UNIVERSITY OF NAIROBI

COLLEGE OF ARCHITECTURE AND ENGINEERING

SCHOOL OF THE ARTS AND DESIGN

BDS 413: PROJECT PAPER

(Interior Design Specialization)

BIOMORPHIC DESIGN IN THE RE-DESIGNING OF A THERAPEUTIC AND AESTHETIC HOSPITAL: incorporation of Monstera leaves in kyuso sub county hospital, Mwingi north.

By:

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Project Concept paper submitted in partial fulfillment of the requirement for the Bachelor of Art in Design Degree submitted to the school of the Arts and Design, University of Nairobi.

April 14th ,2020.

DECLARATION

I, Mutemi Stephen Kimanzi, declare that this is my original work and this project has not been presented in this or any other university for examination or any other purpose to the best of my knowledge.

Signed 

Date 14/4/2020

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SUPERVISOR

Collins S. Makunda

Signed……

Date ……

DIRECTOR

Dr. Lilac Osanjo

Signed……...

Date……..

DEDICATION

I dedicate this project to my family members; Agnetor Nyiva Mati, Boniface Mutemi Ngangau, siblings; Maurice Mutati Mutemi and Reginah Ndanu as well as all my friends. They have been the closest people who have contributed to the completion of this project paper. I thank them all for the continued support and prayers. May God bless them abundantly.

ACKNOWLEDGEMENT

Many people have contributed to the development of this book. I hereby wish to express my uttermost gratitude and recognition to all the people who made this project a success and also my entire degree course.

I thank God for my beautiful loving family, good friends and health through my project and making it successful. I thank my supervisor for the encouragement and dedication to make sure that I completed this work and also not forgetting the entire class of 2020 who we worked together in order to make this project complete in time as well as my supervisor,

Collins S. Makunda.

ABSTRACT

The incorporation of biomorphic design patterns in healthcare designs forms the basis of this research paper. This paper seeks to establish the application of Monstera leaf designs, shapes and forms to create a therapeutic and aesthetic space in the healthcare environments so as to catalyze the healing process. This will involve a clear examination on the ability of nature based designs towards creating therapeutic spaces in the healthcare environments.it will discuss the feasibility of employing locally available materials in creating sustainable healthcare spaces as well. The healthcare system has over the years experienced very long hospital stays due to lack of therapeutic ambiences. This has had these environments encounter congestions in many countries and therefore the design sector has been working towards solving these major problems through the integration of nature and nature based designs in them.

The research paper will be subdivided into five chapters. The first chapter will discuss the introduction and background leading to the study, problem statement, objectives and the research questions, significance of this study and the scope of the research as well as the limitations of the study. Chapter two entails a critical analysis of theoretical literature on biomorphic design, Monstera leaves and sustainable design and how nature based designs have been incorporated in the healthcare systems to create therapeutic environments. Chapter three will outline the research design and methodology used by the researcher to collect, analyze and present data of this study. Chapter four will contain analysis, presentation and interpretation of findings then lastly chapter five will be a summary of the findings and the researcher's recommendations of the four major areas of interior design of the hospital with regard to previously employed techniques by renowned designers in the field of biomorphic or nature based design discussed in chapter two.

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CHAPTER ONE

1.0 INTRODUCTION OF THE STUDY

1.1 Introduction

Themes that are established on nature can be drawn back to the earliest human structures ranging from the basic housing structures to the subtle leafy decorations of the Rococo period. Representation of flora and fauna have since been used for embellishment and symbolism purposes. Beyond representation cultures all around the globe have long incorporated nature into homes and public spaces for various reasons. (William et al., 2014)

Nature has for a long time acted as a source of inspiration and it is clear enough it will continue to be so for the longest time. During the art nouveau movement, organic features were predominant in many designer's works. Artists like William Morris stood out with their floral wallpapers for decoration purposes. This act of working with designs that borrowed inspiration from nature was known as biomorphism. Klein describes it as an act of mimicking natural shapes and forms to create visually appealing designs. (Klein 2009)

This is a style that is slowly growing its popularity in the 21st century and becoming more common to people due to the growth of technology. Organisms in nature tend to have fascinating features and characteristics which are giving researchers and designers ideas to solve day to day modern problems. Nature as inspiration is being part of discussion in many parts of literature due to its infinite captivation and gain to human health and well-being.

The concept of biomorphism is new to Kenya in terms of optimizing healthcare environments. This is a niche that can be interrupted to create functional healthcare systems with aesthetics and ambiences that bring positive impact to the human health.

This research aims at exploring the relevance of nature based designs in healthcare spaces for regions with high deprivation of green natural environments answering the four objectives at hand and how Monstera leaves can be incorporated via utilization of locally available materials within the region. The case study of this research is based on a sub county hospital in Kyuso, Mwingi sub county, Kitui county, Kenya.

Biomorphism will be used as a design concept in the hospital borrowing inspirations from Monstera leaves and other key features within the region in the four key areas; interior architecture, landscaping,

exhibition and display and furniture design with the target of creating a sustainable, aesthetic and a space that can impact self-healing to patients in the hospital.

1.2 Background of the study

Many designers have studied nature in different perspectives and by this developed interest has led them into designing structures and designs inspired by it. It is through biomorphism where day to day products have been created borrowing concepts from nature. This is a design philosophy that has not been highly recognized both in Kenya and the African continent at large in the creation of significant and beautiful landscapes. It is also a new concept in the construction industry in the creation of optimized healing environments; a new concept that is yet to be explored extensively both in Kenya and Africa at large. Most of these designs are widely employed in urban areas in terms of therapeutic healing spaces and less consideration has been played in regions with high deprivation of green nature especially in arid and semi-arid regions a problem that needs to be explored extensively. This research aims at exploring the power of nature inspired designs in hospitals situated in arid and semi-arid regions for the purpose of creating therapeutic spaces, a style that has not been largely exploited.

1.3 Statement of the problem

To investigate how the patients and the staff can have a decent experience in the health facility despite their health subject through use of appealing interiors. This survey will tend to explore how biomorphic approach to design inspired by Monstera leaves can be implemented in the interior as well as the exterior to create a bond or a blend with nature. This is an aspect that has not been put into consideration for the patients therefore materials are to be explored lengthily to create a sustainable and comfortable environment in and within the hospital so as to create a space that can prompt healing.

1.4 Objectives of the study

Main objective

This study aims to establish how biomorphic design patterns borrowing inspiration from Monstera leaves and sustainable design can be employed in re-designing the interior architecture, exhibition and display, landscaping and furniture design at the Kyuso sub county hospital to create a space that is therapeutic in nature and aesthetically appealing as well.

Specific objectives

1To examine how hospitals have made use of biomorphism in their designs to enhance therapy.

2 To examine factors to be considered when refurbishing a hospital design using biomorphic design.

3 To explore the level at which Kyuso sub county hospital has utilized the concept of sustainable design and biomorphic design.

4 To propose ways in which biomorphic design can be used in re-designing the interior architecture, landscaping, exhibition and display and furniture design of Kyuso sub county hospital to enhance therapy and visual appeal.

1.5 Research questions

Main research question

How can biomorphic design patterns with inspiration from Monstera leaves together with sustainable design be employed in re-designing the interior, exhibition and display, landscaping and furniture design at the Kyuso sub county hospital to create a therapeutic space?

Specific research questions

1 To what extent have hospitals made use of biomorphic design in enhancing therapeutic performance?

2 What is to be considered when refurbishing a hospital design using biomorphic design?

3 To what level has Kyuso sub county hospital utilized the concept of sustainable design and biomorphic design?

4 Which is the best approach to use when redesigning Kyuso hospital using biomorphism?

1.6 Significance of the study

The beneficiaries of this research will be future researchers on the same topic and how well this can be applied on their areas of concern. This study will be a point of reference to them. Through this there will be deepened appreciation of the natural surrounding on use of sustainable and locally available materials.

The other beneficiary is the government of Kenya whereby similar approaches used by the researcher to design can be used to create better healing environments for its citizens depending on the different climatic zones. This will minimize congestion by speeding up the healing process.

1.7 Limitations of the study

Time constraints-The research will be conducted over a short period of time due to time limitation and therefore not all information intended to be explored in this research paper will be covered extensively.

Financial restraints-This research will be based on the researcher's financial capabilities therefore all the prototyping, site visits and data collection procedures will rely on the student's financial capacity.

Language barrier-The interviews will be conducted on one on one basis and most people in the region are not conversant with English therefore customized interviews in vernacular will be used therefore hindering access of immediate information since an interpreter will be used.

Distance accessibility constraints-The site under study is located several kilometers away from Nairobi and this will be a challenge in terms of the to and fro site visits.

1.8 Scope of the study

This is the level at which the site will be studied. This scope is divided into three thematic areas which include geographical, conceptual and contextual scopes.

Geographical

This study took place in Kyuso sub county hospital located in Kitui county, Mwingi North Sub county, Kyuso district Gai sub location around 230km north east of Nairobi county. A small town renamed after the Kyuso hills.

Conceptual

This research was tied to four key areas which included interior architecture, furniture design, landscaping and exhibition and display. Biomorphic approach to design will to be employed in these four key areas of study.

Interior spaces to be re-designed will be the administration block which includes; the pharmacy, two consultation rooms, sub county MOH office, medical superintendent office, health administrative office and the district public health office.

Landscaping will involve the parking lot, canteen area, the entrance, the children clinic waiting area, the walkways and the social interaction group areas meant for relaxing.

