UNIVERSITY OF NAIROBI

College of Architecture and Engineering

School of Arts and Design

BDS 413: PROJET PAPER

Interior Design Specialisation

BIOPHILIC DESIGN FUSED WITH ASIA'S UNIQUE NATURE FOR HEALTHY INTERIOR DESIGN SPACES AT PAWA254, NAIROBI.

By:

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Project Paper submitted in partial fulfilment for the Bachelor of Arts in Design Degree submitted to the school of the Arts and Design, University of Nairobi.

14th April 2020

DECLARATION

I, Kambura Murungi, hereby declare that this is my original piece of work. It has not been submitted before for any other degree or part of degree at this or any other university.

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Sign ……. Date…….....

DR. LILAC A. OSANJO

DEDICATION

I dedicate this paper to, first and foremost, the Lord Almighty. His grace has been sufficient for me right from the start all the way into the end. I dedicate this paper to my parents, Mr. and Mrs. Murungi, whose support through my academic journey has been unwavering all along and my siblings, Kajonti and Victoria, who have not been hesitant to give me their support and encouragement. I also dedicate this paper to my friends, who have refused to allow me to give up at any point. May the Lord Almighty bless you all abundantly.

ABSTRACT

This research paper is based on the application of biophilic design in conjunction with Asia's peculiar nature for the designing of spaces that are sustainable. The researcher is looking to establish the importance of having healthy working environments and to endorse biophilic design as an effective way of achieving such results. The reason why the researcher is seeking to establish that is because there is a disconnect between indoor spaces, particularly office spaces, and the healthy natural environment and people are at the receiving end of the adverse effects brought about by this disconnect.

The research design is a case study and qualitative research. The researcher's case study site is Pawa254 and through qualitative data collection and analysis tools, the researcher was able to obtain meaningful information concerning sustainability in work spaces from the site. The researcher also obtained plenty of relevant information about biophilic design for sustainability through literature review. From the results, the researcher ascertained that unhealthy environments in the work space cause adverse effects on people's physical and mental health. However, further research determined that through the application of the 14 biophilic patterns, indoor spaces can become more sustainable and in turn promote the health and well-being of their occupants.

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LIST OF ABBREVIATIONS/ ACRONYMS

HVAC – Heating, Ventilation and Air Conditioning

IAQ – Indoor Air Quality

IEQ – Indoor Environmental Quality

LED – Light Emitting Diode

VOC – Volatile Organic Compound

WHO – World Health Organisation

YMCA – Young Men's Christian Association

OPERATIONAL DEFINITION OF TERMS

Biophilic design: Design that reconnects us to nature. It improves cognitive function and creativity, accelerates healing, reduces stress and improves people's well-being. (Green, 2014)

Biomorphic forms and patterns: Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature. (Green, 2014)

IEQ: It refers to the quality of a building's environment in relation to the health and well-being of the people who occupy that space (Nischay, 2016).

Prospect: The ability to have an unobstructed view over a distance for both surveillance and planning. (Green, 2014)

Sustainable design: A process which allows designers to better asses and expect the environmental, economic and social impacts of a design. (Green Building Solutions, n. d.)

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CHAPTER ONE

1.0 INTRODUCTION OF THE STUDY

1.1 INTRODUCTION

In today's world, people are concerned about their quality of life and well-being in general. In the bigger picture, this relates to their environment, their economy and the society as a whole. In a poor environment, people will have a struggling economy and the society in general will experience a poor quality of life. Sustainability is about a set of conditions, behaviours and actions that seek to attain an indefinite state of equilibrium between the people, the planet and the profit (Wanamaker, 2018).

The researcher will focus on the environmental aspect of sustainability with an emphasis on Indoor Environmental Quality(IEQ). IEQ refers to the quality of a building's environment in relation to the health and well-being of the people who occupy that space (Nischay, 2016). Indoor environments have such huge impact on the occupants of that space, more than they possibly know. Contrary to what people think, human beings are very sensitive even to the slightest changes in their surroundings. For example, the simple addition of one indoor plant per metre square can lead to an increase in productivity by 15% (Demaria, 2018).

Biophilic design, a design philosophy that is pegged on the natural human tendency to have a connection with nature, is one of the best approaches of attaining a sustainable environment. This approach is about understanding the natural types of environments that enable human beings to thrive. These environmental elements are then incorporated into the building design. This allows designers to develop spaces that seek to promote the health and general well-being of their occupants (Bemis, 2019).

This chapter includes the background of the study, the problem statement and the objectives, the main objective and four specific objectives. The research questions are highlighted, the main research question and four research questions. The significance of this study is also contained in this chapter as well as the limitations. The scope of this study is also contained here: the geographical, contextual and conceptual scope.

1.2 BACKGROUND

With the continual growth of the built environment, IEQ has become increasingly important now more than ever. Moreover, poor indoor environments lead to numerous undesirable effects. Unfortunately, some of these adverse effects have already began to manifest globally. According to the United States EPA, indoor air quality has been ranked one of the top five environmental risks to public health (Group, 2014). One of the indoor environments that has been most affected is the workspace. The average person spends about 90,000 hours of their lifetime at work (Premack, 2018). This means that indoor work environments have an immense impact on the quality of life of its users.

In Kenya, when it comes to healthy environments, what is most propagated is outdoor air pollution. This leaves indoor air quality and environmental quality at large, an issue that is invisible. The invisibility of the quality of indoor environments is what makes this issue deadly because it is affecting the lives of many Kenyans without them even realizing it. According to a research done in Nairobi's informal settlements, the average levels of fine particle matter is 76µg/m3 which is three times over the World Health Organisation (WHO) recommended maximum which is at 25µg/m3 (Muindi & Mberu, 2017).

Pawa254, which is the case study of this research, is one of the many working environments in Nairobi which is unknowingly dealing with the effects of poor indoor environments. The interior spaces of this organisation include a number of undesirable factors that take away their chances of enjoying a healthy and comfortable environment. For every wanting indoor condition is an underlying effect. Each of these conditions will be discussed along with their effects on the occupants at Pawa254.

Most of the walls at Pawa254 are covered in paintings and graffiti. As much as this art on the wall is an expression of what the organisation is about, it poses a threat to their health. This is because these paintings emit huge amounts of VOCs. (Demaria, 2018) Volatile Organic Compounds (VOCs), one of the most toxic elements found in indoor spaces, are common in paint, varnishes, wood preservatives and many other building materials. This toxic compound contaminates the air leading to eye, nose and throat irritation, headaches and in the long run may cause damage to the liver, kidney and central nervous system.

The rooms in this organisation have inadequate lighting. Lighting, as an aspect of IEQ has numerous effects on people. Dim lighting causes people to have a low morale in whatever task they are undertaking which in turn drags down their motivation. In addition to this, it slows down the process of creativity and creates a general sense of negativity in the workplace. On the other hand, when natural and artificial lighting is well balanced, people are more energetic. Studies show that people who use natural lighting in their workspace are 18% more productive (Annualleave, 2017).

The office space at Pawa254 is an open-plan layout without any partitions. The downside of this type of layout is that it takes away privacy since everything is out in the open. In a survey done by Canada Life, employees who worked in an open plan office spaces took 70% more sick days than those who worked from home. This layout makes it difficult for people to concentrate and this harbours dissatisfaction and a stressful work environment. Open plan offices also make it easier for diseases to spread in the workplace because more surfaces are touched by many individuals compared to more private office spaces (Landau, 2014).

The interiors at Pawa254 are clustered; the furniture is too close to each other and the pathways within the office are hard to identify. Spatial arrangement has a significant effect on employees. Having little space in a room affects people negatively because it increases stress. A study done in 2009, showed that creating more space in the workplace increased productivity of the employees by 30%. There are basic recommendations that office spaces should follow to have a good spatial arrangement. These are; creating flow zones where there can be movement without creating traffic in the space, including pods of desks that allow colleagues to face each other thus enhancing good working relations and permitting individualization where employees are allowed to personalize their individual work spaces (Annualleave, 2017).

The ergonomics of the furniture at Pawa254 is sometimes uncomfortable for the users. Considering the amount of time people spend sitting on their office desks, poor design can cause a number of problems. They can result in stiff necks, headaches and the most commonly experienced, back aches. According to a research done in an insurance company, productivity increased by $620,000 due to the company's investment in better

ergonomic furnishes. Fast food providers claim that redesigning a workstation leads to an increase in productivity by 20% (Scott, 2013).

The interior environment of this organisation has few windows which is one of the causes of poor ventilation. Insufficient ventilation lowers Indoor Air Quality and this leads to a number of health effects such as fatigue, dizziness and irritation. The long term effects are respiratory complications, heart diseases and cancer not to mention its effects on productivity. Research shows that an increase in ventilation from 20 cubic feet per minute of outdoor air to 40 cubic feet per minute boosted productivity by $6,500 per worker per annum (Demaria, 2018).

1.3 PROBLEM STATEMENT

The Interior Design existing at Pawa254 has failed to consider the health and well-being of its occupants. Aspects of its Exhibition and Display, Furniture, Landscape and Interior Architecture poses a threat to the health, productivity and general well-being of the people interacting with this space. The ventilation is poor as the space has few windows and some rooms have none at all. The lighting is inadequate, both natural and artificial. The space is clustered with furniture too close together, the walkways not being clearly distinguishable and the ergonomics being generally unsuitable for the employees. The walls are covered in paintings which contain adhesives that constantly contaminate the air.

1.4 RESEARCH OBJECTIVES

1.4.1 Main objective:

The main objective of this research is to investigate how the interior environments at Pawa254 are harmful to their occupants and to propose biophilic design fused with Asia's unique nature for more sustainable design spaces.

1.4.2 Specific objectives:

1. To investigate the contribution of biophilic design in the creation of sustainable interior environments.
2. To determine the ideas and processes borrowed from biophilic design that can be applied to make healthier interior spaces at Pawa254.
3. To identify the threats brought to the occupants at Pawa254 due to the state of their interior environments.
4. To propose biophilic design fused with Asia's unique nature as a suitable solution for the developing of a healthier environment at Pawa254.

1.5 RESEARCH QUESTIONS

1.5.1 Main question:

This research will be conducted to investigate: How can Biophilic design in fusion with Asia's unique nature become beneficial in the development of healthy interior environments at Pawa254?

1.5.2 Specific questions:

1. How does biophilic design contribute to the creation of sustainable interior environments?
2. What ideas and processes borrowed from biophilic design can be applied to make healthier interior space at Pawa254?
3. Why do the interior environments at Pawa254 pose a threat to the health and well-being of their occupants?
4. How can the suggestions taken from Biophilic design fused with Asia's unique nature become suitable solutions for building a healthier environment at Pawa254?

1.6 SIGNIFICANCE

This research is important because people are almost always in direct contact with indoor environments. It is estimated that the average person spends a third of their lifetime in the workplace. Since it is proven that human beings are highly sensitive to their environments, having good or bad quality indoor environments at work will have a direct impact on the lives of these people (Demario, 2018). Therefore, it is of great relevance that the indoor environmental quality works to benefit the health and general well-being of the people interacting with these spaces.

The built environment is growing larger day by day. This means that in the long run, people will continue to spend more and more of their time indoors. (Demario, 2018) Indoor environments not only affect the health of their occupants but they also influence other human aspects like productivity, behaviour, social interaction and even sleep. This holistic impact that IEQ has on people makes it an issue that ought to be given serious consideration. Through biophilic design, interior environments can be designed in such a way that they create healthier and comfortable environments that will benefit the health and general well-being of its occupants.

1.7 LIMITATIONS

1.7.1 Sample size constraints

Pawa254 is a small organisation meaning that the researcher will be working with a small sample size. This limitation will hinder the researcher from obtaining information that is precise and an accurate presentation of the entire population.

1.7.2 Time constraints

The researcher has a short period of time to carry out their research. This will to some degree restrain the researcher from obtaining in-depth information in the related processes and topics relevant to the research.

1.8 SCOPE

1.8.1 Geographical scope

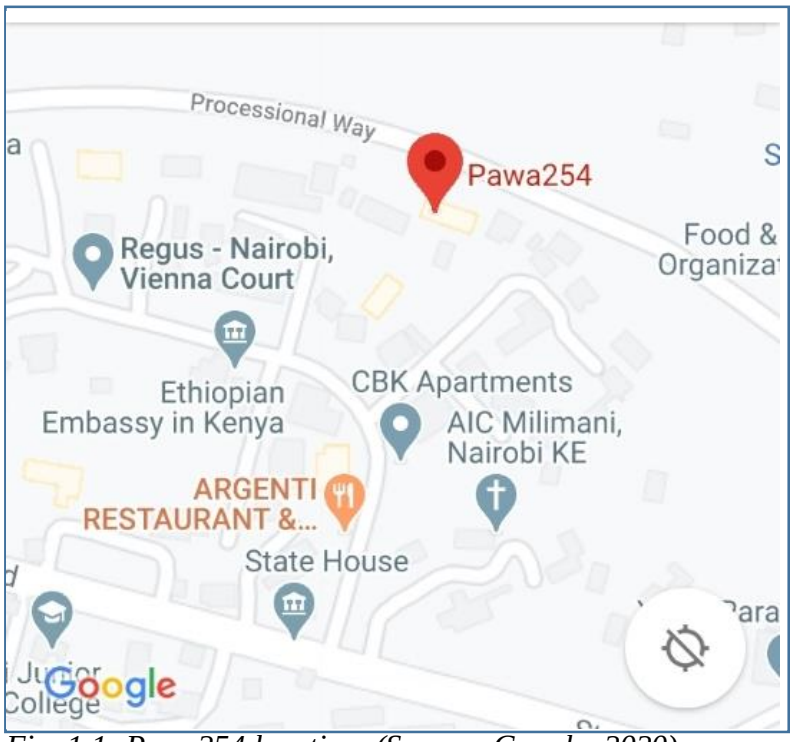

Fig. 1.1: Pawa254 location. (Source; Google, 2020)

Pawa254 is located at the Africa Alliance of YMCAs building near State House Avenue road located in Upper Hill, Dagoretti constituency, Nairobi county, Kenya. It is 3 kilometres from the Central Business District, Nairobi. It is 2.1 kilometres away from University of Nairobi, Main Campus. This is a 28-minute walking distance from the same location. It is enclosed by Processional Way road on its side and State House road to its other side. It borders the Ethiopian Embassy in Kenya and neighbours the African Inland Church Milimani, Nairobi.

1.8.2 Conceptual scope

This research will focus on the concept of biophilic design with an emphasis on Asia's unique nature through biomorphic forms and patterns for the development of healthy sustainable interior spaces at Pawa254. This concept will be applied in Interior Architecture, Landscaping, Furniture and Exhibition and Display.

1.8.3 Contextual scope

This research will be limited to the field of Interior Design with a focus on office spaces. These office spaces will involve the existing spaces at Pawa254. These include the officespace, the gallery and the garden.

1.9 CONCLUSION

In this chapter, the researcher has highlighted the two design philosophies involved in this research and how they are linked together. The current state of office spaces in Nairobi, represented by Pawa254, in relation to aspects of environmental sustainability have been discussed as well.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, the researcher will discuss the two main philosophies that the research is based on. The major philosophy of the research is biophilic design while the minor one is sustainability. The researcher will then discus two exemplars, Selgas Cano Architects and Tom Dixon Design, and one design champion, Oliver Heath Designs, from which the researcher will borrow concepts from. The chapter will conclude with the researcher's design process from the beginning of the project to the end.

2.2 SUSTAINABLE DESIGN

2.2.1 Definitions of sustainable design

Sustainability is a term that is widely used in every field of study. (Worldenergy, 2014) The origin of the term sustainability is found in the German language. Its original word was *"Nachhaltigkeit"* which means "sustainable yield". This word was first published in 1973 in a handbook on forestry and it meant never harvesting more that the forest could yield.

This original German word was then translated into English in mid-19th century. Later in the same century, ecology became a discipline and for this reason sustainability became associated with ecology. The term sustainability therefore encompassed forestry as well as all other biological systems.

It was in the 20th century that the term sustainability began to take on a more concrete form. With the growing awareness of the overuse of resources, the world began to relate sustainability to how human beings live on the planet. From this point on, the most common definition of sustainability, which is actually the definition of sustainable development, was developed. Defined in 1978, by the Brundtland Commission of the United Nations, sustainable development is the development that meets the needs of the present without

compromising the ability of future generations to meet their own needs (Worldenergy, 2014).

Green Building Solutions (n. d.), share a similar point of view in their definition of sustainable design in that it is about how choices made affect the present and most importantly, the future. Sustainable design is a comprehensive approach in the selection and integration of products and processes that account for long term human satisfaction as well as environmental conservation. Sustainable design involves not only structures but processes as well. This view point presents sustainable design as a process which then allows designers to better asses and expect the environmental, economic and social impacts of a design. In doing so, designers are in a better position to make wiser choices for the present and the future.

2.2.2 The three pillars of sustainability

In today's society, sustainability has evolved into a much bigger spectrum because the world is and continues to develop quite rapidly. This means that the dynamics of the world's system are becoming more and more complex. Sustainability can no longer be tied to resources only. It is much bigger than that. Nowadays, what constitutes a people is their economy, their environment and their social state. These three aspects of society are intricately connected. Therefore, when any of these three parts are compromised, it affects the other parts of the society (Wanamaker, 2018).

Sustainable development is classified into three interconnected pillars which show the relationship between the economy, the environment and the social sphere of the world. When these three aspect are all put into consideration, they form the framework of what it means for something to be sustainable (Wanamaker, 2018). Economic sustainability involves making decisions in the most equitable and fiscally way possible while still considering other aspects of sustainability. It is about making decisions that give the most economical value without compromising other parts.

