highlighted. The material is described as follows:

- **Wall**
  The walls of the Service / Consulting Room and the Certificate Reading Room use Tempered Glass material with a thickness of 9 mm. It’s function is in addition to giving a modern and spacious impression, this material can also maximize the entry of sunlight, thereby reducing the use of lights during the day.

![Figure 3. Tempered glass application in Service Room]

- **Ceiling and Furniture**
  Most of the ceilings in this notary office use wood, as applied to the Indoor Mini Garden, Service / Consulting Room and Lobby Area. The wood material used is wood from the deck of the ship. This wood can be a point of interest when entering the room, besides supporting the green design concept. On the ceiling of the Service / Consultation Room and the Certificate Reading Room, the ceiling uses a semi-transparent material, namely Solar Flat with a thickness of 3mm. Solar Flat is a product that supports the green-design concept because it can maximize sunlight entering during the day, without having to absorb heat and filter UV light.

![Figure 4. Wood application in Lobby (View 1)]
![Figure 5. Wood application in Lobby (View 2)]
4.2.3. Lighting System
The lighting system used is natural and artificial light. In the morning, office residents can take advantage of natural lighting that comes in through the existing windows. Also, the lighting in this design uses this type of LED lamp because it has a long duration of use, bright colors, has various variations/shapes, and saves power compared to other types of lamps. Besides, time setting technology and motion sensor are also used to automate the use of lights that can maximize the concept of green design and smart living.

![Image of SOLARFLAT in Notary Office](image)

Figure 6. The application of SOLARFLAT in Notary Office

4.2.4. Ventilation System
The weather in Malang is in the cool category. According to [11], the climatic conditions of Malang City during 2012 recorded an average air temperature ranging from 21.6 °C to 24.7 °C, while the maximum temperature reached 29.5 °C and a minimum temperature of 17.1 °C. The average humidity ranges from 69% - 85% with a maximum humidity of 98% and a minimum of 28%. The cool weather conditions of Malang City must be utilized properly so that there is no need to use artificial ventilation. Take advantage of natural ventilation by increasing the windows for air circulation with a cross-ventilation system. By applying natural ventilation, it will reduce the number of electricity use in this office.

4.2.5. Indoor Pollution Management
One way to reduce air pollution is by putting plants in the room, one of which is the Sansevieria type. Benefits of Sansevieria plants are absorbing CO, CO2, cigarette smoke, and other poisonous gases [12]. These plants also function as decorations to enhancing aesthetic. Besides, by adding green elements such as indoor plants to the office, it can reduce employee stress levels when they are bored at work. This was stated by researcher Masahiro Toyoda (2020) who proved that placing plants on an office table can reduce employee stress when feeling tired. Using the STAI (State-Trait Anxiety Inventory) measurement index it is proven that as many as 27 per cent of employees who stare at the plant intentionally for several minutes and are actively involved in its treatment experience a decrease in pulse rate which is positive [13].

4.2.6. Color Concept
Socio-interior application in the notary office interior design is applied to the interior color concept. Color can provide psychological effects that stimulate human nature and emotions. Color can also influence and control a person's feelings in space because by choosing the right color, it can create the desired atmosphere (Zein et al, 2013). Wolfhard explains in his scientific article that the use of color is not only a basic element of an interior, because color also has a function and meaning. (Wolfhard, 2020).

In this notary office interior redesign, color selection is based on a mid-century-modern theme. Color is an effort to solve the problem of visual comfort. The color chosen to be applied in the office interior aims to give a warm and friendly impression to visitors (clients) and to give a calm impression to reduce employee stress levels. Therefore, the color theory is applied to the interior redesign of the Notary Office as follows:
- **White**
  Psychologically, white gives the impression and feeling of being cold, sterile, stiff, and causes psychological effects that are comfortable, clean, spacious and bright (Syoufa, 2012). In its application, this color is predominantly used in employee office areas, break rooms, and filing rooms on ceilings, floors and walls.

- **Brown**
  Psychologically, brown has a masculine, simple and warm impression, it’s also associated with open nature (Trieha, 2018). This color is predominantly used on the walls in the foyer and lobby area.

- **Green**
  Psychologically, green has the impression of being calm and comfortable, so it gives a psychological effect of coolness and healing (Syoufa, 2012). In its application, the green color is presented as an accent, additional natural colors from plants and wallpapers.

- **Black**
  Psychologically, black gives the impression of being firm, solid, and strong (Trieha, 2018). This color will be applied as accents on ceilings and furniture.

### 4.2.7. Smart Living Application

Smart Building is a concept that combines architectural design, interior design and mechanical electrical to provide mobility as well as easy control as well as access from any direction and time at any time [14]. In terms of automation where all activities that occur in a building can facilitate human needs, both individuals and groups / institutions (Smart Building, 2015). One of the benchmarks for environmentally friendly interiors according to the Green Building Council Indonesia (2020) IS Greenship Benchmark document (2020) is the application of an integrated light sensor/occupancy sensor at one of the points for assessing energy efficiency and conservation efforts. The smart living application in designing the interior of the notary's office is by using sensor light technology. The sensor lights used are sensor lights that are integrated with a program that will turn on the lights according to the set time (time setting), lights with motion or sound sensors (motion and sound sensors) and light sensors in the vicinity (light sensitivity sensor).

The use of sensor lighting technology aims to be effective and save electricity consumption, as well as reduce electricity costs, especially for lighting in office areas. In designing the Notary Office, the type of smart living product used is a lamp with sensor technology:

- **Time Setting**
  Using this setting, the lights will automatically turn on and off at specific times. This reduces energy wastage and makes it easier for users because they do not have to press a switch. The room that uses lights with the time setting according to this rule is the terrace.

- **Motion Sensor & Sound Sensor**
  When the sensor detects human movement, the light will automatically turn on. Besides, it is equipped with sound sensor technology, which means the lights will automatically turn on when they hear a room user's command. This lighting technology can be applied to archival rooms, consultations, meeting rooms that are used incidentally and in an abbreviated time.

- **Daylight Sensor Detects Light**
  The light will automatically turn on when natural light is dim. The difference with the time setting lamp is that the lamp with this type of setting is not set by hour, but according to the amount of light in the room. If the light detects too pinpoint light in the room, the light will automatically turn on. The rooms that use this type of light are the Lobby Area, Indoor Garden and Outdoor Garden.

### 5. Conclusion

The interior design of the Notary Office located in Malang City aims to reduce the effect of global warming through the application of eco-interior and smart living design concept. The application of smart living technology as a part of green design still limited to the use of light sensor lighting to
adjust to the owner’s financial conditions and the availability of sensor technology products for smart living in Indonesia. The application of eco-interior and smart living technology is expected to be able to optimize the use of natural energy by utilizing technology development. In addition to designs that prioritize smart living-based green design, the interior design of the Notary Office located in Malang City is also expected to be able to stimulate visitors to experience smart living-based green design buildings with the hope that they will be eager to implement the concept in their own residential property.

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