Exhibition and display will involve the reception area as well as the queuing area.

Furniture design will involve the furniture in the overall layout of the space including the chairs, tables and cabinets.

Contextual

The researcher will aim at extensively exploring the aspects of nature around the region and how well key patterns, shapes and color from the surrounding can aid in the re-designing of the space with inspiration from Monstera leaves and sustainable materials. These procedures will aid in the four areas mentioned above to be worked on.

Justification of the study

From an observation point of view, it is clear that Kyuso sub county hospital had no consideration of biomorphic design in its construction. It is apparent that there is less use of ecofriendly materials to its design and less consideration of bringing nature indoors so as not to detach the users from the outdoors. This will create a stage from which the researcher will be able to play around with use of locally available sustainable materials with biomorphic design so as to create an aesthetic and optimized environment in Kyuso sub county hospital.

1.9 Conclusion

This chapter clearly creates a framework of the main and supporting design philosophies that will impact the study. Objectives and research questions have been indicated to state why the research is to be undertaken. It describes the current situation in government hospitals especially in arid and semi-arid regions as far as the use of sustainable design and functional aspect is concerned. This study will aid the researcher in formulating a solution for the design problems experienced in Kyuso sub county hospital in Mwingi.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This section of the research paper will tend to review on already existing literature on biomorphic design and the impact of nature based designs on human health. It will discuss the origin of hospitals and the power of design as a healing tool. It will also go into depth on biomorphism analyzing artists who have utilized aspects of biomorphic designs. The middle section of this chapter the researcher will analyze an overview on the nature of Monstera leaves, adaptability, conditions, shape and characteristics into which the leaf belongs to. The last sub topic of this chapter the researcher will discuss sustainability in design and sustainable materials and how they can be utilized in our day to day life. This chapter will be concluded by highlighting some of the outstanding works on sustainability.

2.2 Review of theoretical literature

2.2.1 Biomorphism

This is one of the oldest and most influential design philosophy which has been utilized over by artists dating back to the renaissance period. dating back in the 20th century with roots in the 19th century, the philosophy was used in painting, sculpture, photography and design. it was first coined by the British writer Geoffrey Grigson in 1935 and later used by Alfred H. Barr in the context of his 1936 exhibition cubism and abstract art. This philosophy focuses on the power of natural life. Ideally Biomorphism involves taking naturally occurring patterns or shapes and combining those with creative design elements to produce functional devices. (Geoffrey, 1935)

Many designers have incorporated this particular style in their works and the outcomes are very outstanding and mind blowing. A good example includes the Lockheed Lounge chair which had the highest paid price in history of furniture by a living designer. It sold for $968,000 at Sotheby's in New York made by an Australian Designer Marc Newson. This piece imitated the natural fluid flowing nature of liquids.

Fig 2.0.1 Lockheed Lounge chair (source, google images)

Other biomorphic designs include;

Fig 2.0.2Chairs inspiration from branches (Source google images)

fig 2.0.3honeycomb inspired wall mount (Source google images)

2.2.1a The power of nature

To some extent it is almost impossible to un notice some form of patterns whenever our eyes get into contact with the outdoors. From the tree branches all the way to the tiniest details of the flora. We as humans tend to recognize this without even subconsciously looking at nature. Naturally occurring patterns tend to be instinctual on some level and therefore connects with some inmate aspect of the human brain. They have fascinating features whereby laboratory and clinical investigations have found out that viewing natural settings can produce significant restoration within less than five minutes as indicated by positive changes, for instance, blood pressure, heart activity, muscle tension, and brain activity. (Ulrich, et al., 2005)

A research conducted by the Environmental design research association(EDRA) stated that during the weeks that posters of natural scenes were hang on walls of acute psychiatric clinics the number of people who received injections due to aggressive and agitated behavior was 70% lower than when the walls were left blank, this clearly stated the power of the natural environment towards the human health.

Proven research by scientists' states that patterns are helpful in stress reduction in people's lives. The most impactful structures are fractals that occur in the natural environment and contribute to numerous healing effects. Research conducted by university of Oregon stated that viewing at fractals whether natural or artificially made contributed to 60% stress reduction to people.

Here are good examples of patterns found in nature illustrated in figure 2.0.4 and 2.0.5 respectively

fig 2.0.4 *Fractals found in nature (source google images)*

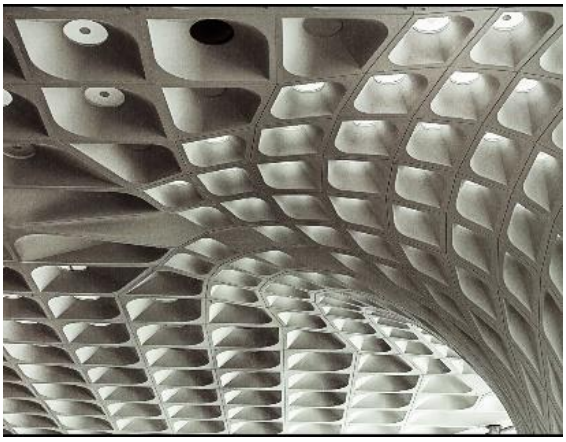


Fig 2.0.5 Mumbai airport terminal (source google images)

Natural patterns tend to bring out a sense of order and balance. By this it can be used in the optimizing and maintenance of human wellness. There have been several articles published proving the benefits of mimicking natural forms like; Terrapin Bright's green report which stated that patterns can promote psychological and cognitive improvement. It further stated that a single pattern or form can connect a human with nature almost immediately and when combined with biophilia they offer a holistic experience.

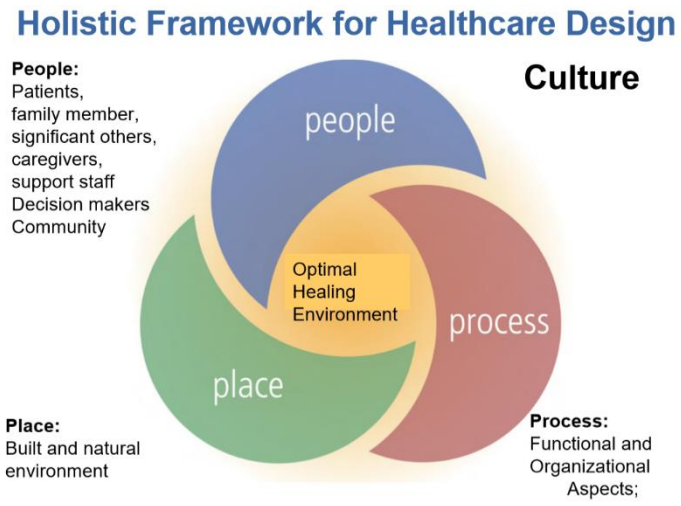
2.2.1b Origin of hospitals

Healing environments or hospitals have been there since the era of the Egyptian temples and over the centuries other hospitals have been springing ever since. These hospitals have evolved from the most basic homes for the homeless to institutions that contribute to self-healing. Florence Nightingale pioneered the nursing profession in hospitals during the Crimean war for the wounded soldiers whereby she opened the Nightingales nursing school in 1860. She became instrumental in reforming the nature and ambience of hospitals which were less therapeutic and more life threatening in the eyes of the public by improving standards of sanitation and changing the image from a place where sick people went to die to an institution highly devoted to recuperation and healing. (Ezekiel, 2018)

Optimal healing environment

The Samueli institute coined the term OHE in 2004 'Optimal Healing Environment' a healthcare system designed to support and simulate the inherent healing capacity of patients, their families and also their care providers. They created a OHE framework as illustrated in the table 2.1a below;

Table 2.1a



OHE framework source (Becket, 2010)

This defines healing as a holistic transformative process of repair and recovery in mind body and spirit leading to positive change. OHE consists of people in relationships, their health creating behaviors and also their physical environment. (Wayne B Jonas, 2014)

There are tanets of the OHE framework which state that healing and cure are distinct but complimentary processes; the frameworks consists of several sections but of interest is the physical space in which healing is manifested and is illustrated in table 2. 1b below

Table 2.1b (Becket 2010)

External environment

Healing Spaces	Healing spaces incorporate evidence-based design and healing principles to optimize and improve the quality of care, outcomes, and experiences of patients and staff. Healing spaces use physical design to enhance the individual's innate healing potential.
Ecological Sustainability	Organizations and individuals can foster ecological sustainability by reducing their footprint and supporting the health of the planet. The chemical impact and energy use of their operations is considered. Products or practices that are resource-intensive can be replaced with more ecologically friendly, less harmful, and cruelty-free alternatives.

The main reason for optimized healing environments is to engage the sick in the process of self-healing and recovery. These spaces are usually designed to be nurturing and therapeutic to minimize family and patient stress for the goal of promoting quicker recoveries.

2.2.1c Ability of design to impact self-healing

Research conducted by the British Medical association stated that good hospital design can reduce a patient's recovery time. Depression can be reduced by exposure to daylight. Also exposure to nature and nature inspired designs are also important in improving patient's moods reducing pressure and stress levels. Comfortable furniture tends to bring comfort and less stress to the users. Open windows also improve airflow and microbial diversity. Florence's main rules was to ensure that patients in hospitals breathed as pure air as the external air without chilling them. (Nightingale, 2004)

Over the years' architecture has been in the forefront to optimize healing environments. Creating environments that can go beyond curing sickness but providing a physically external antidote. Ignorance of the physical contexts in the healing environments would slow down the healing process. It is stated that when hospital looks out to nature patients tend to heal faster. In the modern era architecture is trying as much as possible to minimize the risks within hospitals such as contamination and spread of infection. Newer hospitals are trying to establish designs that take into account the patient's psychological needs. Eco friendly materials and material finishes are being put into use. Ergonomic furniture is also being put into use to cater for diverse users in the institutions. Provision of fresh air circulation, better views from indoors as well as pleasant color schemes and better therapeutic views inside these hospitals are being

utilized. Some of these ideas are borrowed from the past centuries such as the healing power of the natural environment.