The concept of social sustainability has to do with decisions being made for the betterment of the society. This relates to the people's quality of life. It is about future generations having the same or even better quality of life than the current generation has, never going

below what has been there before. Environmental sustainability is about an ecosystem's ability to maintain populations, biodiversity and the effective functionality over long periods of time. This involves making decisions that promote a state of equilibrium within the natural systems as well as promote positive growth within the environment (Wanamaker, 2018).

The researcher has generally defined the three pillars of sustainability and how these aspects are interconnected. At this point, the researcher will look into another perspective of these three aspects for a better understanding on how they are related to design and more so the built environment.

According to Cathi Colla Architects (2018), holistic thinking is an essential part of a sustainable built environment. This means that the three pillars of sustainability need to be balanced properly to have a truly sustainable built environment. If any of these three elements are out of balance, then holistic sustainability has become impossible to achieve. This outlook is in agreement with Wanamaker's perspective on the delicate interconnectedness of the three pillars. However, the contrast between these two standpoints, emerges in how these three pillars are defined by these two authors.

In regard to the built environment, environmental sustainability relates to the form, the materials and the systems related to a building and its site. This aspect is broken down into a number of various considerations. For example, every building material has an environmental cost. The evaluation and choice of materials used in a building can lead to improvements in a space such as reducing the reliance on heating and cooling resources. This will in turn will reduce environmental strain caused by overconsumption of resources. In this research, the focus is on the environmental pillar of sustainability.

Social sustainability refers to the development of inclusive, secure and healthy communities that are thoughtfully integrated into the larger urban systems. It also includes taking into consideration the cultural values, lifestyles and behaviours of the people within the community. For example, designers can foster a sense of equality and cohesiveness within a community by creating spaces that are accessible and inclusive to every individual within that community.

Economic sustainability encompasses the fine line between cost and value. It is all about cost effectiveness. For example, during the design process, decisions such as materials and building size should be based on cost effectiveness. The cost of maintenance in a building is another consideration. A sustainable building is one that has been designed to have a lower ongoing maintenance cost. (Cathi Colla Architects, 2018)

2.2.3 Principles of sustainable design

Earlier on, the main objective of sustainable design was to simply enhance the efficiency of the built environment. However, this objective is incomplete in light of the world today. The world is evolving rapidly leading to the emergence of a new set of problems and considerations as far as sustainability is concerned. Problems such as global warming and the challenge of implementing new technologies in societies built for old ones. Considerations such as having a growing scale of the uses of resources and the growing complexity of efficiency improvements (Sourceable, 2016).

In the society today, the main objectives of sustainable design are three: The reduction or complete elimination of depletion of critical resources such as energy, water and raw materials. The prevention of environmental degradation brought by developments and infrastructure throughout their life cycle. The creation of built environments that are comfortable, safe, healthy and productive.

Sustainable design has various principles. In relation to the built environment, the common principles are indoor environmental quality, site selection, energy efficiency, water use, optimising material use, adaptability and designing buildings to last. Indoor environmental quality refers to the quality of a building's environment in relation to the health and well-being of the occupants of that space (Nischay, 2016). This principle of sustainability will be the researcher's main focus under the environmental aspect of sustainable design.

Site selection is one of the first steps in the creation of sustainable buildings. It involves considering the reuse of existing buildings. It also involves considering the location, orientation and landscape of a building. Energy efficiency is concerned with improving the energy performance of a building by reducing the energy load, increasing efficiency and

maximising the use of energy resources. Sustainable water use is designing buildings that use water adequately and reuse or recycle water for onsite usage where possible.

A sustainable building is designed to use and reuse materials in the most productive way across their entire life cycle. It involves selecting materials for their adaptability for reuse and this is what optimisation of material use is about. Adaptability means the capability of a building to be used for multiple purposes over the life of the building. It also encompasses a buildings ability to adapt to different environments and conditions. Designing buildings is tied to building resiliency. That is the capacity of a building to continue to function and operate under extreme conditions such as natural disasters, extreme temperatures or sea level rise. (Sourceable, 2016).

2.2.4 Indoor Environmental Quality

Indoor Environmental Quality (IEQ) is one of the main principles of environmental sustainability. According to Whole Building Design Guide (2018), ensuring that a workspace has good indoor environmental quality will result into employees who are not only healthy and comfortable but also satisfied and productive. For this reason, all organisations should be designed with a greater emphasis and appreciation for high-quality indoor environments for all its occupants. There are certain recommendations that a space ought to apply to achieve a good indoor environment. They include:

- Value aesthetic and wellness concerns such as the importance of views or the integration of natural and man-made elements;
- Provide thermal comfort with a maximum degree of personal control over temperature and airflow;
- Supply an adequate quantity and quality of ventilation and intake of outside air to ensure acceptable indoor air quality;
- Prevent airborne bacteria, mold and other fungi, as well as radon, through building envelope design that properly manages moisture sources from outside and inside the building, and with heating, ventilating, air-conditioning (HVAC) system designs that are effective at controlling indoor humidity;
- Use materials that do not emit pollutants, or are at least low-emitting;

- Assure acoustic privacy and comfort by employing sound-absorbing material and equipment isolation;
- Control disturbing odors through contaminant isolation and removal, and by careful selection of cleaning products. Pursue energy efficient strategies to remove harmful odors and recover energy used in conditioning the interior environment;
- Create a high-performance luminous environment through the careful integration of natural and artificial light sources; and
- Provide high quality potable water. (para.4)

The recommendations listed above will aid the researcher in identifying what needs to be added, eliminated or modified within the interior spaces at Pawa254 for the purpose of developing a good environmental quality and in turn a healthier sustainable environment.

2.3 BIOPHILIC DESIGN

2.3.1 Definitions of biophilic design

Biophilia is the innate human inclination to be closely connected to nature. This idea of biophilia springs from the understanding that for more than 99% of the history of human evolution, people have developed because of an adaptive response to the natural world and not artificial forces. The development of the built environment has proven to be a hindrance to people experiencing the natural environment and this has led to adverse effects on the people. Biophilic design seeks to satisfy these inherent affiliations to nature in the built environment and thus improving people's physical and mental health and their well-being in general. (Kellert & Calabrese, 2015).

According to Green (2014), biophilia is humankind's inherent biological connection with nature. Biophilic design is design that reconnects us to nature. It improves cognitive function and creativity, accelerates healing, reduces stress and improves people's well-being. Biophilic design provides people with an opportunity to live and work in healthy environments, spaces with less stress that enhance health and well-being.

Kellert and Calabrese (2015), explained the validity of this human inclination to respond to nature through a classic Swedish study conducted in 1987 by psychologist Arne Ohman. In this study, the subjects were subliminally exposed to images of snakes, spiders, frayed electric wires and hand guns. Almost all the participants of the study reacted negatively to the subconsciously revealed images of spiders and snakes. However, they remained unmoved by the frayed electric wired and hand guns. The results of this research demonstrate the noteworthiness of the human inclination to nature even in the modern world.

Green (2014), supports the validity of this affiliation for nature however, he justifies it from a different standpoint. He argues that the consistency of natural themes in historic places and structures suggest that there has always been a connection between nature and people. Right from the earliest human structures like the Egyptian Sphinx to the elusive hanging gardens of Babylon, the art nouveau designs that were nature inspired and the creation of the large public parks found in cities today.

2.3.2 Application principles of biophilic design

For the effective application of biophilic design, certain principles require to be constantly observed in order to experience the intended result. There are five such principles. Biophilic design requires repeated and sustained engagement with nature. It goes without saying that for something to be effective it has to be consistent. An infrequent exposure with elements of nature will result to temporary and fleeting effects on people which will fail to cause any changes in the long run.

Biophilic design centres on human adaptations to the natural world that have overtime proven to work for the benefit of people's health and well-being in general. Some aspects of nature are harmful to the health and well-being of the human species. Therefore, these factors become irrelevant as far as biophilic design is concerned. The natural factors applied in this philosophy are only the ones that have been tested and proven to be of merit to people.

Biophilic design requires the integration and reinforcement of design practices that share a mutual connection with the entire space. For a working biophilic environment, the design

interventions applied need to be properly blended into the rest of the setting. When an applied design in out of place, for example a natural material that is indifferent to the other spatial elements, it compromises the effectiveness of the intended result.

Biophilic design encourages an emotional attachment with settings and places. An emotional attachment with a space improves people's performance and productivity. It also engenders people to identify with that space thus prompting them sustain the existence of that space or place. People take care of what they care about and emotional attachments allow people to develop soft spots for certain places.

Biophilic design fosters positive interactions between people and their natural environments. Because human beings are greatly social beings, endorsing positive interactions of nature within a space allows them to feel secure and become more productive. Biophilic design enhances these connections and enhances that feeling of relationship. (Kellert, 2015)

2.3.3 The 14 patterns of biophilic design

According to Green (2014), biophilic design is organised into three main categories; nature in the space, natural analogues and nature of the space. They form the bodywork for understanding and allowing the effective incorporation of numerous design strategies. These three categories are further subdivided into 14 patterns which guide and assist in the design process. They explain aspects of the connection between the built and natural environment and how people benefit from them. The content also includes how these patterns work and why they work based on scientific research and facts about the effects of nature on the human physiological and psychological faculties.

Nature in the space relates to the direct and physical experiences of nature within a space. It consists of seven biophilic patterns. Natural analogues deal with the indirect, organic and non-living stimulations of nature in a space and contains three biophilic patterns. Nature of the space addresses the spatial features that characterise natural environments within a space and it encompass four design patterns.

2.3.4 Nature in the Space

1. Visual connection with nature

A visual connection with nature means having a view to elements of nature, natural processes and living systems. The main purpose is to create an environment that helps people shift their focus which relaxes the eye muscles as well as reduces cognitive fatigue. A space with a good visual connection feels whole and captivating.

Based on research, some of the responses and benefits of viewing nature are improved concentration, more positive emotional performance and diminished stress levels. It has been reported that people recovering from stress responded in the following ways when exposed to views of nature; lowered blood pressure and heart rate, improved cognitive functioning, reduced attentional fatigue, sadness and aggression and improved attitude and overall happiness (Green,2014). This is particularly beneficial for people in workspaces.

Fig. 2.1: Sapient glass mills. (Source: Interior Architects, n. d.)

The figure 2.1 shows an office space with large windows that allow the occupants to see the trees and river outside. For more effective results, having a natural environment with a wide range of natural life is preferred to having a large quantity of natural land. Continual exposure to views of natural elements does not significantly reduce the viewer's interest for those views even if they have been exposed to them over long periods of time.

2. Non-visual connection with nature

A visual connection with nature has everything to do with the human sense of sight. A non-visual connection with nature, on the other hand, has to do with the other four human senses. It involves creating an environment that uses natural sound, scent, touch and taste to engage an individual with the intention of reducing stress and enhancing their health.

In one study, participants who listened to river sounds or watched a nature movie that had river sounds just before undertaking a task were reported to have more energy and greater motivation compared to the participants who only listened to office noises or silence. The human olfactory system processes scent directly to the brain and this can trigger strong memories. Traditionally, scents from oils were used to either relax or energize people. Scents from essential oils have a positive effect of the body's healing and immune system.

Fig. 2.2: A hand touching an animal shell on a wall. (Interface, n. d.)

The act of touching real living organisms, as shown in figure 2.2, has been shown to evoke feeling of relaxation due to the changes it triggers in the cerebral blood flow rates. A space with a good non-visual connection with nature should feel fresh and well balanced. The elements of the space should be various yet familiar, reminding individuals of how it feels to be outdoors. These four senses can be used separately although a combination of all of them will lead to intensified effects and the health benefits will be amplified as well.

3. Non-rhythmic sensory stimuli

The non-rhythmic sensory stimuli encourage the use of the natural sensory stimuli that constructively attracts an individual's attention and in doing so, allows them to increase their capacity to focus on a task by refreshing them from mental fatigue and other physical stressors. This is attained by designing momentary exposure to unpredictable movements, particularly for the peripheral vision.

Studies have shown that the human response to unpredictable movements of objects in nature leads to physiological restoration. For example, in an office, when an individual is sitting in front of a screen or doing any task within a short visual focus, their eye muscles become contracted and rounded. When the eye's muscles remain contracted for more than 20 minutes, they get fatigued which manifests as eye strain, physical discomfort or even a headache. A momentary visual or auditory distraction that will cause the individual to look up for more than 20 seconds to a distance of not less than 20 feet, will allow the eye muscles to relax, the lens to flatten and will give the individual a mental break.

Fig. 2.3: The Dockside green community. (Source: Green, 2014)

In a practical sense, this can be achieved by designing an environment, like the Dockside green community, with natural qualities like falling water, swaying grasses, flowers that attract insects so that the individual will hear them buzzing or even animals that are visible from windows, walkways and porches. It is about creating brief but welcome distractions.

4. Thermal and airflow variability

Thermal and airflow variability is about an individual's ability to experience the sensory elements of airflow variability and thermal variability within a space. The goal is to provide the user with control over their airflow and thermal conditions, this is by either use of individual controls or allowing the individual to access different ambient conditions within the space.

Research suggests that people enjoy an environment with moderate levels of sensory variability. An environment that lacks sensory variability and stimulation can lead to boredom and passivity. Even elements as subtle as a light breeze can greatly improve an individual's concentration. Changes in ventilation velocity leads to an increase of physical comfort without any negative effects on the cognitive functions. A variety of thermal conditions within a space result in better overall performance.

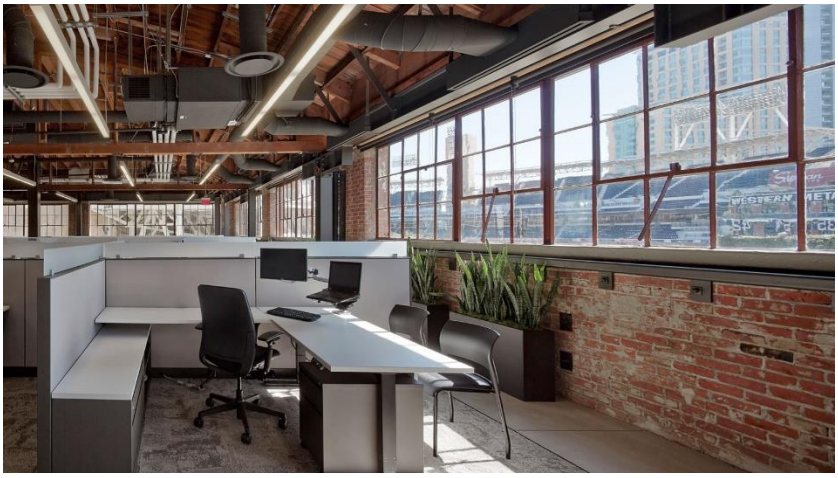

Fig. 2.4: Bumble Bee Foods. (Source: Interior Architects, n. d.)

This can be achieved by creating combinations of atmospheric temperatures, humidity and airflow, similar to those of outdoor environments while at the same time providing some sort of control over these elements. The designer can also provide materials with variable conductance, seating options (which can be outdoors or indoors) that allow an individual to experience solar heat gain or even close and accessible proximity to functional windows, as seen in figure 2.4, an image of the Bumble Bee Foods office space, which will allow the user to catch a breeze on a hot day.

5. Presence of water

The presence of water is a pattern that enhances the experience of a space by seeing, hearing or touching water. It focuses on maximising the multi-sensory attributes of water to enhance an individual's experience of a space by creating a space soothing, motivates contemplation, evokes positive moods and provides restorations from mental fatigue. For these effects to be attained, the water must be clean and unpolluted.

Environments containing water elements have been proven to reduce stress, increase feelings of tranquillity, lower heart rate and blood pressure levels as well as improve concentration and memory restoration. Research shows that landscapes with the presence of water lead to higher rates of restorations and are more preferred by people in comparison to spaces without any water elements.

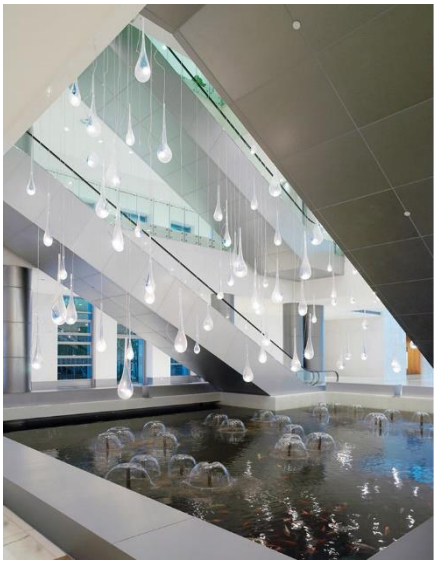

Fig. 2.5: Suzhou administrative building. (Interior Architects, n. d.)

Taking advantage of the sound of small scale running water and giving the user a chance to touch it will amplify the desired health benefits. The space in figure 2.5 is a good example of a maximised used of small scale running water. There are small fountains that produce the sound of falling water and the user has access to touch the water. Images of nature that include aquatic elements can lead to reduced blood pressure. Views of large water bodies or access to natural or designed water bodies will also result into positive physical and mental effects. Repeated exposure to water elements will not cause reduced interest over time, however long.