Roger Ulrich performed experiments that window views could affect healing. He chose 46 patients 23 of which were assigned in wards that looked out to beautiful landscapes and trees while the other 3 looked towards bare brick walls. He studied the patient's vital signs and their pain medical doses it showed that those patients that overlooked to landscapes views healed faster compared to those that were assigned inwards that overlooked to bare brick walls. This experiment proved that hospitals should also put more emphasis on the physical context of themselves. (Esther, 2009)

By this healing design aims to;

1. Eliminate environmental stressors such as lack of privacy, external noise, air circulation and glare.
2. Generate feelings of peace, hope and spiritual bond.
3. Provide positive distractions such as art, aquariums, lighting, soothing music and visual representations of nature.
4. Accommodate opportunities for the purpose of social support such as appropriate furniture in patient rooms.
5. Connect the indoor and outdoor by including natural elements in the healing environments.

The benefits include; shorter hospital stays, reduced pain due to positive distractions and less infections within the hospital.

Exemplars

One of the hospitals that has utilized the concept of optimization of healing environments to stimulate self-healing is the Mary & AL Schneider healing garden which was designed as an integral part of the new Seidman Cancer Center by the Lead Design Landscape Architect.
It provides a place for respite and relaxation for cancer patients, staff and families.
Enables people privacy whereby one can rest, think and regain emotional and physical energy.

*fig 2.0.6 labyrinths from rocks (*worldlandscapearchitect.com,*2018)*

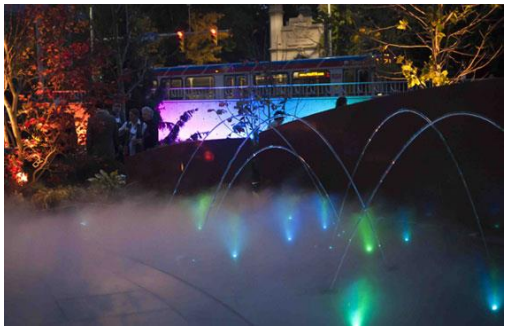


*fig 2.0.7 colored garden lights (*worldlandscapearchitect.com,*2018)*

*Fig 2.0.8 Rock sculpture (*worldlandscapearchitect.com,*2018)*

The rocks allow those journeying with cancer something to hang onto and feel their strength of being able to find a place of respite, to inspire by quotations, having an open space to breathe, a place to be away from busy streets yet a part of the urban fabric.

The other one is the Du point hospital for children borrowed natural forms from leaves and animals. In their design both visual and tactile texture were put into use. Outdoor lighting was also put into consideration with highly ventilated rooms and interesting lighting systems.

Use of therapeutic furniture has been put into use with printed cushions on seating pads and comfortable backrests to offer relaxation to the users.

*Fig 2.0.9 & 2.1.0 The Du Point hospital interior (*communitypro.com,*2017)*

Another design is the Morton and Linda Bouchard Healing Garden in the Nicklaus children hospital. It is a garden that offers a quiet environment that compliments the recovery process for the sick. Both nature and visual representations of nature have been put into use.

Fig 2.1.1 Exterior healing garden (Source google images)

2.2.2 Monstera leaves

Fig 2.1.2 Monstera leaves (pinterest)

The generic name is Monstera deliciosa coming from a Latin word to mean "monstrous" or "abnormal", and refers to them due to their odd-looking, perforated leaves that are often punched through with holes. They are also commonly referred to as the ‘Swiss Cheese Plant’. The leaf is from a species of evergreen tropical vines or shrubs that are native to Central America with shiny dark green surfaces. They are leaves that are now widely known in Africa and are used in both indoor and outdoor aesthetics purposes. The leaf can enormously grow with dozens of feet tall and leaves can spread to as wide as two feet.

2.2.2a Physical characteristics/adaptations of the leaf

This leaf is usually very huge and wide in surface area. It is curved in nature with visible leaf venation. The leaves are halfway sliced in nature with perforations on the surface of different shapes. A Monstera is a hemi epiphyte. This is a plant that lives as an epiphyte during a part of its life. epiphyte epi to mean 'on' and phyte to mean 'plant'.

Monstera is a plant that mostly lives on another plant.

2.2.2b leaf fenestration

The Monstera holes make it have several adaptations for its survival.

The reasons behind the perforation are governed by theories and the leading theory states that:

It is because of lighting situations that Monstera leaves have advanced holes. Monsteras develop from the forest floor in a semi-epiphytic manner, vining up bushes and such to acquire more light. As it is in such forests, the only way that understory plants can survive is by capturing sun flecks, or small beams of sunlight that make it through the canopy. By modifying the leaf structure to have holes, the same area of leaf can cover a greater area. So, even though a few sun flecks may go through the holes and be missed, the probability/incidence of catching a sun fleck increases because there is more area covered. (Christopher Muir)

Other theories state that;

They create holes in their leaves to resist the strong winds of hurricanes.

They have the holes that better allow water to come in contact with their roots.

Reasons as to why the researcher will pick the leaf as a source of inspiration is that It has grown to become a staple of design vocabulary in the recent years. The leaf also has a unique and easily identifiable shape. Consists of interesting perforations that can be used in designing of both an interior and an exterior space. It brings a tropical kind of vibe in any space and have jumped out of the background from being ornamental to being the star. They've moved from the back of the bouquet to being the only thing in the bouquet. (Lieber, 2018)

It is a leaf that is a statement making figure on its own. Both physical and adaptational features of the leaf will be of great importance to the researcher in re designing the hospital.

Fig 2.1.3 Light penetration (source google)

2.3 Design Champion

Antoni Gaudi

He was born in 1852 Reus, Catalonia in Spain and later died in 1926 in Barcelona Spain. He was one of the most celebrated Spanish architects of his time and became the most influential person in the Catalan modernism. He is known as the God's architect due to his splendid work; the Sagrada Bacilica.

His major stepping stone into his career occurred at the Paris world fair that took place in 1878 where he met Eusebi Guell who gave him his personal works to work on for example; Palacia Guell and Park Guell. (Gijs, 2001)

Influencers and inspirations

Antony Gaudi was heavily influenced by;

(i) His love for nature. Gaudi's works clearly consisted of organic or biomorphic designs rather than geometric designs. He said that this is simply because nature does not produce sharp corners therefore buildings should not have straight lines so as to blend in with the surrounding. Animals and plants are seen in his works such as the nave in the Sagrada Familia with a hyperboloid vault that borrows Inspiration from trees.

(ii) His immeasurable faith in his religion. He was acutely rooted to the catholic church and this made him create churches that had environments with a feel of nature. This was simply because he believed nature was where humans felt closer to God.

(iii) the Mediterranean heritage. Gaudi believed that these people had a distinct approach towards art.

Key works

Sagrada Familia

This is the longest architectural project since its beginning in 1882 and still under construction up to date. It is considered as Gaudi's masterpieces in history.

Characteristics

The ceiling is a striking display of the architect's engineering genius. It has the feel of a forest so as to make the congregants feel closer to God. The columns branch out like tropical trees forming tree-like features. The columns are made of the strongest materials in the world. The Traditional Gothic cross which is flower reinterpreted and is one of the most typical features of Gaudi's works.

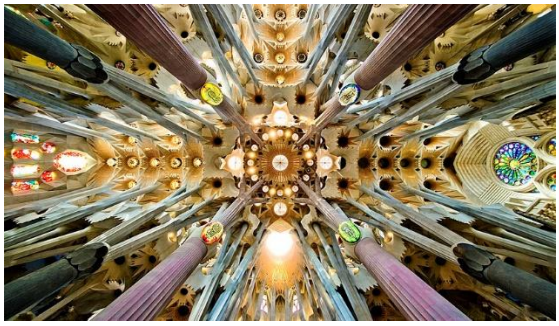


Fig 2.1.4 Ceiling of Sagrada Familia (source, whc.unesco.org)

Fig 2.1.5 The Sagrada Familia (source, whc.unesco.org)

Gaudi knew this project wouldn't be complete during his lifetime therefore he also spent most of his time creating models that would guide future engineers and architects to follow his design. The Spanish civil war in 1936 led to smashing and scattering of these models and modern technology is being used to gather pieces and matching them to each other so as to figure out the intents of Antoni Gaudi. The church is the tallest church and is estimated to be complete in 2026. (Hensbergen,2017)

Other projects include the Casa Batllo a building with a highly organic appearance, with its tracery resembling a skeletal frame or the delicate wings of an insect. The other one is park Guell which reminisces the fluid naturalistic form a unique style used by the architect.

2.4 Design Exemplar

Mathias Bengtsson

He was born in Copenhagen in 1971. He studied furniture design in the Danish college of design in 1992 and later attended the art college in Switzerland. After completion, he formed a design collective with other four of his fellow graduates called Panic. He then moved to London in 1996 where he enrolled in furniture and product design course at the Royal college of art under the director Ron Arad. He is known for his biomorphic designs including the;

Slice chair

It was exhibited in 1998 at the Galleria post design in Millan. It is considered a masterpiece up to date in furniture design which combined organic shapes with cutting edge technology.

The chair looks like stack layers of materials that pile up hence creating a form reminiscent of topological maps.

*Fig 2.1.6 Slice chair (source,*mathiasbengtsson.com) *Fig 2.1.7 topological map (*mathiasbengtsson.com*)*

Cellular chair

Made of light weight epoxy

Mimics patterns of the bone regeneration and is designed based on growth principles of the human bones.

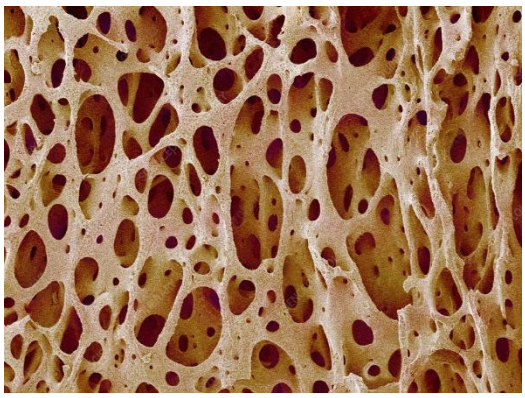


Fig 2.1.8 Cellular chair (source pinterest.com) *Fig 2.1.9 bone tissue (source google images)*

Alfred Johnson

He is a UAE based designer who owns a firm 'Imagination design' with his business partner Amir Zaidi. Here he has realized his true passion in Biomorphic design. This is nature inspired language that has made him famous with the likes of US architecture firm Asymptote and Zaha Hadid.

Working for a pitch of a boutique hotel in Dubai his biomorphic design made him a pioneer of biomorphic design in United Arab Emirates. Some of his works include;

Medusa

This is a conference table with a capacity of 10 or more people.
It is customizable to 18 people
Hand cast and made with mild steel subsections
Draws inspiration from the core values of the biomorphic design language.

Fig 2.2.0 medusa table (source google images)

Hewlett-Packard (HP) retail shop

The approach behind this was to convert a temporary space into a high impact branded retail space that would engage the consumer's delivery a constantly evolving message and become a cutting edge branded biomorphic architecture.

The counters are morphic in nature to display specific multiple products.

This created a seamless integration from one zone to the other.

The ceiling has a suspended biomorphic canopy with a backlit HP logo connecting the consumers to the brand.

Fig 2.2.1 HP retail shop concept (source Pinterest)

2.5 Design Process

There are several steps the designer will use in the design process which are stated below in order;

Programming
Concept development
Presentation of sketches
choice of the best ideas
Design and documentation
presentation of final designs
Execution of final designs

1: *programming*

The programming phase will be broken down into four stages;

1.a Statement of the problem

This stage will define the problem in general terms stating the nature of the project at hand.

1.b Research in relation to the topic under study

The research process will include the end users of the project at hand from the top ranking individuals to the lowest. Information will be gathered by the researcher from the hospital top ranking management (doctors) all the way to the staff. People who have ever visited the hospital for medication will be involved in the research process as well as documented data whether from books or online publications. This stage will involve gathering of opinions or preferences in relation to the design of the hospital as well as the challenges faced.

Information concerning the design philosophy will be gathered from different sources and the ability of the philosophy to solve the objectives at hand will be analyzed at a deeper level.

1.c Documentation of the programme

It will be important for the researcher to ascertain the objectives, requirements, feasibility and finances associated with the project. Activities within the facility will be documented in form of bubble diagrams to illustrate the traffic flow and the relationship between the different facilities within the hospital All this data will be compiled into a programme document.

1.d Supervisor review and approval of the designs

The programme document will be presented to the supervisor for approval purposes.

2: *Concept development*

The concept development will begin once the programme document is approved by the supervisor. This phase will be broken down into two phases;

2.a The ideation stage

Brainstorming design solutions will be involved and sketches will be done in thumbnail forms. The designer will keep in mind the research on the design philosophy as he does his sketches and generate ideas. These sketches will evolve slowly. Filtration of the unfeasible ideas will take place until several practical design concepts emerge.

2.b Concept Statement with Schematics

The main design concepts will be articulated in form of a written concept statement expressing the ideas for the proposed design solution. This will be accompanied by schematic drawings. Main ideas will be visualized using sketches and simple visualizations. Portrayal of seating areas, orientations, space allocations, color schemes and other important details of the proposed designs will be done.

3: *Presentation of sketches*

The possible ideas will be presented in form of a series of steps for approval purposes by the supervisor

4: *Choice of the best ideas*

The designer will pick the best ideas from the presented sketches recommended by the supervisor.
These ideas will be analyzed with a listing of its strengths and weaknesses in relation to suggested opinions by the supervisor.
Optimization of these ideas will take place at this stage so as to enhance a better performance in regards to the objectives of the site under study.

5: *Design and documentation*

The best ideas will be set aside and additional information will be gathered testing the feasibility of the designs.
Realistic drawings will be done to help visualize how the designs would look like in real life.
Computer aided designs will be done and prototypes modelled as well.
Recommendations on the site will be presented in form of sample materials and finishes to be done.
Mood boards and site plans will be presented showing the relationship between the designer's philosophy and the actual final designs.
After this stage the final designs will be presented for supervisor's approval.

6: *Presentation of final designs*

The final designs will be presented to the supervisor for final approval awaiting the final marking and any additional changes.

7: *Execution of final designs*

once the design is approved the implementation process will begin like the creation of the final design. This may include actual furniture models or exhibition and display units created to scale.

2.6 Analytical review

Sustainability

This is an approach to design that minimizes the harmful effects on human health and the environment at large. sustainability aims at creating and maintaining conditions under which humans and nature can co-exist in productive harmony to support present and future generations. United States Environmental Protection Agency (US EPA) states that it is one that can persist over generations; one that is far-seeing enough, flexible enough, and wise enough not to undermine either its physical or its social system of support.

The main aim of sustainability is to maintain balance among different aspects of society and the environment. Sustainability is classified into several principles which include the ability to:

- optimize site potential;
- minimize non-renewable energy consumption;
- use environmentally preferable products;
- protect and conserve water;
- enhance indoor environmental quality; and
- optimize operational and maintenance practices.

The problem

In the current world designers are creating designs and items that cannot withstand over time without replacement. These products tend to easily wear out or break down hence ending up in landfills. This is contributing to polluting the natural environment and contributing to probable hazards to humans. Some of the products are created from materials that are not ecofriendly hence becoming harmful to the environment and this is becoming an alarming factor in the design world.

The solution

It is our role as designers to come up with solutions to cater for the problem at hand. Innovative ways to reduce production of harmful products should be arrived at. Reusing and repurposing of these products should be put into consideration. Designing of products that are environmentally friendly should be an upcoming trend to cub the current production of harmful products.

Sustainability in interior design

Interior design is one of the professions that should be in the fore front in advocating for sustainable design. Designers should aim at creating products and items that can be able to endure different conditions as well as last long with little or no maintenance. Use of natural materials is one of the ways in which designers can contribute towards sustainable development.

Sustainable materials

In material selection, the most important criteria are to select the materials according to the features of function. Each of every function has specific needs. As an example, materials used in the hospital interior and the shopping mall should be different due to the sterilization aspect. Especially, the selection should aim at long term use. It is very important to use a material in its maximum potential in order to reduce waste of resources.

Fig 2.2.2 furniture made from natural stone (source google images)

As, in the process of producing materials, the energy is used. This is known as the embodied energy. Each material has different amount of embodied energy. For example; concrete, steel and the plastics are higher in embodied energy amount in the construction materials. Especially, natural materials such as stone and timber gradually have less embodied energy. Embodied energy is the energy consumed by all of the processes associated with the production of a building, from the mining and processing of natural resources to manufacturing, transport and product delivery.

Another important criterion in material selection is the recycling potential of the materials. There are many studies in the field of waste management which aim to innovate new construction materials. A Cierra Recycling can be an example to one of these. Basically, they collect and separate the waste, and then they transform it and remanufacture these waste products.

Moreover, the level of emission of toxic gases both used in production process and during the using period of the materials is an essential criterion in achieving sustainability. Especially, most traditional techniques in construction and materials are widely sustainable. As an example, traditional materials like mud brick and adobe are highly sustainable in the means of level of toxic gases emission. They are natural materials. All these criteria are important in maintaining indoor air quality. Finally, materials, as interior design elements, should meet the requirement of sustainability in the potential of long term use, recycling, and less emission of toxic gases.

Interior Design Element: Furnishing

Furniture is the major element in any interior space. They have a wide range of materials and color. In the context of sustainability, materials used in the production process and the long term use of the furniture are the major criterions. Wood products are the widely used materials in the furniture production. They can be recycled depending on the type of wood such as reclaimed wood and mango wood.
Furniture produced from waste sometimes face the problem of aesthetics. These type of furniture are

sometimes considered as unaesthetic. This is the major problem in selecting this furniture. The aesthetic quality of the furniture should be considered.

Fig 2.2.3 coffee table made from discarded drum and glass. (Source google images)

Interior Design Element: Lighting

Lighting considerations in interior design is mostly concentrated on the reduction of using electric energy. Energy used in interior environment of the building is approximately captures the 40-50% of the total energy used in buildings. It occupies a large amount of energy consumption. Therefore, designers should use the maximum possible natural lighting in interior environments. Environmental lighting is also one of the physical parameters affecting the indoor environmental quality.