6. Dynamic and diffuse light

Dynamic and diffuse light takes advantage of varying intensities of light and shadow that change over time to create conditions that occur in nature. The main objectives of this patterns are two. First, to provide the users with lighting options that hold their attention as well as stimulate the eye in ways that promote their mental and physical wellbeing. The second is to help maintain the circadian system functioning. The circadian rhythm is the 24-hour internal clock in the human brain that regulates the cycles of alertness and sleepiness by responding to light changes in a person's environment.

Research shows that productivity is higher in well day lit work places and sales are higher in stores with good daylights. The sunlight changes its colour throughout the day; it is yellow in the morning, blue at midday and red in the afternoon or evening. The human body responds to these daylight colour transitions that occur. Higher content of blue light leads to the production of a hormone called serotonin whereas a lower content of blue light causes the production of hormone melatonin. The balance of these two hormones is directly linked to mood, alertness, sleep quality depression and other health conditions.

Fig. 2.6: IA's San Francisco's office. (Source: Interior Architects, n. d.)

Designing an environment with illuminance fluctuation, light distribution and light colour variability similar to that of the outdoor environment, that stimulate the human eye without causing any discomfort, will lead to an improved user quality of a space. Diffuse light on ceilings and other vertical surfaces provide a calm visual feel which leads to feelings of relaxation. The IA's office space, in figure 2.6, is a balanced mixture of natural and artificial lighting which creates a healthy well-lit room.

7. Connection with natural systems

A connection with natural systems means being aware of natural processes, especially seasonal and temporal changes that occur within a healthy ecosystem. The aim of this pattern is to elevate the awareness of natural properties and processes and in doing so, to improve the environmental stewardship of the natural ecosystems in which those properties and processes occur.

Although there is little documented research on this pattern, it is suspected that natural processes enhance positive health responses. Kellert and Calabrese (2015), explain that seeing and understanding the processes of nature can cause a shift in the perception of what is being seen and experienced. The temporal component of this pattern carries the most weight as it triggers a deeper awareness of a functioning ecosystem.

Fig. 2.7: Hines in Santa Ana. (Interior Architects, n. d.)

A simple way to create this pattern within a space is by providing access to existing natural systems within a space. For example, squirrels burrowing through the ground, running around and climbing trees or flowers blossoming, even trees shedding leaves and sprouting again during spring. The space, figure 2.7, is surrounded with flowers which allow people to observe how they change through their life cycle; how they fall, sprout and bloom. A space with good connection with natural systems evokes a relationship to a greater whole and increases the awareness of seasonality and nature's cycles and processes.

2.3.5 Natural Analogues

8. Biomorphic forms and patterns

Biomorphic forms and patterns can be explained as symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature. The purpose of this biophilic pattern is to design representational elements within a space that allow a user to make connections to nature. The result of well used biomorphic patterns is an environment that improves cognitive function as well as reduces stress.

It is proven that human beings have a preference for organic and biomorphic forms although scientists are unaware of the reason behind why. Since natural forms and patterns cause a shift in focus, they cause reduction of stress and an improvement in concentration. Even though the human brain understand that biomorphic forms and patterns are not living organisms, it sees them as symbolic representations of life.

Fig. 2.8: Conference Client London. (Interior Architects, n. d.)

There are two ways of applying biomorphic forms and patterns to a space; either as a decorative component of a larger design or as an essential part of a structural and functional design. The shelf, in figure 2.8, which mimics the form of a beehive an example of biomorphic forms applied as functional designs. A space with good biomorphic forms and patterns makes a person feel captivated, comfortable and quite interesting.

9. Material connection with nature

The material connection is about exploring the quantities and characteristics of natural materials which are most favourable for producing positive cognitive functions and physical results. It involves materials and elements from nature that have gone through minimal processing and therefore reflect the environments ecology and geology thereby creating a sense of place.

A study showed that different ratios of the amount of wood on walls in an interior space led to varying physiological effects. It was observed that in a room with moderate coverage of wood, about 45%, caused a decrease in the occupants' blood pressure and an increase in their pulse rate. However, a high ratio coverage of about 90% led to a decrease in brain activity. In another experiment, it was concluded that the exposure to the colour green before undertaking a task led to an improvement of creative performance.

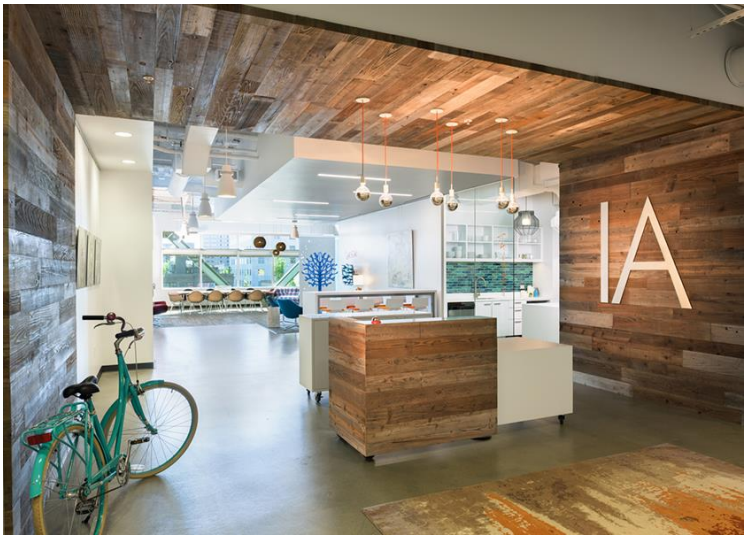

Fig. 2.9: IA's Portland office. (Interior Architects, n. d.)

Natural materials can be included in a space as either decorative or natural elements. They can be altered or extracted from their natural state. Good examples are granite countertops or a plank of wood. It could even be simply having raw wooden parts in a wall as seen in IA's Portland office. Environments with this patterns create an ambience or richness, warmth and authenticity.

10. Complexity and order

Complexity and order patterns involves providing symmetries and fractal geometries to create a visually satisfying environment that enhances a positive physiological and psychological response. It is defined as rich sensory information that follows a certain spatial hierarchy similar to those encountered in nature.

Research has reported that fractal geometries in nature are beneficial towards improving people's physical wellbeing. However, in a study, it was reported that overly complex designs and environments lead to psychological stress and even nausea. It was determined that the interaction of multiple wall patterns, complex patterns in carpets and seat fabrics caused these surfaces to appear to be in motion as the occupants walked through the space. As such, they led to extreme problems in visual perception and in turn led to increased stress.

Fig. 2.10: The British Museum. (Source: Lehner, 2018)

In a space, fractal geometries can exist at any place in any scale. They range from textile patterns to desktop trinkets or even a faced design. The glass dome of the British museum, figure 2.10, has a beautiful fractal geometrical pattern in its dome design. A design challenge in incorporating this pattern into a space is identify the fine line between an information rich environment that is interesting and relaxing and information surplus space that feels overwhelming and stressful.

2.3.6 Nature of the space

11. Prospect

Prospect is about having an unobstructed view over a distance for both surveillance and planning. The main aim of this pattern is to provide the occupants with a suitable condition for visually surveying and contemplating the surrounding environs for opportunity and hazard. In landscapes, prospect is defined as the view from an elevated position or across an expanse.

According to evolutionary psychology, people have a preference for habitats that are similar to the African Savannah since it is where human beings are believed to have evolved from. The Savannah has wide open terrain, clumps of trees with shades, calm grazing animal and evidence of human habitation. Some of the health benefits relating to prospect are reduced stress, boredom, irritation and fatigue, as well as a sense of improved comfort.

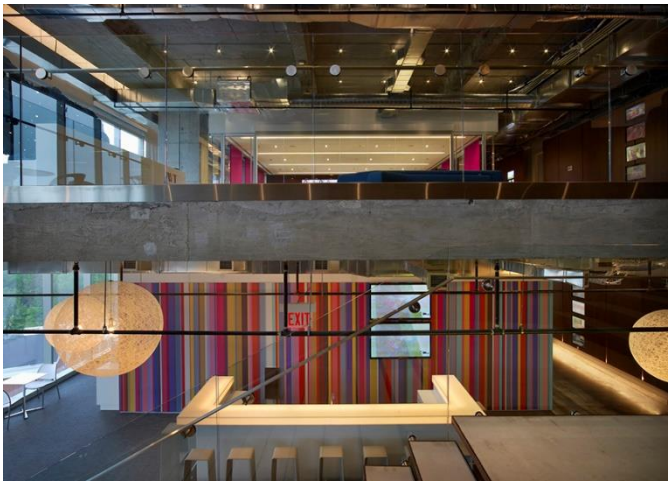

Fig. 2.11: JWT in Atlanta. (Source: Interior Architects, n. d.)

There are many ways in which prospect can be applied in a space. There is interior prospect and exterior prospect as well as short depth and high depth prospects. In interior spaces of dense urban spaces, prospect can be applied by creating an ability to see from one space to another. This can be amplified by creating clear distinctions between spaces and giving the user an opportunity to see through multiple spaces, as seen in the JWT in figure 2.11, which has been designed with transparent wall materials allowing the user to see through.

12. Refuge

Refuge means having a place of withdrawal, from environmental conditions or the main flow of activity, where the user is protected from behind or overhead. The main aim of this pattern is to provide occupants with an accessible and protective environment, a smaller space in a larger space, that facilitates restoration. The other aim is to limit visual access to that space of refuge.

Spaces of refuge are important for restoration and stress reduction. They reduce levels of stress and fatigue as well as enhance concentration, alertness and a perception of safety. In urban parks, the size of the park is not as important as the ability to be immersed into the space within conditions of enclosure that then lead to the feeling of restoration. In larger spaces, the refuge spaces are under trees or vegetation next to an open space. Most people prefer such spaces over others in a park.

Fig. 2.12: Hubspot in Cambridge. (Source: Interior Architects, n. d.)

In a space, refuge is not entirely closed but provides some contact with the rest of the surrounding space. The greater the number of protective sides, the greater the refuge condition. However, complete protection, that is protection from all for sides, is ineffective since the occupant will be completely detached from the rest of their environment. A good example is a seat in the bay window of a room. The seating space in Hubspot is a nicely enclosed space ideal for refuge.

13. Mystery

Mystery is attributed to a space where the user is motivated or compelled to move forward to find out what is around the corner. It is the partially revealed view ahead. It is the promise of more information ahead, achieved through partially obstructed views and other sensory elements, that lure the individual into travelling deeper into the environment, to explore other elements of the space.

This pattern is based on the idea that in a space, there are two needs to be met; the need to understand and the need to explore. Study shows that anticipatory situations cause pleasure responses. Mystery evokes strong responses of pleasure in the human brain, which is a similar mechanism to that of anticipation, which gives a hypothesized reason as to why people enjoy listening to music; because they will be guessing what may be around the corner.

Fig. 2.13: Maritime museum. (Source: Ryan, 2016)

A good mystery in a space can be achieved through obscuring boundaries or the portion of a focal point in a room or creating curving edges, as seen in the design of the corridors of the maritime museum, that slowly reveal a space as opposed to sharp edges. Dramatic shades and shadows within a space also bring in mystery. Mystery spaces are mostly located in corridors, pathways, indoor and outdoor plazas as well as other transitionary spaces.

14. Risk or peril

Risk or peril entails having a space with an identifiable threat but also a reliable safeguard. The objective of this pattern is to arouse an individual's attention and curiosity as well as refresh memory and improves problem solving skills. A space with good risk conditions feels exciting and with an implied threat.

Risk can be produced by a learned or natural response triggered by a near or present danger. However, this danger is immobile and unable to cause any harm. Having an awareness of a controllable risk contributes to positive experiences which are as a result of strong dopamine, which is the hormone responsible for feeling of pleasure. In adults, short doses of dopamine lead to improved motivation, memory and problem solving.

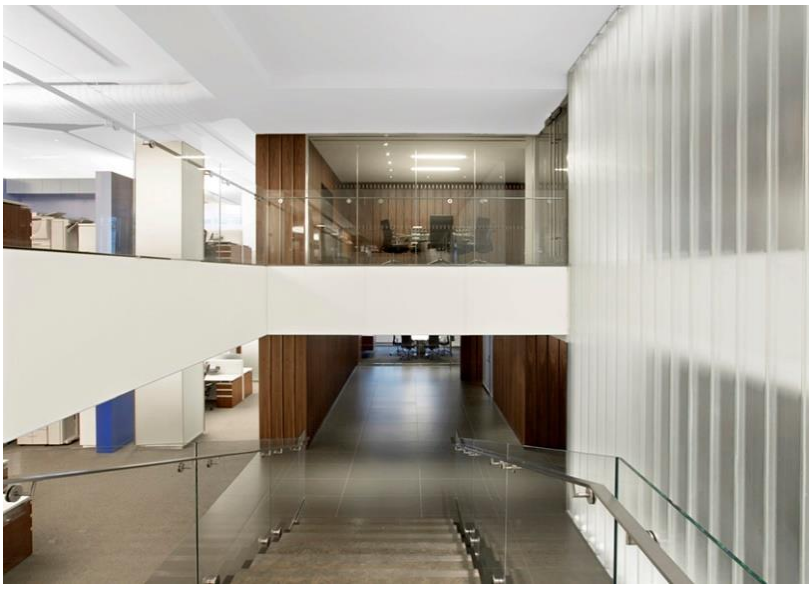

Fig. 2.14: JLL in New York. (Source: Interior Architects, n. d.)

There are different ways in which peril can be incorporated into a space. Viewing a predator in a zoo exhibit provides a sense of control. Rock hoping through a gentle water feature presents an individual with the risk of getting their feet wet. Glass railings on staircases allows the individual to see clearly see the height all the way down, figure 2.14. An extreme case may be a cantilevered walkway over a sheer cliff.

2.4 Asia's unique nature

In the 14 biophilic design patterns, the researcher will borrow heavily from biomorphic forms and patterns and this is where Asia's nature comes in. In comparison to other continents, Asia has the most mysterious yet fascinating natural elements. The researcher's inspiration drawn from Asia will include, but will not be limited to, its plant life. The researcher has identified five plants that they will be drawing inspiration from. These five plants will be highlighted and the researcher will point out what about them is inspiring their designs.

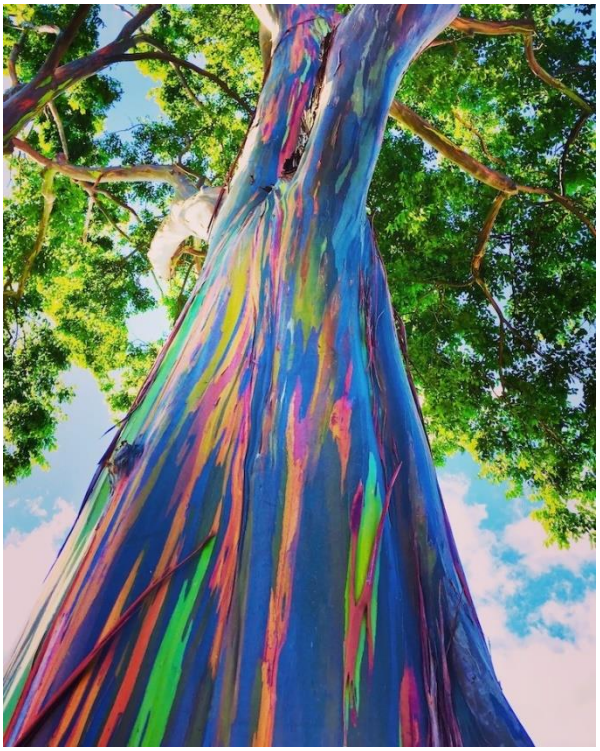

Fig. 2.15: Rainbow eucalyptus tree. (Source: Stewart, 2020).

The rainbow eucalyptus tree has a multi-coloured bark which makes it a spectacular sight to behold. The *Eucalyptus deglupta* grows in the Philippines, which is a country located in southeast Asia. The rainbow eucalyptus has a bark which slowly sheds over time, as it sheds it reveals different parts of the tree's bark. These first appear in a green colour but they change into different colours over time creating colourful striations (Stewart, 2020). The researcher will draw inspiration from the tree's multi-coloured bark as well as its multi-coloured wood.

Fig. 2.16: Ta Prohm trees, (Source: Patowary, 2011).

Ta Prohm is the name of an old abandoned temple, built in the late 12th and early 13th centuries. The temple is found in Angkor, Cambodia, southeast Asia. Ta Prohm tree is the collective name given to the two types of trees, silk cotton tree and strangler fig tree, whose roots have spread over, on and even in the temples old structures. These huge trees create surreal appearance which give the temple a queer atmosphere (Patowary, 2011). The researcher will be inspired by the form of the trees and how its roots spread all over the buildings.

Fig. 2.17: Wisteria plant. (Source: Lina, 2015).

The Wisteria plant shown in figure 2.17 is one of the oldest Wisteria plants in the world. It is found in the Ashikaga flower park in Japan. Although people assume the wisterias are trees, they are in fact vines. The vines can become quite heavy therefore the plant is supported by steel frames. The flowers of the wisteria tree that fall from the branches are so mysteriously beautiful. Wisteria plants have flowers of different colours, some purple, some lavender-blue, even white (Lina, 2015). The researcher will draw inspiration from the wisterias flowers and the plant as a whole.

Fig. 2.18: Arashimaya bamboo forest. (Source: Japan Info, 2015)

The Arashimaya bamboo forest in Kyoto, Japan, is one of the most calming places to be in Japan. The bamboo sway softly to the movement of the wind allowing the sunlight to softly pour into the pathways. The place is also very visually relaxing and appealing, no wonder it is one of the most photographed places in the world. The bamboo groves have grown to a height of 30 metres with a diameter of about 15-20cm (Japan Info, 2015).