Day light is the main source in natural lighting. It can be explained as "the practice of bringing light into a building interior and distributing it in a way that provides more desirable and better quality illumination than artificial light sources". In this context, the building should be located accordingly to gain maximum day light. Also, the size and the windows should be maximized to increase day light. Recently, there has been development of new technological tools to carry day light into the deep interior space of the buildings. The main principal in these tools is to collect the sun light and reflect the it through the reflective tubes. Laser cut panels, light piping systems, horizontal and vertical light pipes are examples of these systems;

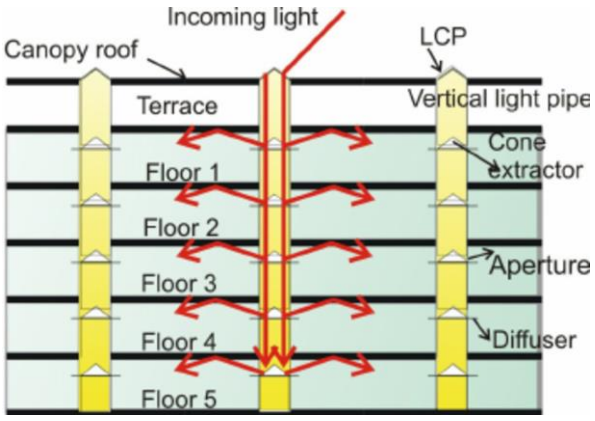


Fig 2.2.4 vertical light pipes (source google.com)

Fig 2.2.5 light tube bringing natural light indoors (Source google.com)

MANGO WOOD

Mango wood, baobab trees and acacia trees are one of the most common trees found in Kitui county as well as kyuso. Mango wood may be considered a stranger in the furniture industry but it is one of the fastest growing materials used by the furniture industry.

Fig 2.2.6 mango wood surface (source google.com)

This wood was formerly listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora in the red list of vulnerable natural materials but currently it was not included in the list. This is simply because the world still has plenty of the material.

what exactly makes this wood sustainable is that it is the byproduct of the mango fruit. The mango trees can reach up to 80-100 feet in just 15 years. Once the tree has matured fully, fruits can be harvested. After it stops bearing fruit altogether, it can be harvested for timber. Then, another generation of mango trees is planted. Harvesting mango wood does not only give extra income to farmers, but it also provides furniture manufacturers a new and affordable material that they can easily work with. It is strong but lightweight as

well.

This is a type of wood classified as hard wood due to its capabilities in terms of strength, durability, density of the grains which makes it resistant to wear and also because of its tactile texture. The capabilities of this wood is that it can be used to create various household items and accessories. This is simply because it is not too hard to curve into various shapes and patterns hence suitable for furniture. This type of wood is unique because of its visual appeal with colors of different tones and slowly darkens with age. It also has natural grains which visually are appealing to look at and can undergo several finishes to create a great work of art. Some of these finishes make it survive harsh conditions making the wood a good source of material for outdoor furniture.

The main benefits of the mango wood are that it can easily be harvested and processed without many processes to undergo. Due to all this reasons the researcher will explore extensively about mango wood and how well he will utilize it in improving the health facility.

Fig 2.2.7 Mango wood flooring and dinning furniture (source google.com)

Fig 2.2.8 mango wood storage media console(Source (google.com)

Robin Guenther

Robin Guenther is a renowned architect and leading expert in sustainable healthcare design. She promotes the idea that we can design healthier and more healing buildings.

A good example of her works is the Lucile Packard hospital whereby she used reclaimed wood in its interior design. This wood has also been used in the creation of furniture within the space.

Fig 2.2.9 Lucile Packard hospital using reclaimed wood by Robin Guenther source (google.com)

Natural stones

Due to the growing interest in creating beautiful, timeless homes that are also sustainable, many materials are at the fore front but natural stone tends to stand out as the perfect choice for meeting all these needs. Natural stone is versatile enough to achieve the aesthetic, performance, and cost goals on both the exterior and interior of homes over the long term.

what makes stone sustainable?

stone is a natural material- Stone is a natural product of the Earth, the original building material. It does not require other materials or resources to create it. There is an abundant supply with different veining, textures, colors, shapes, and technical characteristics that make it possible for it to be used in a wide range of applications. Natural stone contains no harmful chemicals or toxins hence health friendly to humans.

Stone is very durable- Stone stands the test of time, which means the choice to use natural stone will only enhance the value of any setting while reducing the need to replace materials over a longer period of time.

Stone offers ease of care and maintenance- If maintained properly, stone lasts for years. There are a wide range of fabrication options and finishes that can be applied to natural stone that also enhance its performance, including extending its life, resisting weather and wear and tear, or

making the stone more slip resistant.

Stone is recyclable- Stone is completely recyclable and has the potential to serve many different uses and purposes over its lifetime. Salvaging and recycling stone is a very viable option and a sustainable way to ensure that the useful life of the material will be lived out to its fullest.

Stone is quarried and manufactured sustainably- Advancements in technology, including improved methods of quarrying, extraction, and fabrication have led to increased options and reduced costs of stone products, making natural stone easier to use and more desirable than ever before. Conserving resources, preventing pollution, and minimizing waste are some ways the stone industry is working to be eco-friendly through practices that support sustainable design requirements.

Types of stones

There are several stone types ranging from; andesite, quartzite rock, mazera stone, scoria stone, pumice stone, machine cut rocks, river rock, cobblestone rock, coral stone just to mention a few.

Basalt- This is an igneous rock that is formed from molten rock that has solidified under pressure. It has a uniform grey color and is very hard and compact. Its most common use is as an aggregate but polished basalt is also used for flooring, monuments and other stone objects.

Fig 2.3.0 Basalt stone (source google.com)

Coral stone- this is stone formed in marine regions.it is almost pure white on extraction and is porous and lightweight.

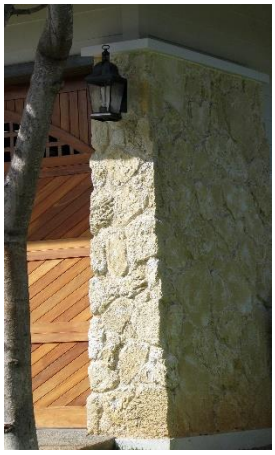


Fig 2.3.1 wall cladding with coral stone (source google.com)

Quartzite-This is a metamorphic rock which is formed from pure quartz sandstone as a result of heating and pressure. Quartzite is very hard and more resistant to staining. uses include kitchen counters, wall and floor tiles and stairs. Crushed quartzite is also used as railway ballast and to produce industrial silica sand.

Fig 2.3.2 quartzite counter top (source google.com)

cobblestone rock-used for pavement roads, streets and buildings

Fig 2.3.3 Cobblestone pavement (source google.com)

River bed rock-found on banks of rivers and is formed by the sedimentation of the sand particles found at the bank with the water from the river.
Used in landscaping, decorating ground covers and construction material for wall facades and walkways.

Fig 2.3.4 river rock interior décor. (source pinterest.com)

Designing with natural stone for a home presents an exciting array of options. The choice to design with natural stone is a very personal one, but sustainability should be taken into consideration to help with the decision making process.

Steel

Steel is a uniquely sustainable material because once it is made it can only be used as steel forever. Steel is infinitely recycled, so the investment in making steel is never wasted and can be capitalized on by future generations.
Steel is a material that is used, not consumed. Steel can uniquely claim to be the only truly recyclable material because when steel is recycled, it is not downgraded in any way. The steel recycling loop is a true closed loop. It is recycled and used again, without any loss of quality, time after time. The investment of resources in making steel is not wasted because steel is not consumed in any way.

Exemplars;

Michael Murphy

Michael Murphy is the Co-Founder and Executive Director of MASS Design Group, which is an architecture and design firm geared towards improving social equity and health outcomes through design innovation. In addition to leading the design and construction of the Butaro District Hospital in Rwanda, which opened in January of 2011.
The Butaro district hospital is based in Rwanda. It is a masterpiece in terms of sustainable design. Centered around an Umuvumu tree, the hospital is a landscaped campus of buildings on the terraced

hillside. It is designed to alleviate and decrease the transmission of airborne diseases through various systems, including overall layout, patient and staff flows, and natural cross-ventilation.

Local materials such as the volcanic rock and sand from the Virunga mountain has been maximized in its construction. The rocks have been employed on the walls of the exterior and interior walls. They have also been used in landscaping. Walkways and sitting areas have been also created from the rocks to cater for aesthetics bringing the natural look of the space. By this the hospital blends from the surrounding rocky landscapes of Rwanda. The careful coordination of design and construction resulted in saving of over 30 percent of materials compared to other hospitals currently built in Rwanda.

Fig 2.3.5 Interior of Butaro hospital (source massdesigngroup.org)

Fig 2.3.6 walkways & landscape Butaro hospital (source massdesigngroup.org)

2.7 Conclusion

This chapter outlined the philosophy and the main factors that would influence the final design of the site under study. It showed the current trends in the design of modernized spaces and this will help in the solving of the problems experienced in Kyuso sub county hospital.

CHAPTER THREE

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter aims at exploring the research methodology employing both qualitative and quantitative approaches. It is focused on establishing whether biomorphic patterns have been incorporated in the interior of the hospital in respect to the four thematic areas of study which are interior architecture, landscaping, furniture, exhibition and display. It is aimed at establishing whether designers have incorporated the same aspects of using natural occurring facets into the design for the space.

Data collected from the identified sample of individuals was presented on this study including primary secondary and tertiary data.

Primary data is data originated for the first time by the researcher through direct efforts and experience, specifically for the purpose of addressing his research problem. Also known as the first hand or raw data. Primary data collection is quite expensive, as the research is conducted by the organization or agency itself, which requires resources like investment and manpower. The data collection is under direct control and supervision by the investigator.(Surbhi, 2017)

Primary data is data that is collected by a researcher from first-hand sources, using methods like photography, observation technique, video-audio tape recording and taking measurements. It is collected with the research project in mind, directly from primary sources.

This data was obtained from the research site such as from the senior doctors, nurses, cooks, security guards, cleaners, area residents and students.

advantages

The researcher obtained data in relation to all objectives of the study.
The information was tailor made to suit the needs of the researcher.
Advantage of primary data is that raw and original information was obtained from the site of study.
If required, it may be possible to obtain additional data during the study period.

disadvantages

Weather can be a contributing factor that can hinder the obtaining of data from the site.
Funds can be limiting in terms of data collection from a given site of study.
Restrictions from the site can hinder collection of data by the researcher.
Time consuming since the researcher has to be actively involved in the site.

Secondary data implies second-hand information which is already collected and recorded by any person other than the user for a purpose, not relating to the current research problem. It is the readily available form of data collected from various sources (Surbhi, 2017)

advantages

Data can be obtained using lesser time since it relies on existing information. This is simple because of the many reliable sources which can be accessed online and published documents about the specific study site.

Little or no restrictions when collecting existing data

disadvantages

Data obtained is not original and therefore can be biased in some form.

It is hard to find data that suits the researcher's needs.

Tertiary data- Tertiary sources tend to summarize and synthesize what is already known so they are rather not original. They usually are sources not credited to a particular author.

advantages

Has simple facts that can easily be recognized widely.

They establish balance, tertiary sources are often included as supporting (not principal) evidence in considering the relevant prominence and due weight of conflicting views, to ensure article balance.

disadvantages

The researcher is not able to prove how true the data is and therefore wrong information can be obtained.

Tertiary sources usually end up having over inclusive works hence too much unnecessary information that don't really relate to the objectives of the study

3.2 Research design

Research is the systematic process of collecting and analyzing information so as to increase understanding of the phenomenon under study. It is the function of the researcher to contribute to the understanding of the phenomenon and to communicate that understanding to others.

Research design is the logical sequence that connects the empirical data to a study's initial research questions and its conclusions. It is the action plan that the researcher uses to undertake the research study, from data collection and analysis to data presentation and finally, drawing conclusions from the information initially collected. (Yin, 2009)

Methodology is the philosophical framework within which the research is conducted or the foundation upon which the research is based.

Research methodology may be defined as a way to systematically solve the research problem. Research methodology constitutes of research methods, selection criterion of research methods, used in context of research study and explanation of using of a particular method or technique and why other techniques are not used so that research results are capable of being evaluated either by researcher himself or by others.

This chapter discusses the means of data collection the researcher used which was qualitative. It aimed at looking into opinions from different avenues of data collection and comparing it with the critical objectives of the study.

3.3 Population

Population target- define a population as a complete set of individuals, cases or objects with some common observable characteristics. (Mugenda and Mugenda 1999)

Sample-A sample is a small Portion of a target population. Sampling means selecting a given number of subjects from a defined population as a representative of that population. Any statements made about the sample should also be true of the population (Orodho 2002). According to Mugenda and Mugenda (2003) a sample of 30% is appropriate in social science study.

Sampling-this is the process of taking a subset of subjects that is representative of the entire population. The sample must have sufficient size to warrant statistical analysis. "Sampling is a procedure, process or technique of choosing a sub-group from a population to participate in the study (Ogula, 2005)." Members from the hospital were as representatives of the total population as a source of obtaining information from them. The sample consisted of; Senior doctors(management), Neighboring people, students, cooks, Security guards, Nurse/matron, gardener, Clinical officers, Compressive care center doctors

3.3.1 Research methodology

Population- defines a population as a complete set of individuals, cases or objects with some common observable characteristics. (Mugenda and Mugenda, 1999)

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from Kyuso town were used as representatives of the total population as a source of obtaining information from them. The sample consisted of neighboring people, doctor, nurses, cooks, security guards, students and the author himself who has been to the place severally for different occasions.

The researcher established the sample as follows in table 3.1a below;

CATEGORY	FREQUENCY	PERCENTAGE
Senior doctor(management)	2	8%
Neighboring people	4	16%
students	4	16%
cooks	2	8%
Security guards	3	12%
Nurse/matron	4	16%
gardener	1	4%
Clinical officers	3	12%
Compressive care center doctors	2	8%
TOTAL	25	100%

Table 3.1a sample population. (source author, 2019)

The researcher distributed the sample population to accommodate as many group of individuals from the hospital as illustrated below in table 3. 1b:

KYUSO LEVEL IV HOSPITAL	Neighboring people	students	Nurse/ matron	Clinical officers	Senior doctors	Security guards	Compressive Care Centre doctors	gardener	cooks
Male	2	2	2	1	1	3	1	1	1
Female	2	2	2	2	1	0	1	0	1
Disabled	1	0	0	0	0	0	0	0	0
Over 10 years in the hospital	2	0	0	0	0	0	0	1	1
Under 10 years in the hospital	2	4	4	3	2	3	2	0	1
total	4	4	4	3	2	3	2	1	2

Table 3.1b sample distribution (source, author 2019)

3.4 Sampling method

Random sampling-this is a sampling technique where each sample has an equal chance of being selected. This technique was used on the larger population which was the neighboring people as well as the students who go to the hospital for medical issues.

convenience sample-is a type of non-probability sampling method where the sample is taken from a group of people easy to contact or to reach.

Voluntary sample-this sampling technique involves senior individuals in any site under study**.** The researcher put out a request for senior doctors from the hospital to join the sample population. This turned out well as they were ready to provide any information the researcher needed. This included; senior doctors, clinical officers and CCC doctors (Compressive care center).

TYPE OF SAMPLE	**SAMPLE SIZE**	**SAMPLING METHOD**
Senior doctor	2	Voluntary sample
Neighboring people	4	Random sampling
students	4	Random sampling
cooks	2	Convenience sample
Security guards	3	Convenience sample
Nurse/matron	4	Convenience sample
gardener	1	Convenience sample
Clinical officers	3	Voluntary sample
Compressive care center doctors	2	Voluntary sample

Table 3.1c sampling methods (source; author 2019)

3.5 Data collection instruments

Research instruments are tools used to gather required data for the study. The researcher requires methods that provide high accuracy, generalizability and explanatory power, with low cost, rapid and minimum management demands with administrative convenience. (Kombo and Tromp 2006)

For this research the researcher used the qualitative aspect of data collection which included in depth interviews, photography and participatory observation

Photography-One of the most elaborate ways in data collection is the use of visual representation. Use of visual information tends to present data effectively and easily to the receiver or the interpreter. By this

cameras act as aids to capturing of photographs or images to present a reflection of what is actually on the ground. Photographs are good reference points and can be utilized even when the researcher is off-site. "Photo-elicited interviews have also been identified as a way to bridge cognitive limitations, as participants can use photographs to prompt their memory" (Erdner and Magnusson 2011)

advantages

Fast and easy way of obtaining data.
Less costly.
Only necessary information will be obtained from the site.
Can be used as a point of reference when off site.
Firsthand information is obtained from the site under study.

Disadvantages
Lack of power can affect caption of photographs.
Limitations/restrictions from the site users or owners.
Due to the many advantages of photography as a method of data collection the researcher will employ this technique to obtain information in relation to the site under study

Materials to be used; professional camera, mobile phone.

Participatory Observation-This method involves being actively present in the site and through visual analysis the researcher is able to take key short notes and draw relevant sketches so as to elaborately illustrate the nature of the space he's working with.

advantages

Detailed information was collected by the researcher.
Only relevant data was obtained by the researcher.
Affords the access to backstage data. I.e. lending credence to one's interpretation of the observation since the researcher has been through the design process.
This gave the researcher a better understanding of what exactly happens on the site under study.

disadvantages

Time consuming since the researcher had to be keen and actively present.
Costly since the researcher had to be actively present in the collection of data from the site.

In depth interviews- Interviews are used to accumulate records from a small organization of subjects on a wide variety of subjects. Structured or unstructured interviews will be put to application by the

researcher. Structured interviews have the same questions in the same order for each subject and with multiple choice answers while unstructured interviews differ per subject and can depend on answers given on previous questions, there is no fixed set of possible answers.

advantages

Give more space for detailed questions to be aske so as to obtain accurate information.
Create a personal contact between the interviewer and the interviewee hence freedom of expression by the interviewee.
Incomplete answers can be put back into consideration and this enhances clarity between the researcher and the interviewee.

disadvantages

Time consuming.
Costly since the researcher has to be actively involved in data collection.
Lack of active participation from the interviewees.