The researcher will be inspired by a number of elements from the bamboo forest. One will be how the bamboo grooves neatly stand next to the pathways as if they partition the ways. Bamboo is also a good source of natural wood as it durable, flexible and sustainable, since it is fast growing. The ambience of the forest is also something worth of inspiration as it creates a serene ambience.

2.5 RENOWN DESIGNER

Oliver Heath Design is an architectural and interior design firm that creates sustainable spaces in the built environment. Their human centred design approach focuses on creating more prolific, healthier and enjoyable spaces through biophilic design. They work on various spaces that include hospitality spaces, educational spaces, offices and others within the built environment (Oliver Heath Design, n. d.).

Figure 2.19 and 2.20 show one of their projects, a space within The Garden School, Hackney, London. The Garden School is an educational institute for children with special needs, most of which are autistic. For this reason, having plants within the space might pose a threat to the children. However, biophilic design is much more than potted plants in a room.

Fig. 2.19: The Garden School. (Source: Oliver Heath Design, n. d.)

The hexagonal furniture with built-in sitting spaces has a biomorphic form, which mimics the structural form of a beehive. Its three enclosed sides create a good refuge space within the room. The windows are large allowing plenty of natural light to flood the room. The built in seats allow the children to view the natural world outside and they also act as additional refuge spaces. The primary material used in the room is natural wood which has been applied in just the right amount.

Fig. 2.20: The Garden School, (Source: Oliver Heath Design, n. d.)

The textured tiles at the corner as well as the wallpaper with trees, figure 2.20, create a natural fresh feeling as they are reminders of what it feels to be outside. In this space is a multi-sensory feature that the children can interact with. When any of the natural surfaces are touched, the LED light discs on the ceiling change softly and natural sounds are triggered (Oliver Heath Design, n. d.). This is a very clever application of the non-visual connection with nature pattern.

2.6 DESIGN EXEMPLARS

Under this heading, the researcher will highlight one project from two different design exemplars for the purpose of gaining a better practical understanding of how biophilic design can be applied to a space.

2.6.1 Selgas Cano Architects

Selgas Cano is an architectural firm based in Madrid. This firm designed an office for themselves that took biophilic design to another level. The offices are located in the woods

of Madrid and the space has been designed in such a way that the structure is immersed and surrounded by nature all around. The architects behind this projects are Spanish architects are Jose Selgas and Lucia Canoe (Montagud,2015).

Fig. 2.21: Selgas Cano office, (Source: Montagud, 2015)

This office in the woods has a curved glazed wall which is an advantageous feature in many ways. It allows the architects to have a direct view of their natural surroundings which in turn allows them to develop a connection with their natural system; as they observe the trees change in colour through the seasons. Natural lighting floods into the space as glass is transparent. This transparency also allows the architects to have good prospect as they see all the way through their surroundings.

Fig. 2.22: Selgas Cano Office, (Source: Montagud, 2015)

The interior of the office has a number of biophilic patterns applied. To begin with, there are a number of biomorphic forms. The entire structure of the office has a very organic shape as most of its corners are curved. The lantern near the wall, figure 2.22, as well as the shape of the book rack is also circular and curvilinear. The material used in the space is mostly wood and the colours in the space are orange and green which reflect the colour of the vegetation in their surroundings.

2.6.2 Tom Dixon Design

McCann Erickson's office in New York was designed by Tom Dixon Design. Their approach to biophilic design proves that it is possible to create a natural healthy environment without having to put in too much effort in making structural changes to a space. (Heath, 2015).

Fig. 2.23: McCann Erickson's Office, New York. (Heath, 2015)

The positioning and arrangement of the office desks allow users to maximise the use of natural light. That aspect in addition to the artificial lighting creates a healthy lighting system in the space. How the plants have been incorporated has made the space healthier in many ways. Plants are perfect for air purification which means the indoor air quality of this office is at its best. Plants are also sound absorbent and that means they minimise noise pollution and create a more serene workspace.

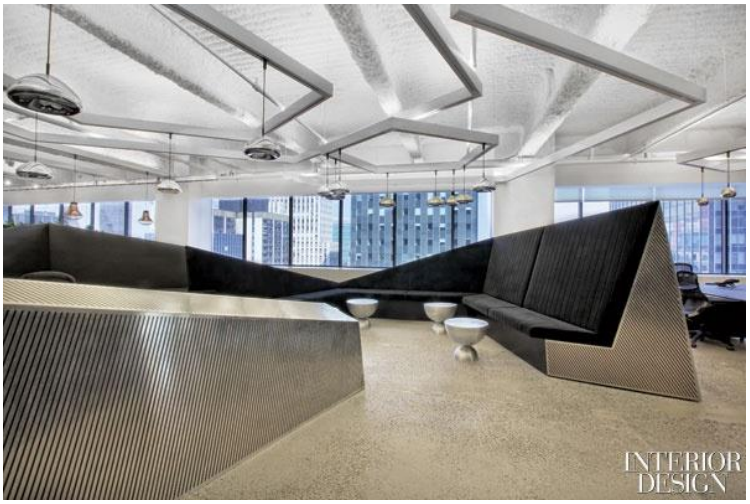

Fig. 2.24: Reception area, McCann's office. (Rubinstein, 2013).

The reception area at McCann's new office has captured a number of biophilic aspects. The beams on the ceiling are good examples of the complexity and order biophilic pattern as well biomorphic forms and patterns. The beams have adapted the hexagonal pattern of the beehive which can be considered a fractal geometry. Tom Dixon has managed to apply that biophilic element in the right proportion and amount in such a way that it isn't too busy for the eye.

The provided seating spaces carry that same flow of fractal geometry. In addition to that, the structure of the seat is a good refuge place within the space. From any sitting position in the seat, the user's view is covered from at least two sides which creates privacy even in such a public area and that is what makes it a suitable refuge space. Just like in the first space, the natural and artificial lighting are well balanced creating a healthy environment.

2.7 DESIGN PROCESS

A process is a series of actions, steps or operations used in making something or resulting in a certain desired result. Likewise, a design process is a sequence of creative problem finding and solving steps used by a designer to develop a suitable solution for a given client or project (Cheng, 2018). The researcher's design process involved a sequence of six steps; identifying the problem, research and data collection, brainstorming, generations of ideas, prototyping and refining of the design.

1. Identifying the problem

The first step of the design process was simply identifying the existing problems present at their site. In order for a designer to create something that is better and more efficient, they need to overcome the flaws that the existing design has. This begins by identifying these problems that require solutions (Rude, 2012). The researcher carried out this step and formulated a problem statement, which is a brief summary of the existing problems in the researcher's case study, Pawa254.

2. Research and data collection

The next step is collection of data and carrying out research. The collection of data helps the designer gain a better understanding of the problems. It is also essential in identifying the requirements, criteria and constraints, that the designer needs to consider as they design the space. Carrying out research is vital as it gives greater insight on the problem and allows the designer to gain knowledge about how the problem has been dealt with before (Rude, 2012). The researcher used qualitative data collection tools to obtain information and their research sources were both primary and secondary.

3. Brainstorming

Brainstorming is the process of creative free thinking and the production of ideas without being bound by restrains (Slater and Cory, 2003). This step simply means coming up with a number of possible solution or ways to improve the space (Rude, 2012). The researcher came up with a number of initial ideas which were presented in form of rough or thumbnail sketches.

4. Generation of ideas

The fourth step is the generation of ideas. In simpler terms, this step is a more detailed version of the brainstorming session. The designer chooses one or two ideas which were generated in the brainstorming session. These ideas are then developed further and expressed or explained in greater detail (Rude, 2012). The researcher chose some ideas and even combined others; these were represented in comprehensive sketches.

5. Building a prototype

A prototype is a rudimentary working sample, model or mock-up of the actual product based on which other forms are developed (Pahwa, 2017). This step is important as it gives the designer a rough visual of the final design. The designer then analyses the efficiency and practicality of the solution and looks for other opportunities to improve their design (Rude, 2012). The researcher built mock-models of the final pieces of furniture.

6. Refining the design

The final step involves making the final adjustments to the design. The design is refined to make it work more efficiently. After the solution is enhanced, the final idea is modelled and made (Rude, 2012). At this step, the researcher made the final working drawings which included orthographic projection, isometric or axonometric and perspective drawings.

2.8 CONCLUSION

The researcher has discussed the two main philosophies that the research is based on. The major philosophy of the research was biophilic design, where the researcher explained the 14 biophilic patterns. The minor philosophy was sustainability where the researcher focused on indoor environmental quality. The researcher then discussed two design exemplars and one design champion. The chapter concluded with a highlight of the design process.

CHAPTER 3

3.0 RESEARCH METHODOLOGY

3.1 INTRODUCTION

Research methodology specifies the logical development of the process used to generate theory. This theory indicates the framework within which a research is carried out (Haradhan, 2017). In this chapter, the researcher will discuss the research design. The sample and target population will be highlighted. The sample design will involve the sampling technique as well as a table presenting the population category at Pawa254. The researcher will then discuss their data collection, data analysis and the data presentation methods. A logical framework will be included in a tabular form.

3.2 RESEARCH DESIGN

According to Barbara (2006), a research design refers to the general approach that a researcher will choose to integrate different components of their research. This ensures that the entire research is done in a logical manner which then allows the researcher to effectively and adequately deal with the research problem. It forms the framework for the collection, analysis and presentation of data. In this research, the researcher used two main approaches in the research design; qualitative research and case study research design.

Qualitative research allows the researcher to understand the meanings that people attribute to a behaviour, action, opinion or interaction. It is designed to interpret the meaning behind an action or behaviour. Qualitative research seeks to answer the why question; why there exists a relationship between one variable and another. This research design investigates meanings, interpretation, symbols and processes (Crossman,2019).

The second approach the researcher used is a case study research design. A case study design involves an in depth study of a particular research problem rather than a general overall cover for a segment of research. It involves narrowing down a wide field of research into one single unit and thus allowing more in depth information (Jeane, 2003) The researcher's case study was Pawa254, Milimani, Nairobi.

3.3 POPULATION

A population is a complete set of individuals who all have common observable characteristics (Maina, 2012). The specific population in this research was found at Pawa254. The population entailed people from both genders; male and female. The age group is between 18-35 years and it encompasses the young working class population. The population consisted of three categories of members; permanent members, training members and visiting members.

3.4 SAMPLING METHOD

A sample is a small part of the population that is used as a representative of the whole. Sampling is the process of selecting respondents from a population so that from that sampled population, the researcher will be able to draw meaningful generalisation about the entire population from (Maina, 2012).

The researcher used purposive sampling to collect information from their respondents. Purposive sampling is a technique that involves choosing respondents who have the necessary information in relation to the specific objectives of the research. It allows the researcher to handpick the people with the required characteristics that the researcher is looking for. The specific purposive sampling technique the researcher used is homogenous sampling. It entails choosing a certain group of individuals because they all possess similar attributes (Maina,2012).

In the population at Pawa254, the category that the researcher chose is the permanent members. This is because they have been consistently interacting with the interior spaces at Pawa254. They have enough time experience with the space to know where the problems lie and the various effects of staying in that environment. The permanent members were fifteen in number. The table in the next page shows their population categories in terms of their departments represented in both numbers and percentages.

Table 3.1: The population category at Pawa254. (Source; Author, 2019)

Population category	**Number of subjects (frequency)**	**Percentage of actual sample**
Executive director	1	6.7%
Community department	2	13.3%
Human Resource department	1	6.7%
Administrative department	3	20%
Finance department	1	6.7%
Programmes function	4	26.7%
Communications	3	20%
Total	15	100%

3.5 DATA COLLECTION METHODS

Data collection is described as the process of gathering and measuring information on the variables of interest in an established and systematic way that enables the researcher to answer to the stated research questions and evaluate the possible outcomes. The main purpose of collecting data is to come up with answers which are obtained from raw data that is then transformed to meaningful information (Anastasia, 2017).

The researcher used qualitative data collection methods to gather information. This was done using both primary methods of data collection as well as secondary data collection methods. For the primary methods, the researcher carried out face to face personal interviews, non-participatory observation and taking photographs. Literature review was the secondary research method.

3.5.1 Primary data collection methods

1. Face to face personal interview

Also known as an in-depth type of interview, this method of data collection is effective because it is personal. It involves the researcher obtaining data directly from the respondent

(Anastasia, 2017). The researcher used a semi-structured interview approach which consisted of a series of open-ended questions which were then guided by whichever direction the respondent took. The researcher interviewed three random members at Pawa254. This research instrument allowed the researcher to explore experiences, views and opinions about the problems and general interactions of the population within the space.

2. Non- participatory observation

The researcher used non-participant observation method which involved observing without asking question or communicating with the respondents. This research tool allowed the researcher to understand the problem by studying people's accounts in their everyday context (Maina, 2012). The researcher observed the respondents at Pawa254 for about two hours as they went about their normal activities. This raw data was then recorded in form of short notes that the researcher wrote down as they observed.

3. Photographs

Photography gave the researcher an opportunity to get first-hand information that was void of biasness in terms of people's personal opinions and perspectives. This research method entailed taking pictures using a camera. These pictures included the existing spaces at Pawa254: their conditions and components, the population interacting with their environment and any other information relevant to the research.

3.5.2 Secondary data collection methods

4. Literature review

Literature review, also known as desktop review, involves using previously existing and reliable documents or other sources of documented information as a source of data for the research. These allow the researcher to gain a deeper understanding of the subjects being looked into. This research tools also offers the researcher different perspectives and opinions on the relevant subjects thus allowing them to make comparisons and contrasts

(Anastasia, 2017). The researcher chose this data collection method to gain a better understanding on the design philosophies and exemplars.

3.6 DATA ANALYSIS METHODS

Data analysis involves a range of processes and procedures whereby the researcher moves from the qualitative data that has been collected into looking for explanations and understanding the people, situations and problems that were being investigated (Bhatia, 2018). The researcher used qualitative data analysis methods. They included; narrative analysis, content analysis and photographic analysis.

1. Narrative analysis

Narrative analysis seeks to reconstruct stories given by respondents in different context and based on their various experiences and perspectives. The researcher sorts them out by understanding them, classifying them and presenting them in a clearer manner to the reader (Sunday, n. d.). This type of analysis was suitable for the interview.

2. Content analysis

Content analysis is the procedure of categorizing written data. The researcher then goes on to classifying, summarizing and presenting the information in a way that can easily be understood (Sunday, n. d.). This type of analysis was appropriate for the literature review and observation method.

3. Visual analysis.

This method of analysing photographs involves three main activities. They are description, reflection and formal analysis. These activities allow the researcher to easily draw out meaningful content from the images taken (The Getty, n. d.). This analysis method was used in understanding the data collected by photographing.

3.7 DATA PRESENTATION METHODS

Data presentation involves the organization of information into diagrams, images or another presentation method so that logical conclusions can be obtained from collected information (Ocenar, 2014). The researcher used qualitative data presentation methods. They entail; flow diagrams, photographs and reports.

1. Flow diagrams

This method of data presentation involves constructing flow diagrams that shows how a narrative evolved as the data was being taken. When a narrative is being told, it normally flows in certain paths of thought all the way until the end. Flow diagrams are suitable because they present a flow of thoughts, ideas or perspectives from the respondents rather that separate bits of information (Royal Geographical Society, n. d.). This was used to present the information from narrative analysis.

2. Photographs

This method was used to represent the photographs taken during data collection. It involved categorizing photos with the similar content and organizing it into segments for easier understanding. Photographs are visually interesting, carry a lot of data and present information in a simplified way making it easier to understand.

3. Reports

The information analysed through content analysis was presented in form of a report. The report presented the information in relation to what the researcher was looking for, what they find out and how the information obtained answered to the stated objectives of the research.

Table 3.2: Summary of data collection, analysis and presentation methods. (Source: Author, 2019)

Data Collection Method	**Data analysis methods**	**Data presentation method**
Face to face personal interviews	Narrative analysis	Flow diagram

Non- participatory observation	Content analysis	Report
Taking photographs	Visual analysis	Photographs
Review of existing literature	Content analysis	Report

3.8 LOGICAL FRAMEWORK

A logical framework is a strategical planning tool used by a researcher to provide and outline of a study's objectives, activities and the expected result at the end. This allows the researcher to have a systematic structure for the components of their research, the activities involved and how these two relate to one another (Collins, 2019). The following logical framework is structured after the four specific objectives of the researcher.

Table 3.3: Logical framework. (Source; Author, 2019)

1. To investigate the contribution of biophilic design in the creation of sustainable interior environments:

Data needs	Data source	Data collection	Data analysis	Expected output
Determining the precise roles played by biophilic design in sustainability	Literature	Review of literature	Content analysis	Knowledge on the exact input given by biophilic design in sustainability

2. To determine how the ideas and processes borrowed from biophilic design can be applied to make healthier interior spaces:

Data needs	Data source	Data collection	Data analysis	Expected output
To examine the 14 biophilic patterns and how they are applied to a space.	Literature Online sources	Review of literature	Content analysis Visual analysis	Understand the techniques for incorporating biophilic patterns in an interior space.

5. To identify the threats brought to the occupants at Pawa254 due to the state of their interior environments.

Data needs	Data source	Data collection	Data analysis	Expected output
Existing state of interiors at Pawa254 and their effects on people.	Existing space at Pawa254 Pawa254 employees	Photography Interview Observation	Visual analysis Narrative analysis Content analysis	Identification of the design problems at Pawa254 and their effects.

6. To propose biophilic design fused with Asia's unique nature as a suitable solution for developing a healthier environment at Pawa254.

Data needs	Data source	Data collection	Data analysis	Expected output
Propose design solutions for incorporating biophilic design and Asia's nature	Literature Existing spaces at Pawa254	Sketches Prototypes	Evaluation	Design solutions for incorporating biophilic design and Asia's unique nature for healthy

in Pawa254 through the designing of healthy indoor environments	Pawa254 employees			indoor environments at Pawa254.

3.9 CONCLUSION

In summary, the researcher has discussed the research design which sets the tone for the entire approach to research methodology. The population and sample design explain the who and the how in terms of data collection at Pawa254. The logical framework allowed the researcher to plan accordingly and to obtain the required information in an orderly sequence.

CHAPTER 4

4.0 SITE ANALYSIS, INTERPRETATION AND PRESENTATION OF FINDINGS

4.1 INTRODUCTION

This chapter entails the analysis of the researcher's site, in terms of its geographical location and climatic conditions which will include two graphs; a rainfall graph and a temperature graph of its region. The researcher will then interpret and represent the findings of the data collected. This information will be presented in three main ways; flow diagrams, reports and pictures under three forms of analysis which are narrative analysis, content analysis and visual analysis.

4.2 SITE ANALYSIS:

The researcher analysed the site in two ways; a climatic analysis and an analysis of the space at Pawa254.

4.2.1 Geographical analysis

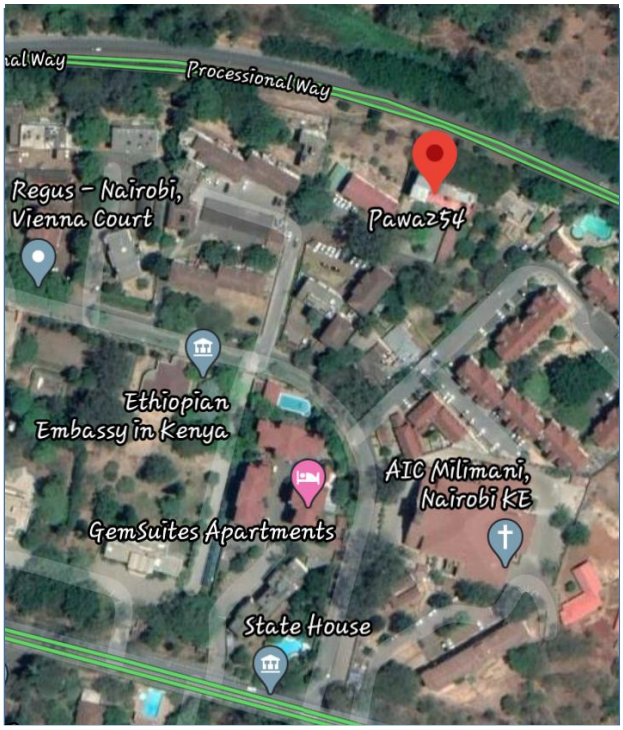

Fig. 4.1: Pawa254 location, satellite map. (Source: Google, 2020)

Pawa254 is located at the Africa Alliance of YMCAs building near State House Avenue road located in Upper Hill, Dagoretti constituency, Nairobi county, Kenya. It is 3 kilometres from the Central Business District, Nairobi. It is 2.1 kilometres away from University of Nairobi, Main Campus. This is a 28-minute walking distance from the same location. It is enclosed by Processional Way road on its side and State House road to its other side. It borders the Ethiopian Embassy in Kenya and neighbours the African Inland Church Milimani, Nairobi.

4.2.2 Climatic analysis:

Climate is defined as the composite or generally prevailing weather conditions of a region. There are a number of measurable variables that are considered to be climatic. For example, atmospheric pressure, temperature, wind, rainfall and humidity. However, the researcher will highlight two of these climatic variables.

Rainfall graph

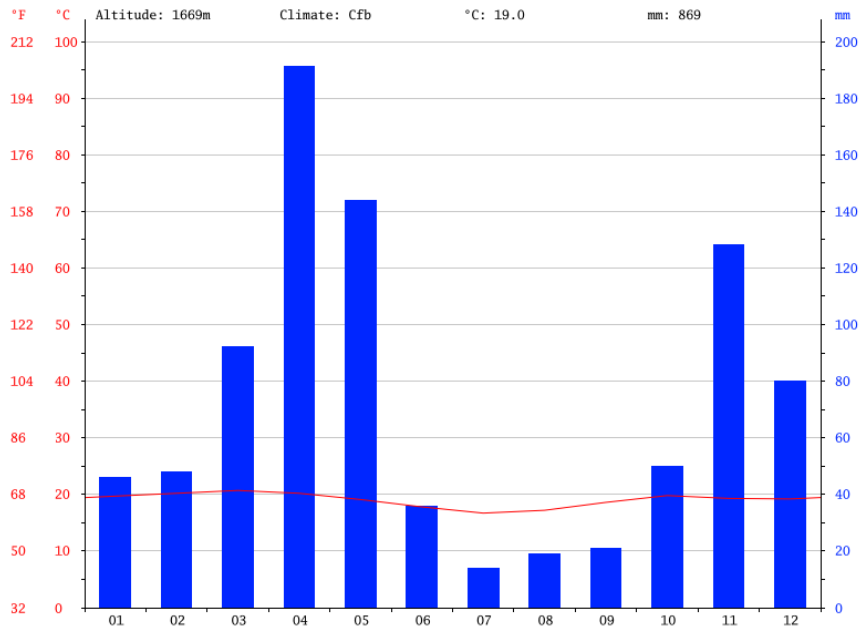

Fig. 4.2: A graph showing the rainfall amount, Nairobi. (Source: Climate-data.org, n. d.)

The graph, figure 4.2, represents the rainfall amount in millimetres over each month in a year. From the graph, it can be concluded that April is the month with the heaviest rainfall while July has the least amount of rainfall. The amount of rainfall ranges from approximately 190mm to 10mm per annum.

Temperature graph

The temperature graph, figure 4.3, represents the average temperature of Nairobi per annum. It can be concluded the February is the hottest month of the year while July is the coolest. When it is cold, the lowest temperature is about 12 degrees Celsius while the highest temperature is approximately 27 degrees Celsius.

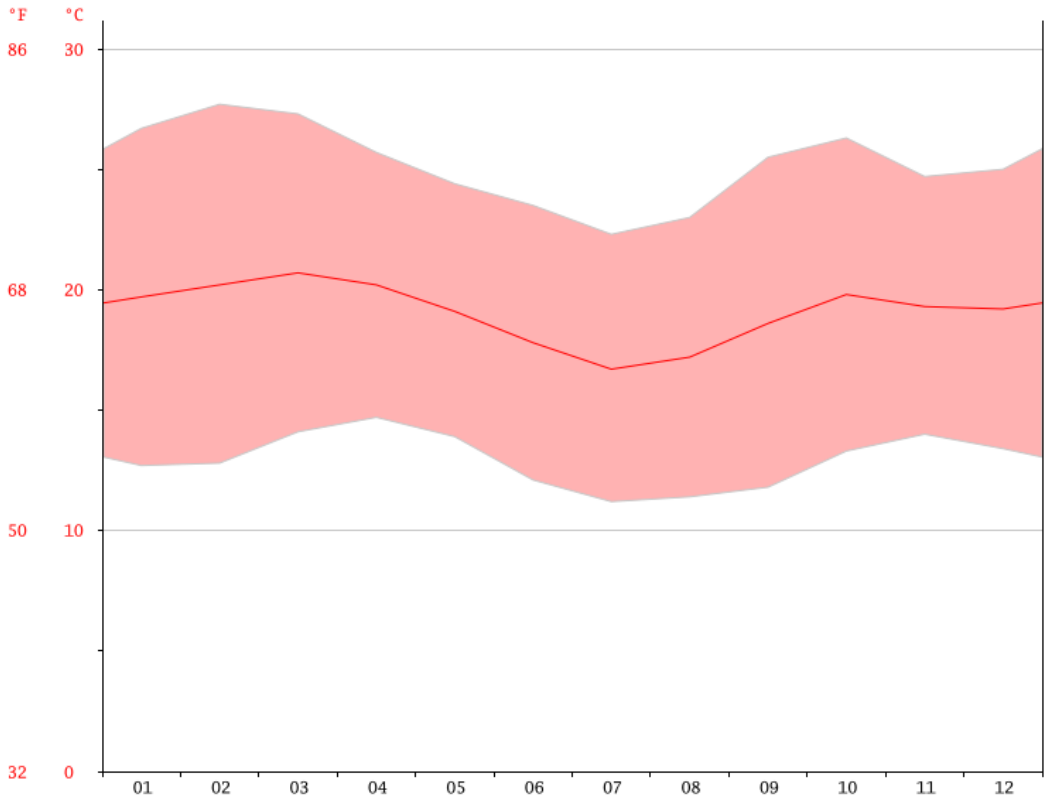

Fig. 4.3: A graph showing the temperature in Nairobi. (Source: Climate-data.org, n. d.)

4.2.3 Pawa254 building structure

Pawa254 located in the YMCA building which sits on a half an acre plot of land. The building has four stories out of which Pawa254 occupies two of these stories plus the rooftop of the building. The institution has five main spaces; the office space, the gallery, the theatre space, the rooftop and the garden. The building is surrounded with the Pawa254 garden at the back and parking space at the front.

The office space is an open plan layout which includes the working space as well as a mini-library, the floors are tiled and the walls are painted and partly covered in graffiti portraits. The gallery room is located on the rooftop. It is a rectangular room whose walls are covered in paintings. This space also has some jewellery and clothes for display.

The theatre space has carpeted floors, theatre seats and a stage. The rooftop is a multi-functional space. It consists of a mini-bar, a stage and a fish pond. Its half walls are covered in colourful graffiti. The garden is located behind the building. Its ground is covered in grass; the main trees are eucalyptus trees which are planted in close rows therefore their canopies provide complete coverage for the garden.

4.3 INTERPRETATION AND PRESENTATION OF FINDINGS

The researcher will analyse, interpret and represent the data collected from the site. Since this research is a qualitative research, the methods of analysis will be qualitative as well. The researcher will use three methods of qualitative analysis; narrative analysis, content analysis and visual analysis. These will be presented in form of flow diagrams, brief reports and visual analysis.

4.4 Narrative analysis

Narrative analysis seeks to reconstruct stories given by respondents in different contexts and based on their various experiences and perspectives. It has been used to analyse the information obtained from the three interviews carried out by the researcher. The information obtained has been presented in form of three flow diagrams and a brief report.

Interview 1:

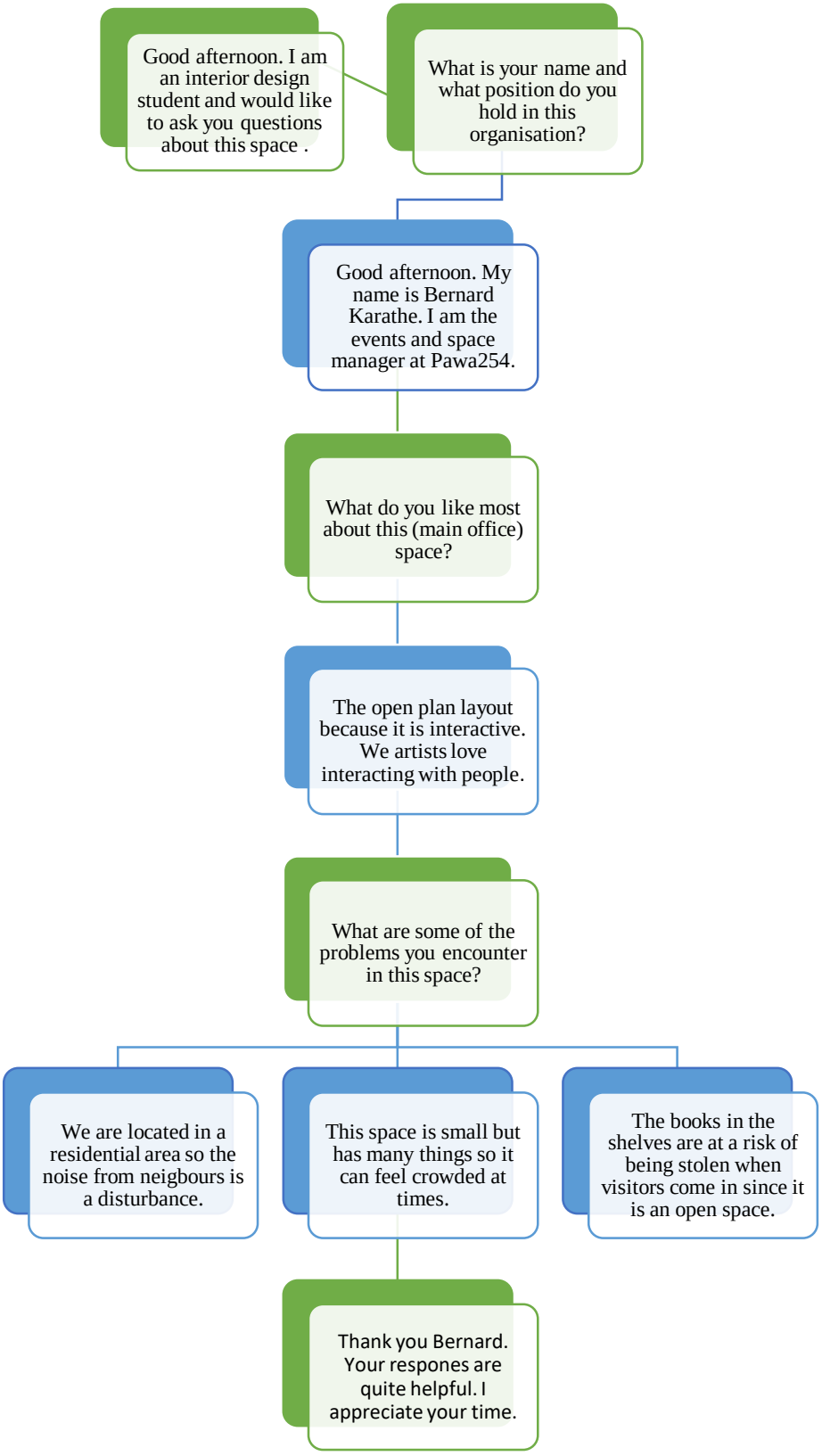

Fig. 4.4: A flow chart showing the first interview's conversation. (Source; Author,2020)

Interview 2:

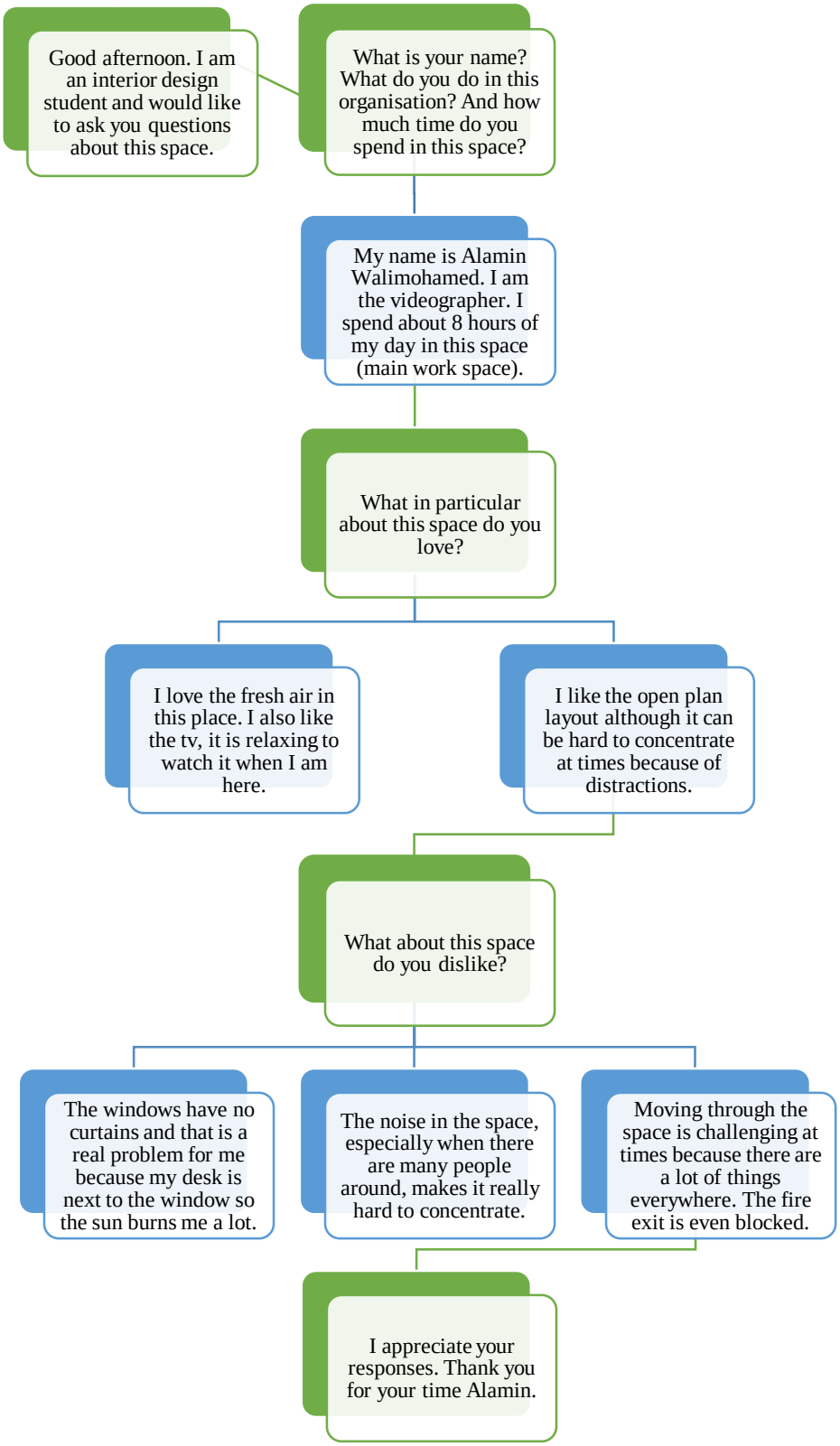

Fig. 4.5: A flow chart showing the second interview. (Source; Author, 2020)