Focus group discussions- involves gathering people from similar. backgrounds or experiences together to discuss a specific topic of. interest. It is a form of qualitative research where questions are. asked about their perceptions attitudes, beliefs, opinion or ideas. The researcher picked students from the department of design and discussed possible solutions in relation to the objectives of study.

advantages

They offer opportunities where the researcher can seek clarifications
Time and money saving compared to individual interviews
Useful in obtaining of detailed content about people
They tend to provide a comprehensive information
Provide information of great use from people

disadvantages

They can be hard to control and manage
Disagreements can be in place leading to irrelevant discussions that end up distracting the researcher from the main objectives of the study.
Thy are based on self-selecting therefore they may not be representative of non-users
Can end up being hard to convince a range of people to participate.

3.6 Data analysis tools

Data analysis refers to a systematic searching and arranging interviews, field notes, data and other materials obtained from the field with the aim of increasing their understanding and enabling the researcher to present them to others. (Orodho, 2005).

Labelling-photographs taken from the site were analyzed in line with the objectives of the study. Labelling and clear indications on each photograph was done to act as a guideline throughout the entire research paper.

(Observation)-analyzation of key events such as programs within the institution. Various settings, people and processes followed with regards to the objectives of the study.

Interviews-for the interviews the researcher employed content analysis and discourse analysis.

Content analysis -This is a research technique used to make replicable and valid inferences by interpreting and coding textual material. By systematically evaluating texts (e.g., documents, oral communication, and graphics), qualitative data can be converted into quantitative data.

discourse analysis -Discourse analysis is sometimes defined as the analysis of language 'beyond the sentence'. With this technique the researcher will follow the following criteria,

Discourse and Frames-Reframing is a way to talk about going back and re-interpreting the meaning of the first sentence. This is a type of discourse analysis that asks, what activity are speakers engaged in when they mention something. What they think they are doing by talking in that way at that time.

Turn-taking -Conversation is an enterprise in which one person speaks, and another listens.

Discourse Markers-Discourse markers' is the term linguists give to the little words like 'well', 'oh', 'but', and 'and' that break the speech between the two parties up into parts and show the relation between parts. 'Oh' prepares the hearer for a surprising or just-remembered item, and 'but' indicates that sentence to follow is in opposition to the one before.

Speech Acts-Speech act analysis asks not what form the utterance takes but what it does.

3.7 Data presentation methods

Both qualitative and quantitative data was illustrated in form of bar graphs, pie charts and tables.

Bar graph-this is a way of summarizing a set of categorical data. It displays the data using a number of rectangles, of the same width, each of which represents a particular category. Bar graphs can be displayed

horizontally or vertically and they are usually drawn with a gap between the bars. This is a method the researcher will use to present information about the climatic conditions of the region.

Tables- They are a useful way to organize information using rows and columns. Tables are a versatile organization tool and can be used to communicate information on their own, or they can be used to accompany another data representation type like a graph. Tables support a variety of parameters and can be used to keep track of frequencies, variable associations

Photographs will be critically analyzed and interpreted in written form in relation to what will have been observed from the site. Each photo will be printed out clearly and they will be presented in a categorical order such that photos of the outside will not be mixed up with photos of the interior of the hospital.

Data obtained from observation will be indicated in narrative forms as well as simple interpretable and elaborate sketches, Interviews were presented in form of narratives.

3.8 Logical framework

Objective 1: To examine how hospitals have made use of biomorphism in their designs to enhance therapeutic performance.				
Data needs	**Data source**	**Data collection tool**	**Analysis method**	**Expected output**
Get information on how hospitals have incorporated biomorphic design to enhance therapeutic performance.	literature	Literature review	Content analysis	Knowledge on biomorphic design capabilities in enhancing therapeutic performance.

Objective 2: To examine factors to be considered when refurbishing a hospital design using biomorphic design.

Data needs	Data source	Data collection tool	Analysis method	Expected output
What is to be considered when re-designing a hospital facility using biomorphism.	literature	Literature review	Content analysis	understanding strategies to be followed when refurbishing a hospital using biomorphism.

Objective 3: To explore the level at which Kyuso hospital has utilized the concept of sustainable design and biomorphic design.

Data needs	Data source	Data collection tool	Analysis method	Expected output
Gather information on what kyuso hospital has done in line with use of sustainable materials and biomorphic design.	Staff members, Management. site	interview Photography Observation	Narrative analysis Visual analysis Content analysis	Acquire an understanding of how sustainable materials and biomorphic design can be applied.

Objective 4: To propose ways in which biomorphic design can be used in re-designing the interior design, landscaping, exhibition and display and furniture design of Kyuso level IV hospital to enhance therapeutic performance.				
Data needs	**Data source**	**Data collection tool**	**Analysis method**	**Expected output**
Developing a design proposal using a design process for the interior architecture, landscaping, furniture design and exhibition and display.	Literature site	Literature review Photography Observation	Content analysis Visual analysis Content analysis	design proposals on how to incorporate biomorphic design to solve the problem in Kyuso hospital.

Table 3.1d logical framework (source, author 2019)

3.9 Conclusion

This chapter discussed on the ways in which data was collected, analyzed and presented.

CHAPTER FOUR

4.0 SITE ANALYSIS AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter aims at establishing how biomorphism, Monstera leaves and use of sustainable materials can all be applied together in the creation of a space that can impact patient's wellbeing as well as enhance aesthetics. All the data obtained from Kyuso sub county hospital will be critically analyzed to govern whether biomorphism with use of sustainable materials have been put into utility and whether it can be an appropriate approach for the design of the hospital. Information concerning the history, climatic conditions, geographical location, vegetation distribution, notable features within the region that will guide the researcher as well as services within the hospital and Kyuso at large will be stressed.

Existing conditions of the hospital will be discussed in depth following the four main areas of interior design namely; interior architecture, landscaping, exhibition and display and furniture design. This will be presented in form of photographs taken from the site as well as the neighboring regions and will also be presented in form of narratives and visual computer aided presentations.

4.2 Qualitative analysis

This area focuses on information in regard to the site profile like historical background, geographical location and other factors affection the site under study. A detailed description of the existing interior and exterior of the hospital will be presented in relation to the four key areas of interior design.

Historical background

Kyuso sub county hospital is located 230km north east of Nairobi, in Kitui county, Mwingi Sub county, Kyuso district. It is a hospital that offers basic and comprehensive medical services to the immediate community and others in the neighboring regions. It is essentially the referral center for all medical emergencies happening in most other peripheral facilities within the sub county. The hospital offers both inpatient and outpatient services with a capacity of 25000 patients annually. The hospital has a total of 20 departments with almost 30 staff members under the management of Dr. Daniel Asiago Misiani.

Geographical location

Kyuso sub county hospital is located in Mwingi sub county and its coordinates according to google maps is 0°33'06.2"S 38°13'05.0"E neighboring the rocky hills of Kyuso.

Fig 4.0.1 Kyuso sub county hospital (source google maps)

Physical;

Soils

Soils are complex mixtures of minerals, water, air, organic matter, and countless organisms that are the decaying remains of once-living things. It forms at the surface of land and is considered the "skin of the earth." Soil is capable of supporting plant life and is vital to life on earth.

Soils differ from one part of the world to another, even from one part of a backyard to another. They differ because of where and how they formed. Five major factors interact to create different types of soils: Climate, organisms, relief, Parent material and time.

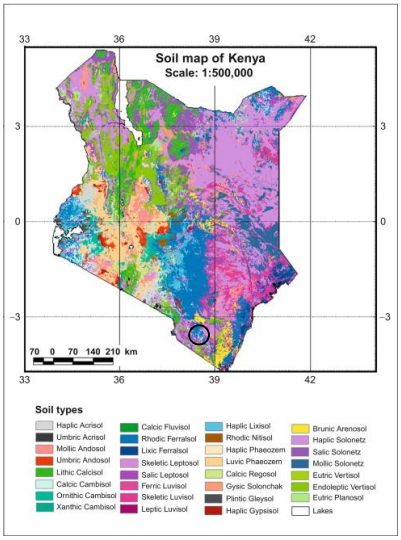


Fig 4.0.2 Soil map of Kenya (source google images)

Nature of soils in kyuso, Mwingi sub county

The county has ferrasol soils

Ferralsols

Ferralsols occur on gently undulating to undulating topography. They are very old, highly weathered and leached soils, and therefore with a poor fertility, which is restricted to the top soil, as the subsoil has a low cation exchange capacity.

They consist of small particles of weathered rock. Sandy soils are one of the poorest types of soil for growing plants because it has very low nutrients and poor in holding water, which makes it hard for the plant's roots to absorb water. This type of soil is very good for the drainage system. Sandy soil is usually formed by the breakdown or fragmentation of rocks like granite, limestone, and quartz.

Topography

Topographic surveys show critical information about the site's biophysical context. Three key attribute maps can be derived from a topographic survey to graphically show variations in elevation, slope, and aspect.

Elevation

Changes in elevation affect both drainage patterns and visibility to and from the site. Elevation data are portrayed on topographic maps as contour lines and spot elevations.