Interview 3:

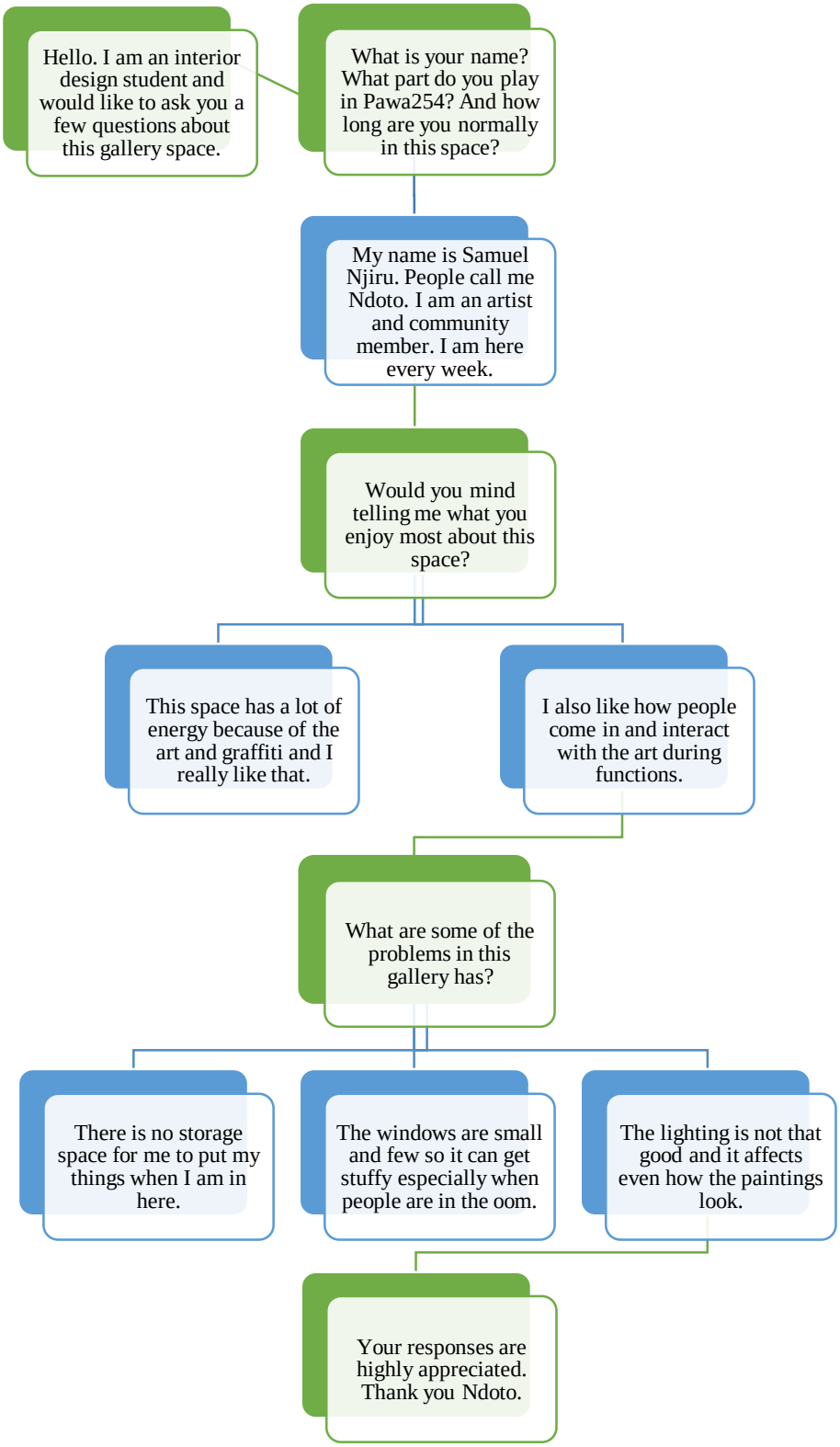

Fig. 4.6: A flow chart showing the last interview's conversation. (Source; Author,2020)

From the information obtained from the three respondents, the researcher came to the following conclusions. The open plan layout was both an advantage and a disadvantage to the occupants. The advantage was that the open space allowed the occupants to interact more freely which is something that most artists enjoy. The space being open plan also made it feel airier since it improved the overall air circulation in the room. The disadvantage was that it hindered the occupants from having privacy which was something that was much needed at times.

The problems that the occupants experienced in the space outweighed the benefits. One of these problems was the bad acoustics. The space is open plan and facilitates a number of different functions. For this reason, there is a lot of noise in the space especially when some of these functions are happening simultaneously. For example, when there is a book club in the space and the occupants are working on their desks, the noise is inevitable.

Another problem is the cluttering of the different components of the space. The space is small with many functions, elements and furniture, this results in overcrowding. That problems creates another problem which is a poor space flow. Most of the pathways are blocked when the space is in full use and it becomes difficult to move around. In front of the fire exit, there is a round table that completely blocks the entire door. This can be dangerous in times of emergency. There windows have no curtains or blinders. This creates problems on sunny days as the sunlight directly falls on the work desks near the windows, disrupting the occupant's ability to work well.

4.5 Content analysis and visual analysis

Content analysis is the process of categorizing written data. The researcher will use this analysis method to analyse what was observed in Pawa254. This analysis will be presented in form of brief reports which will highlight what was observed in the different spaces. Visual analysis has been applied in the analysis of photographs. This analysis will include photographs of the space and brief reports about those spaces. These two analysis methods will be used together.

4.5.1 Interior architecture

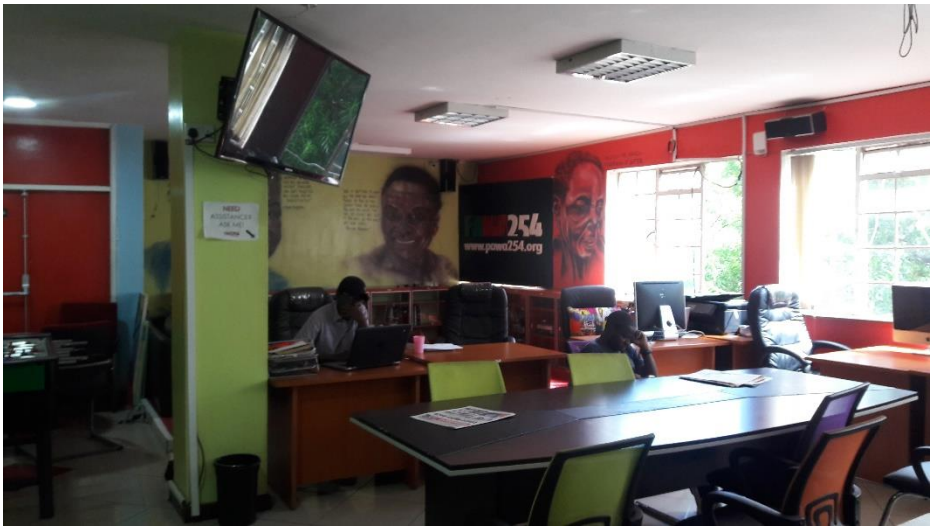

Fig. 4.7: The main work space, Pawa254. (Source; Author,2019)

It was observed that the main work space at Pawa254 had a number elements that posed a threat to the health of its occupants. To begin with, most of the walls are covered in graffiti, figure 4.7, paintings which contain adhesives which pose a serious threat to the indoor air quality of this space.

A healthy space use both natural an artificial lighting to create a healthy lighting sysytem. This is not the case for the above space as half of the room is well lit due to natural light whereas the other end is much darker. This disparity should have been dealt with by the artificial lighting however this has failed to happen.

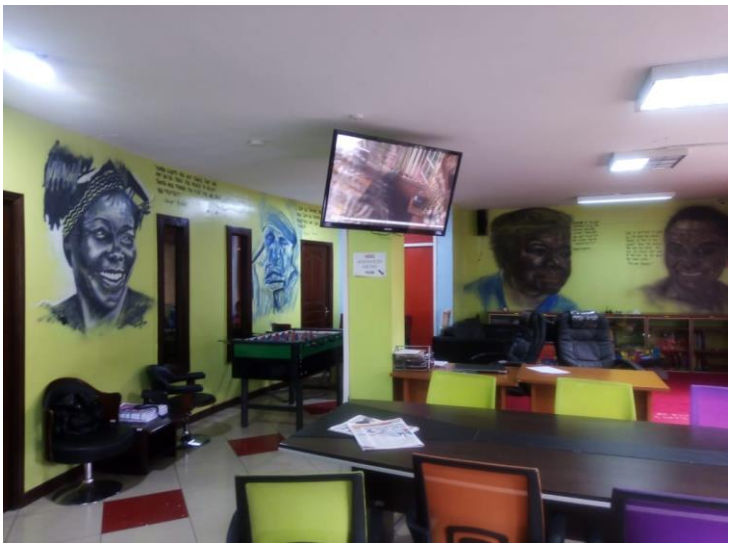

Fig. 4.8: The main work space, Pawa254. (Source; Author, 2019)

A healthy space is one that works to the benefit of the mental and physical health of its occupants. As seen in figure 4.8 the space is clustered and this creates a stressful environment for the occupants. Stress causes mental fatigue which affects the occupants productivity in the space.

Noise is one of the contributors of an unhealthy environment. In the space in figure 4.8 there are many elements that create noise. There is a television in the workspace which creates unnecessary noise when people are working. The discussion table is at the center of the work desks. This causes acoustic problems when there is an ongoing discussion yet there are people working on their desks.

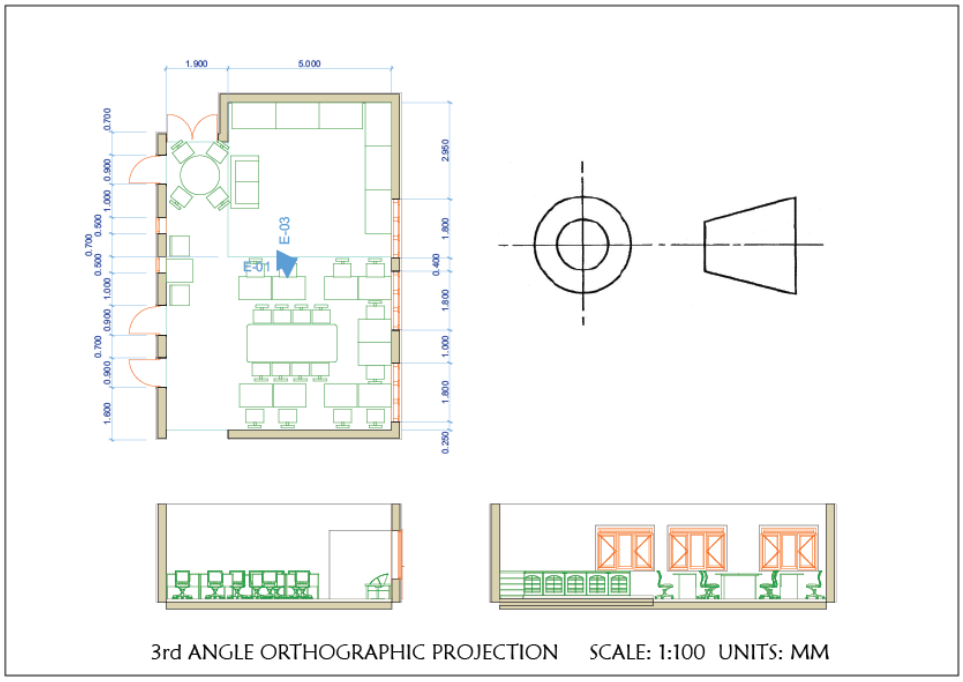

Fig 4.9: Orthographic projection of the main office space. (Source, Author, 2020)

The figure 4.9 is an orthographic projection that includes a floor plan and two elevations of the existing offfice space at Pawa254. The space includes both the office space where the work desks and chairs are as well as a section where the organisation holds their weekly book club. As seen, the flow of movement through the space is cumbersome due to the arrangement of furniture. The space shares many functions without partitioning.

4.5.2 Exhibition and display

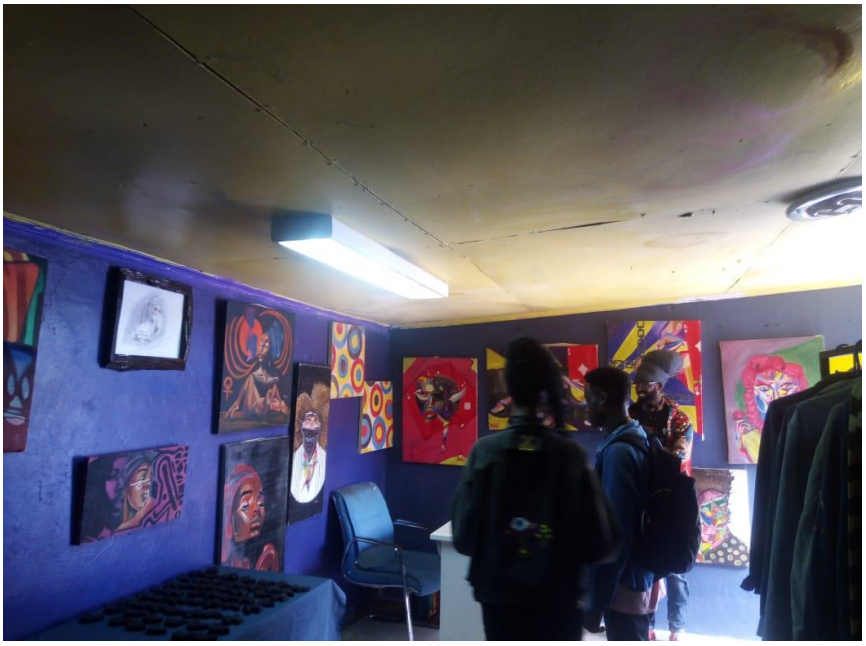

Fig. 4.10: The gallery space at Pawa254. (Source;Author, 2019)

One of the most important elements when it comes to exhibition and display is lighting. Proper lighting is good for both the occupants and the items on display. In figure 4.10, the lighting in the space is inappropriate for a gallery. The lighting ought to have be focused on the paintings but that is not the case. In addition to this, the light bulbs are few causing some spaces to be darker compared to others.

Fig. 4.11: The gallery room, Pawa254 (Source; Author, 2019)

The flow of movement in a gallery is another important element. It directs the viewers through the space and allows them to comfortably look at the items on display. It was observed that one of the setbacks in the gallery space, as seen in figure 4.11, is that there are a lot of uneccesarry items that are lying around that disrupt the flow of the gallery. In addition to that, they occupy a lot of space that would have been better utilised. The figure 4.12 below shows the orthographic projection of the space that clearly highlights some of the problems mentioned earlier in this paragraph.

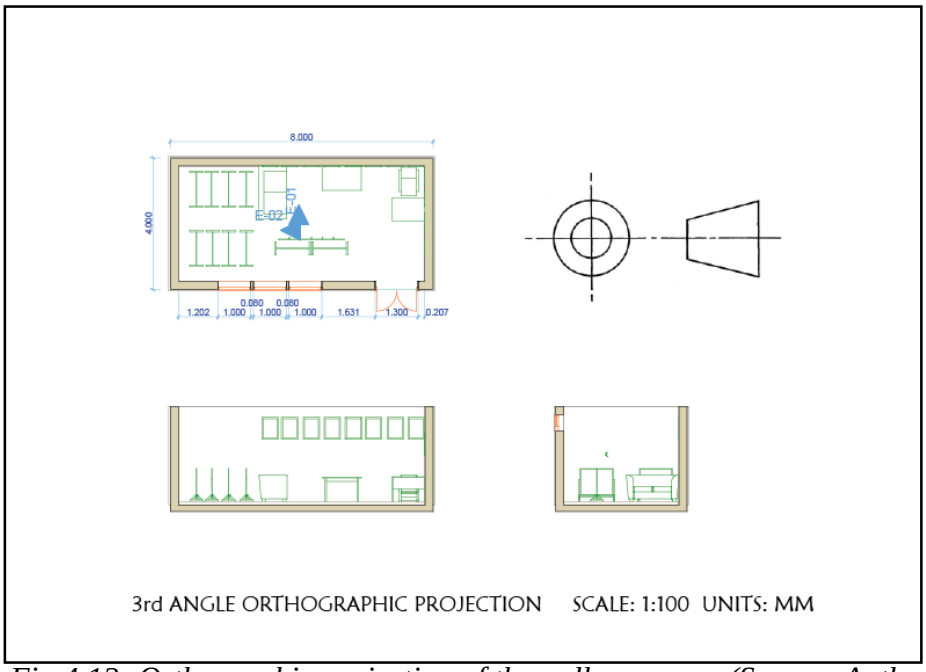

Fig 4.12: Orthographic projection of the gallery space. (Source, Author, 2020)

4.5.3 Furniture

Furniture ergonomics is important for a healthy workspace. Physical discomfort due to poor ergonomics is one of the contributors of physical health complications among workers. The office desks, as seen in figure 4.13, are smaller than average. Therefore, the users are unable to properly turn around when sited or even stretch their legs. In addition to this, they lack storage cabinets which are quite convenient for an office desk.

Fig. 4.13: Office desk in the mai workspace, Pawa254. (Source; Author, 2019)

When it comes to office chairs, the extent of comfort is determined by the adjustability of the chair. In the figure 4.14, the office chairs are inflexible, the tilt of the backrest is fixed, the seat doesn't swivel around, the height of the chair too is fixed. This can cause physical discomfort or strain as the occupants use them.

Fig. 4.14: Conference table in the work space, Pawa254. (Source; Author, 2019)

The position of a piece of furniture in a room is as important as its ergonomics. In figure 4.15, the conference table has been placed in the middle of the office desks. It was observed that this creates a problem in the space because when the conference table is in use, there is no space for people to move around within the space. In addition to this, there are pieces of furniture place in door entrances or exits. For example, the two waiting area seats and table on the left are right in front of a door while the round table on the top left corner is blocking an emergency exit door.

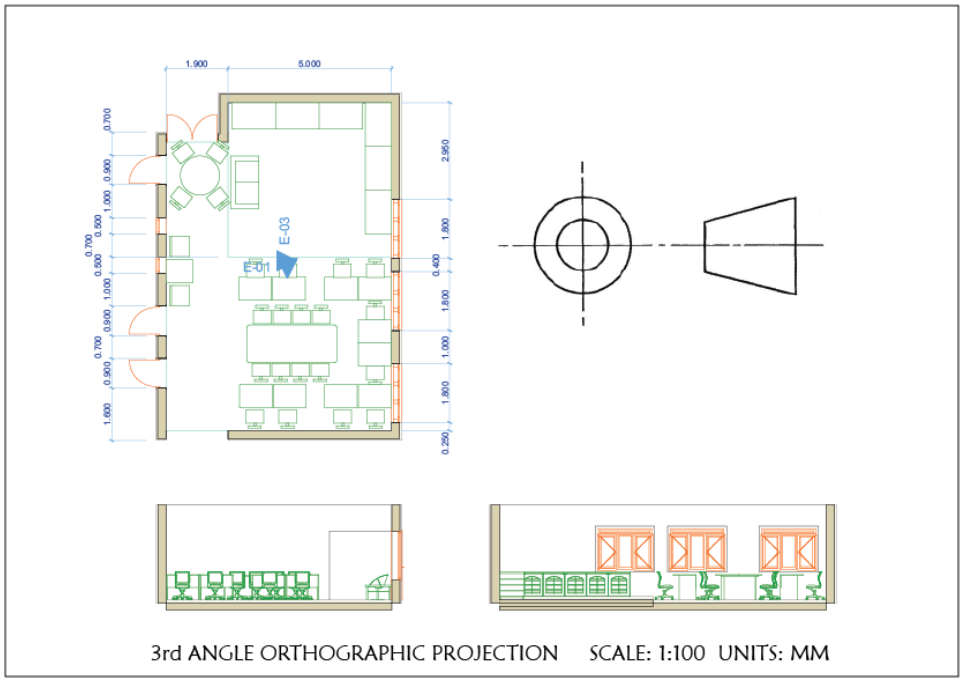

Fig 4.15: Orthographic projection of the main office space. (Source, Author, 2020)

4.5.4 Landscape

Figure 4.16 is a photograph of the garden at Pawa254. One of the main provisions that a recreational garden should have is seating space. The garden is lacking some outdoor furniture where people can sit on to interact better with the outside environment. The pathways limit the user's interaction with the garden as they are short and positioned on the edges of the garden space leaving most of the space in the middle empty.

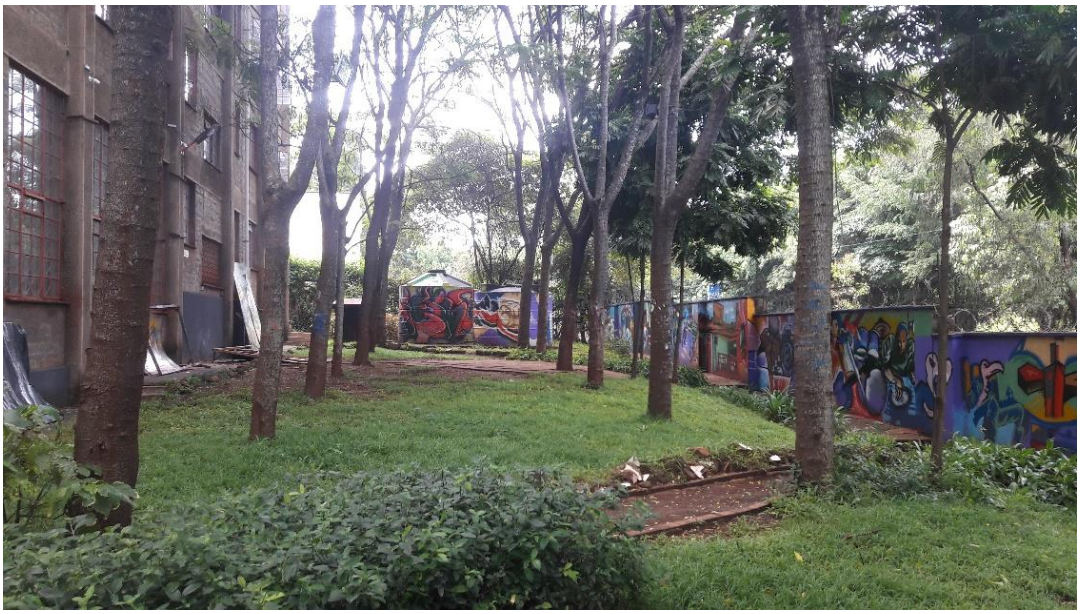

Fig. 4.16: Garden, Pawa254. (Source; Author, 2019)

The parking space at Pawa254 is missing some important elements. There are no walkways therefore pedestrians are forced to walk in the parking spaces to access the building. The parking space lacks racks for bicycles and bikes to be parked. There are no restroom facilities which security officers or even visitors can access when outside.

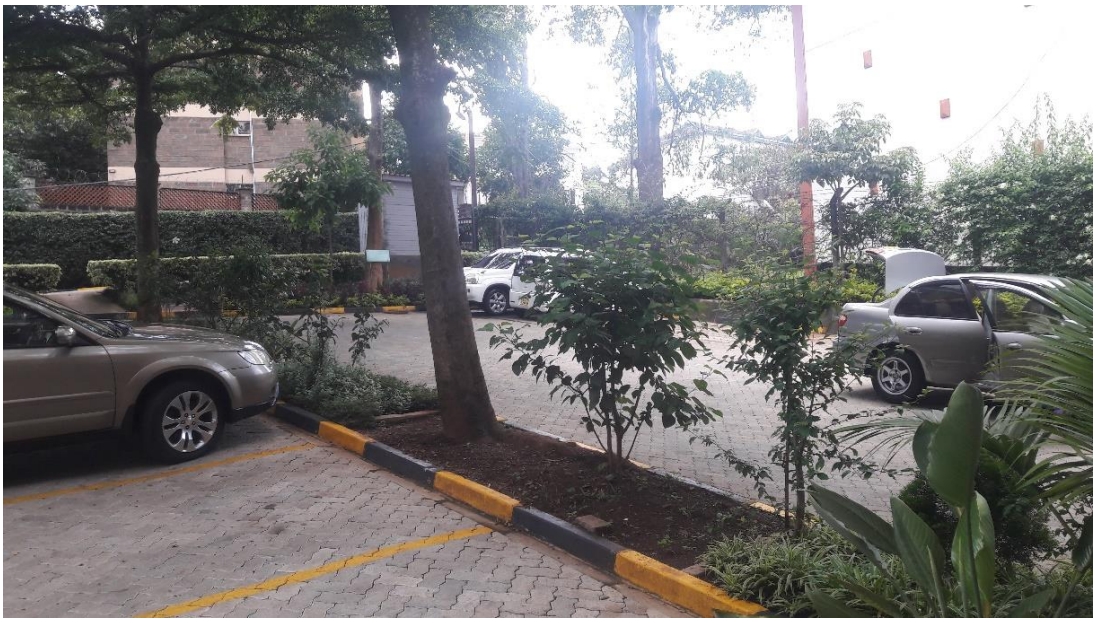

Fig. 4.17: Parking space, Pawa254. (Source; Murungi, 2019)

4.6 CONCLUSION

In summary, the researcher has analysed the site in two different ways: a climatic analysis and an analysis of the building's structure. The researcher then interpreted the data collected from the site. This information has been presented through flow charts, photographs and brief reports.

CHAPTER 5

5.0 SUMMARY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, the researcher will provide a summary of the data collected and analysed as well as a highlight of important findings in the research. This will be followed by relevant recommendations that can be applied in the Interior Architecture, Exhibition and Display, Furniture and Landscape to create environments that are sustainably healthy. This chapter will close with a comprehensive conclusion as well as suggestions for further research.

5.2 SUMMARY OF DATA ANALYSIS AND FINDINGS

The researcher discussed that one of the main considerations of a sustainable environment in the context of interior design is whether that environment offers surroundings that promote the health and well-being of its occupants. The researcher then focused on IEQ as an emphasis point in the designing of healthy environments. As per the research, biophilic design was found to be an effective approach in the creation of healthy sustainable environments. By designing a space through the application of the biophilic patterns, the space will be automatically healthy and in turn sustainable.

According to the analysis of the data collected from the site, Pawa254, which is presented in chapter four, it was observed that a number of elements were a great hindrance to the health and well-being of the occupants. Some of them included having inadequate lighting in the office space, poor ventilation in the gallery space, lack of privacy in the workspace because of an office plan that is completely open space, poor ergonomics of the furniture, just to mention a few.

According to the findings from primary research in chapter one, some of these undesirable effects have been proven to have a negative impact on the health of its occupants. For example, in a survey done by Canada Life, employees who worked in an open plan office spaces took 70% more sick days than those who worked from home. The reason for this is

an open plan layout makes it difficult for people to concentrate and this harbours dissatisfaction and a stressful work environment (Landau, 2014). Inadequate lighting, especially dim lighting causes people to have a low morale in whatever task they are undertaking which in turn drags down their motivation. In addition to this, it slows down the process of creativity and creates a general sense of negativity in the workplace (Annualleave,2017). The list of adverse effects caused by those elements goes on.

From the findings obtained from the literature review in chapter two, it is agreeable to say that biophilic design is an effective approach for the creation of healthy environments. It is an approach that has been tested and proven. For example, based on research, some of the responses and benefits of viewing nature are improved concentration, more positive emotional performance and diminished stress levels. People recovering from stress responded in the following ways when exposed to views of nature; lowered blood pressure and heart rate, improved cognitive functioning, reduced attentional fatigue, sadness and aggression and improved attitude and overall happiness (Green,2014). By simply allowing people in a workspace to view natural elements, for example a potted plant, they experience more mental and physical benefits.

5.3 RECOMMENDATIONS

The practice of biophilic design is about the application of different biophilic design strategies, which are also known as patterns. For the effective application of biophilic design, the designer needs to stick to the principles of biophilic design application. It is of importance to know that biophilic design should never occur in a disjointed manner, rather in a way that all these diverse elements complement one another creating an overall integrated ecological whole (Keller & Calabrese, 2015).

Similarly, the researcher will apply components and parts from the 14 patterns of biophilic design. Although some patterns will be more prevalent than the others, the researcher's goal is to end up with a coherent and harmonised result that will give the occupants at Pawa254 a comfortable and healthy experience of their space.

5.3.1 Furniture

The researcher will create a healthy environment through furniture in mainly two ways. First by choosing materials that are promote biophilic design as well as forms and colours that mimic natural elements. According to Green (2014), when it comes to materials, using natural materials that have gone through minimal processing creates a sense of serenity in a space as they mimic the natural environment's geology and ecology. Similarly, forms and colours that are derived from nature become representation elements that enable the occupants to make connections with nature.

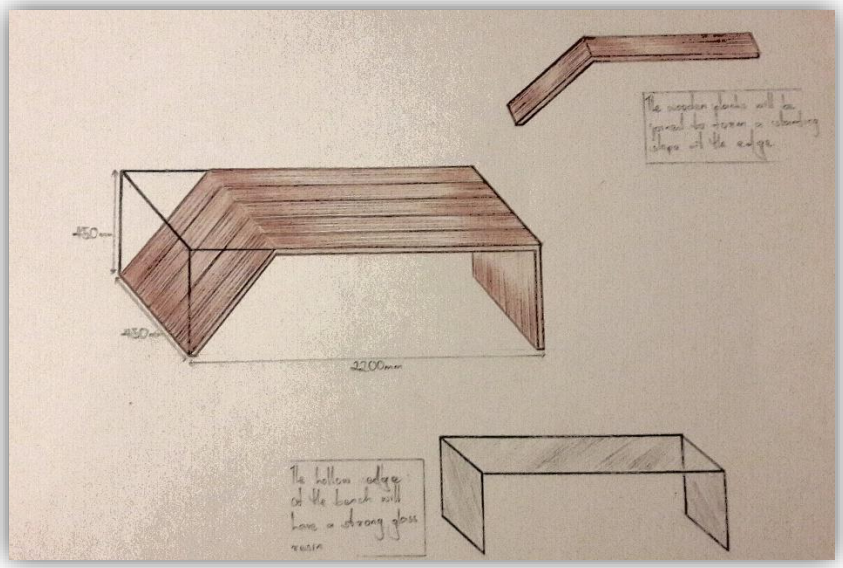

Fig. 5.1: A sketch of a wooden bench. (Source; Author, 2020)

In figure 5.1, the bench will be made from natural wooden material. However, unlike most wooden surfaces today, this surface will not have undergone through many chemical processes that will have stripped its natural elements away. These will simple be planks of wood that will have undergone minimal processing. So by simple looking at it visually, a user can make a connection to the natural wooden elements found in nature.

Another advantage of using natural surfaces is they seize to become a threat to the indoor air quality within a space. Wood preservatives are high emitters of VOC's which are one

of the main pollutants in an indoor environment (Demaria, 2018). When choosing furniture that has gone through minimal processing, the threat of air contamination is eliminated.

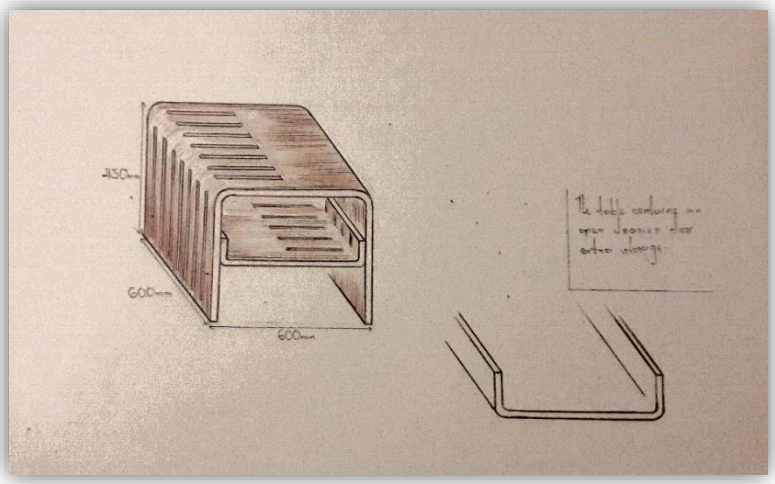

Fig. 5.2: A sketch of a reception waiting table. (Source; Author, 2020)

The figure 5.2 above is that of a reception waiting table sketch. The main function of the table is to hold magazines that can be read by visitors in the waiting area. The table is also made from natural wood that has undergone natural processing. In addition to this, the vertical and horizontal lines are open spaces that have been inspired by the rainbow eucalyptus flowers whose flower parts resemble many stick like lines. Although the sketch does not show clearly, this waiting table will be made from the rainbow eucalyptus wood which looks like any other natural wood only that it is multi-coloured. The figure 5.3 below, represents a clearer image of the multi-coloured wood.

Fig. 5.3: Rainbow wood bowls. (Source: The Pioneer Woman, 2010)

5.3.2 Interior Architecture

Under this area of specialisation, the researcher's aim is to create an atmosphere that feels like a natural environment. This will be achieved in many ways as there are many elements under consideration in the space. Some of the ways the researcher will incorporate these natural elements is through the use of natural colours, textures, patterns that mimic nature, materials and even lighting.

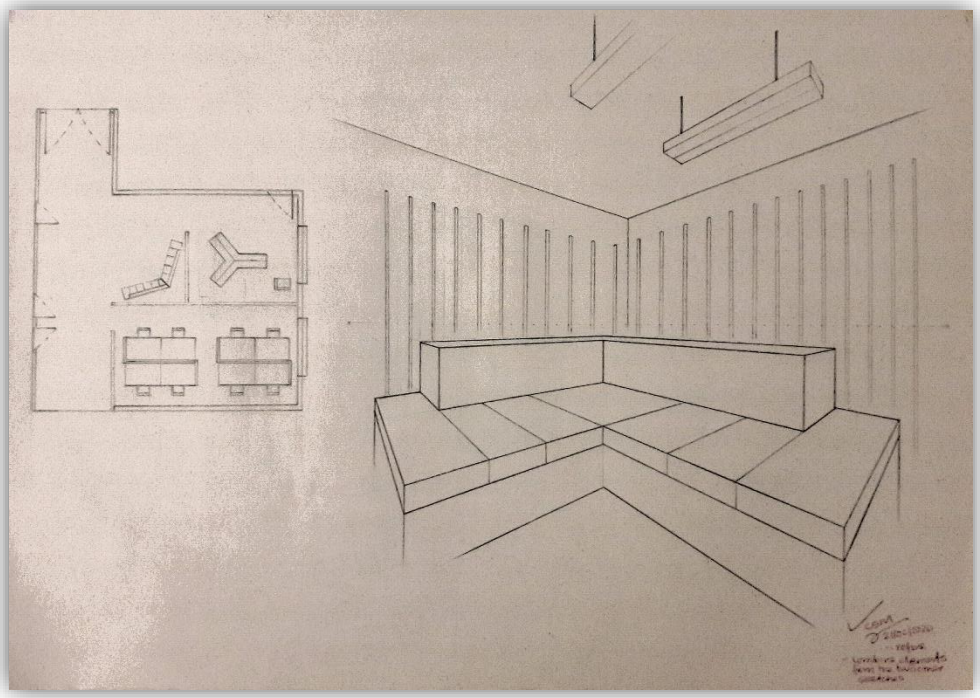

Fig. 5.4: A sketch showing the waiting area. (Source: Author, 2020)

The figure 5.4 shows a sketch of a part of the waiting area. The wooden partition at the back will be made from bamboo wood. This has been inspired by the Arashimaya bamboo forest of Japan where the bamboo groves stand next to the pathways. The colour of the partitions will be pastel green, almost similar to the actual colour of the bamboo groves. The wooden partitions will trigger memories of the bamboo forest while at the same time providing privacy without inhibiting the free movement of air within the space.

The sofa which will provide seating for the visitors will have its upholstery partly covered in a fabric that has the rainbow eucalyptus patterns and colours. This organic and lively fabric will create a warm, welcoming and feeling in the space.

The general outlook of the office space will mimic the natural outside environment outside, a forest environment to be specific. This will be incorporated into the space by having dark hardwood floors that resemble the dark brown colour of the ground, a neutral colour for the walls and a brighter colour for the ceiling to create that feeling of a bright blue sky or white clouds. This way, the whole room will have a serene fresh atmosphere like the feeling one has when outside in a forest.

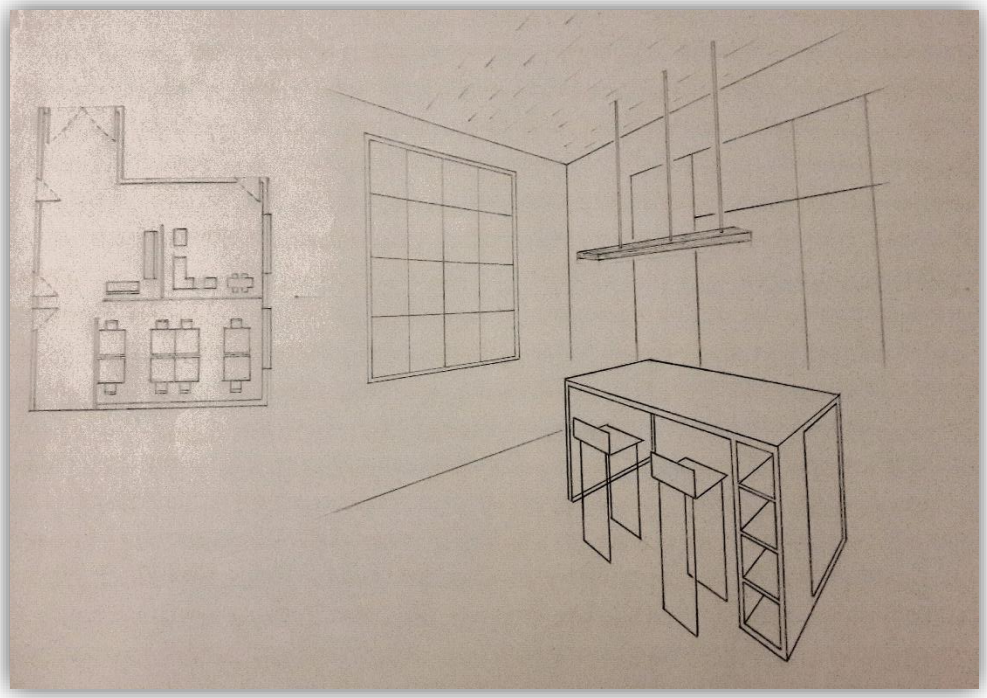

Fig. 5.5: A sketch showing part of the lounge area. (Source; Author, 2020)

Figure 5.5 above is a sketch of a section of the lounge room area. This is where the occupants of the space can relax or work from when they want to be in a more relaxing and less formal environment. One half of the room will have a comfortable couch with an ottoman while the other half has a high working table with two high stools. The space will have plants and plenty of light.

In this space, the researcher will take advantage of the natural light and balance it well with artificial lighting. This way the space will have a good lighting system that will allow the occupants to have a calm visual feel which will lead to feelings of relaxation.

5.3.3 Exhibition and Display

In exhibition and display, the researcher will focus on two aspects that are important in a gallery space, the flexibility of the space and the lighting. The researcher will create a calm refreshing natural atmosphere. The walls will be painted in the colour and texture of the white wisteria flowers. Since the white wisteria is white in colour, the walls will still remain neutral which is important for an art gallery.

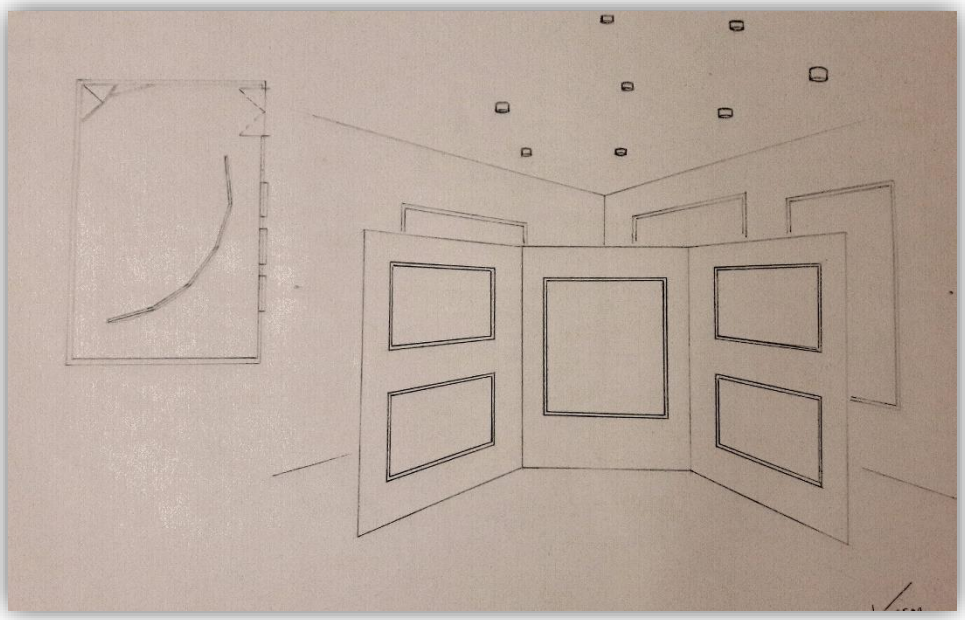

Fig. 5.6: A sketch showing the gallery room at Pawa254. (Source; Author, 2020)

The image in figure 5.6 above shows a sketch of the art gallery of the researcher's site. The researcher will use panels, which are already existing in the space, to create more room for the exhibited art and also to increase the flexibility of the space. The existing panels at the site have graffiti drawn on the front side while the other side of the panel is blank. The researcher will put wallpaper, similar to the white wisteria paint on the wall, on the blank side of the plank so that the panels blend in with the rest of the walls. The researcher will add rollers on the underside of the panels to increase their mobility.

The choice of lighting for the gallery space will be ceiling- mounted accent lights. One of the best ways of illuminating artwork is through spot lights that direct light onto individual artworks. This type of lighting allows the direction of the light to be adjusted and the range

of the light-beam spread can as well be specified (McKeough, 2018). The figure below shows a clearer image of ceiling mounted accent lights.

Fig. 5.7: Ceiling mounted accent lights (Source: Experiential Ideas, 2019).

The researcher will include display units in the gallery room since the art exhibited includes paintings and jewellery. The display unit will be made of maple wood which is naturally lighter than most wood colours and will easily blend in with the neutral walls. Figure 5.8 below shows a sketch of the display unit.

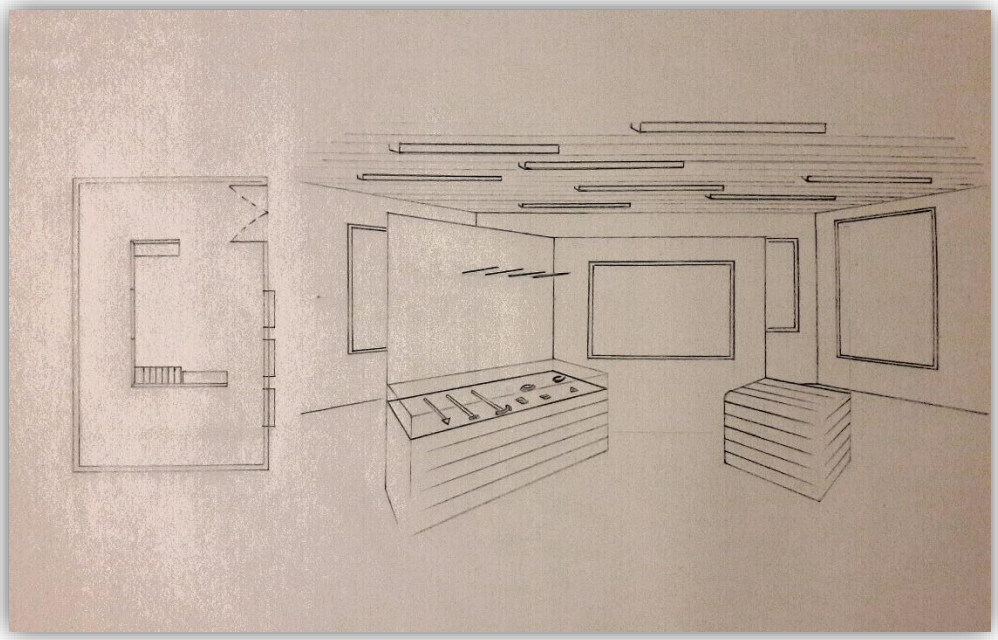

Fig. 5.8: A sketch of the gallery room with display units. (Source: Author, 2020)

5.3.4 Landscape

In the landscape, the researcher will incorporate biophilic design by incorporating a wide range of natural life. According to Green (2014), for greater benefits derived from a visual and non-visual connection with nature it is preferred to have a wide range of natural elements over large quantities of natural land. The more the variety, the greater the results. In that case, the researcher will incorporate various natural elements into the space ranging from water fountains and streams, to green walls, to flowers and vines and organic shapes and forms.

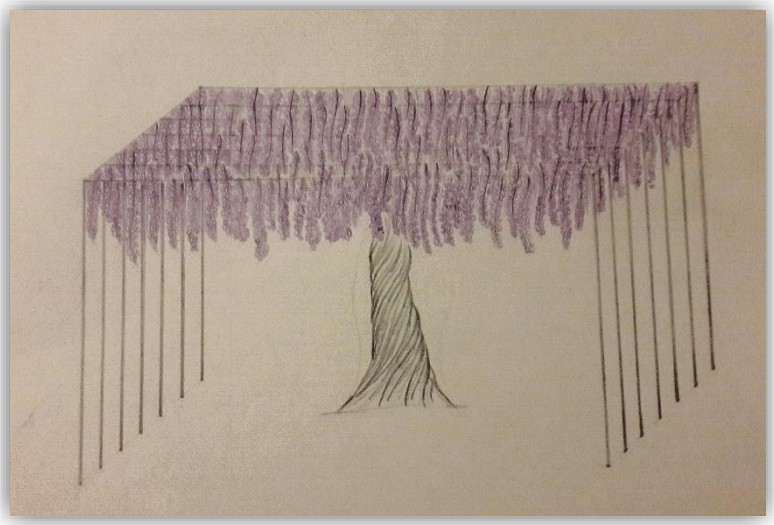

Fig. 5.9: A sketch showing a wisteria vine pergola. (Source; Author, 2020)

Figure 5.9 is a sketch that shows one of the ideas the researcher will incorporate into the landscape at Pawa254. It is a sketch of the Japanese wisteria vine supported by steel frames. This structure will act as a pergola for the occupants of the space to sit under. There will be outdoor furniture and other natural elements underneath where people can relax and enjoy having a closer interaction with nature.

Figure 5.10 is a sketch showing one of the outdoor furniture that will be underneath the wisteria. It is circular seating structure where a group of people can sit on outside and have a conversation or enjoy a team building activity. The seat has a more organic form that will blend easily with nature. According to Green (2014), human beings have a preference over organic forms, they lead to mental health benefits like relieving of stress.

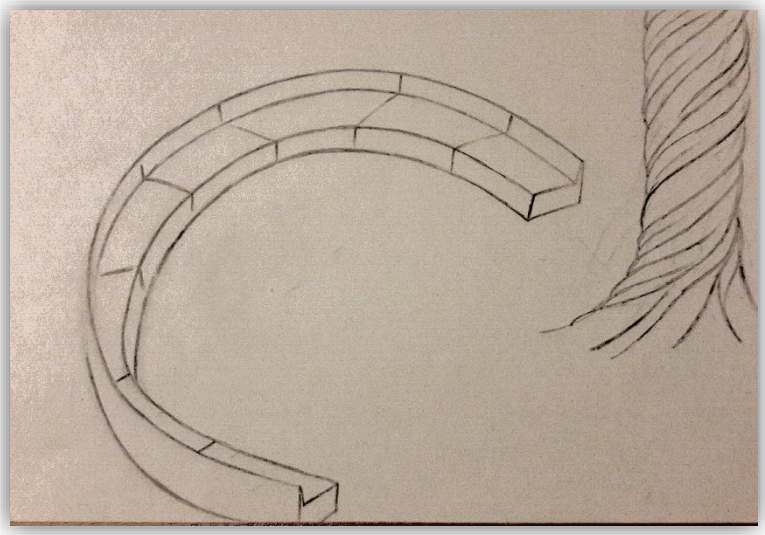

Fig. 5.10: A circular seating structure under the pergola. (Source; Author, 2020)

In figure 5.11 is a sketch of the backside of the Pawa254 landscape, in its existing state the entire wall is covered in graffiti. This makes the wall seem disjointed from the natural environment around it. The researcher will be growing a green wall on it. However, the green wall will not entirely cover the whole wall. It will have big patches in some places to allow people to view the beautiful graffiti beneath it. This way the researcher will incorporate the green wall without completely stripping away an important aspect of the organisation, which is art graffiti.

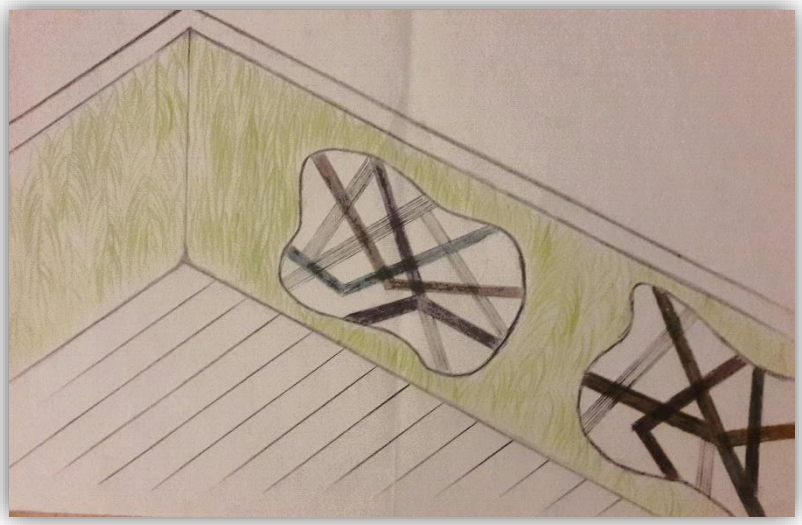

Fig. 5.11: A sketch of a wall with a green wall and graffiti. (Source; Author, 2020)

5.4 CONCLUSION

In conclusion, from the summary of data analysis and findings, the researcher has highlighted that unhealthy environments lead to adverse health and mental effects. The findings also suggested that biophilic design is an effective design approach for creating healthy sustainable environments. Under the recommendations, the researcher suggested different biophilic strategies to be applied in the four thematic areas of interior design, Furniture, Interior Architecture, Exhibition and Display and Landscape, to create a more sustainable environment at Pawa254.

5.5 SUGGESTIONS FOR FURTHER STUDY

As a continuation to this study, the researcher suggests further investigation in the following areas:

- A comprehensive research on whether indoor environments cause any adaptations in the living natural elements within the space as a result of the natural elements being taken out of their original habitat.
- A thorough research about the Kenyan working population's level of awareness, value and investment for healthy sustainable working spaces.

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APPENDICES

INTERVIEW GUIDE

1. What is your name? What position do you hold in Pawa254? On average, how much time do you spend in this room (office space or gallery room)?
2. What are the things you like about this space? And why?
3. What are some of the problems you have encountered or even observed about this space?