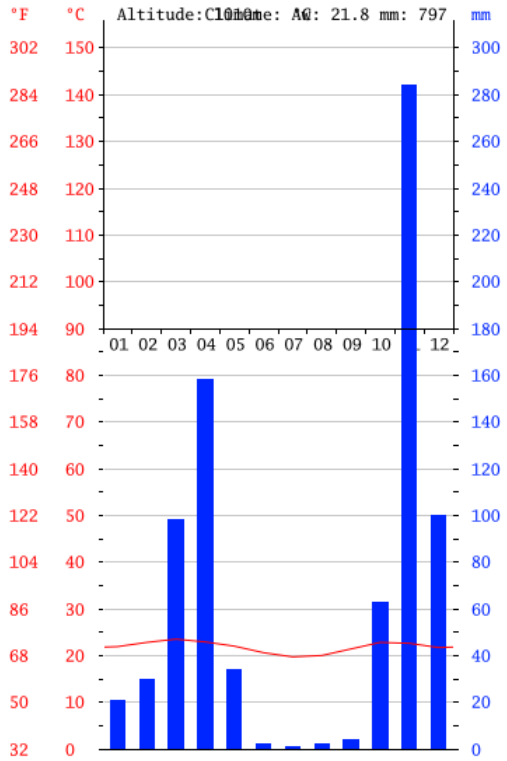
Slope

Differences in soil parent materials and weathering account for characteristic landforms or landscape "signatures." The landforms also reflect the area's surficial geology. Landforms result from constructional processes for example, wind deposition and destruction processes for example, soil erosion acting on underlying geologic structures.

Aspect

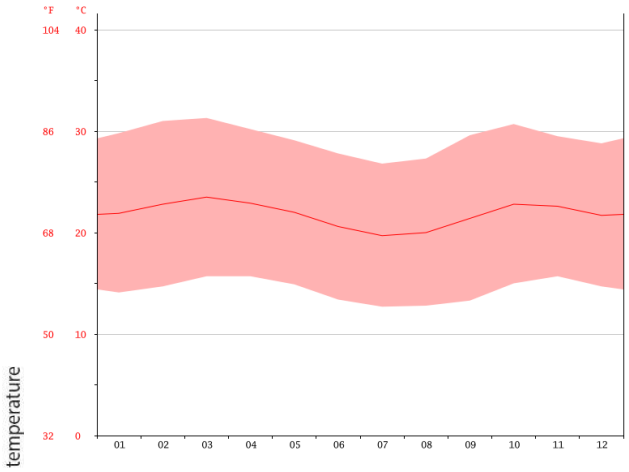
A slope's orientation, or aspect, is the compass direction that the slope faces for example, north or northeast. Variations in slope and aspect influence the daily and seasonal solar. radiation received by the site.

MWINGI CLIMATE GRAPH / WEATHER BY MONTH



Precipitation is the lowest in July, with an average of 1 mm. The greatest amount of precipitation occurs in November, with an average of 284 mm.

Mwingi average temperature



At an average temperature of 23.5 °C, March is the hottest month of the year. The lowest average temperatures in the year occur in July, when it is around 19.7 °C.

MWINGI WEATHER BY MONTH // WEATHER AVERAGES

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	21.9	22.8	23.5	22.9	22	20.6	19.7	20	21.4	22.8	22.6	21.7
Min. Temperature (°C)	14.1	14.7	15.7	15.7	14.9	13.4	12.7	12.8	13.3	15	15.7	14.7
Max. Temperature (°C)	29.8	31	31.3	30.2	29.1	27.8	26.8	27.3	29.6	30.7	29.5	28.8
Avg. Temperature (°F)	71.4	73.0	74.3	73.2	71.6	69.1	67.5	68.0	70.5	73.0	72.7	71.1
Min. Temperature (°F)	57.4	58.5	60.3	60.3	58.8	56.1	54.9	55.0	55.9	59.0	60.3	58.5
Max. Temperature (°F)	85.6	87.8	88.3	86.4	84.4	82.0	80.2	81.1	85.3	87.3	85.1	83.8
Precipitation / Rainfall (mm)	21	30	98	158	34	2	1	2	4	63	284	100

Between the driest and wettest months, the difference in precipitation is 283 mm. The variation in temperatures throughout the year is 3.8 °C.

Solar access

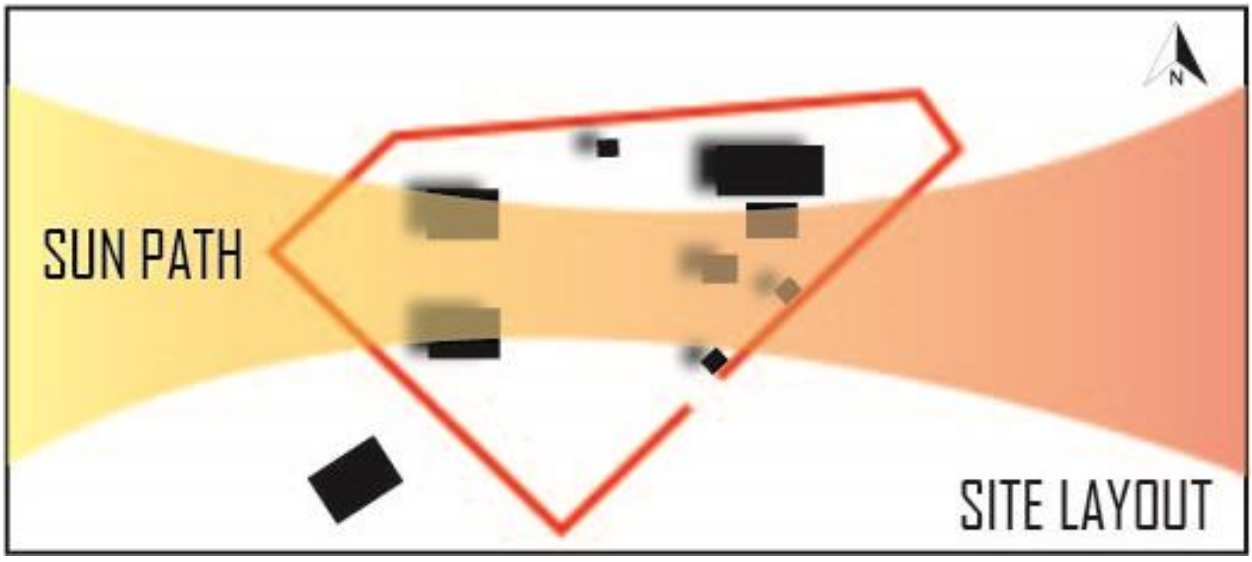


Fig 4.0.3 Sun path of the site. (source, author 2019)

The site receives equal sun flakes due to its location throughout the year.

Winds

Class Nr	classification	speed in m/s	wind power density in W/m2	CODE
1	poor	0-4.5	0-90	
2	marginal	4.5-5.5	90-165	
3	moderate	5.5-6.5	165-275	
4	good	6.5-7.5	275-425	
5	very good	7.5-8.5	425-615	
6	excellent	> 8.5	> 615	

Fig 4.0.4 Wind classification in Kenya (source solar and wind resource Kenya)

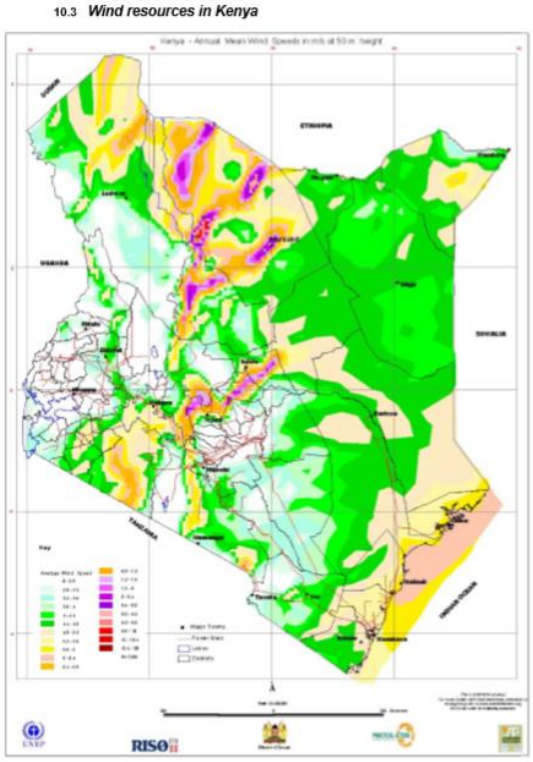


Fig 4.0.5 Map showing annual mean wind speeds at 50 m height above ground (source solar and wind resource Kenya)

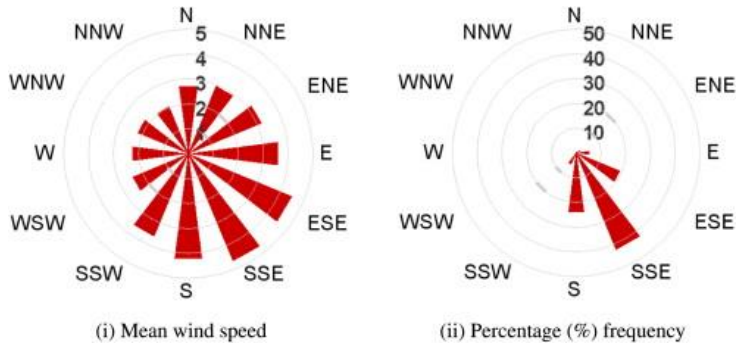


Fig 4.0.6 Mwingi North wind rose (source sciencedirect.com)

Vegetation

There is un-equal distribution of vegetation in the site with 80% of the land being poorly distributed with vegetative cover.

Fig 4.0.7 Vegetative distribution (source author, 2019)

Land use

The main land use for this region is rather not specific because of the unequal rainfall and poor climatic conditions. But cultivation is dominant especially during the rainy seasons. Livestock keeping is also a major activity within the region with cattle and goats.

Legal

The hospital is owned by the Government of Kenya. Restrictions occur on the northern side where there are personal properties. Kyuso hill is also present on the north western side. On the eastern side there are personally owned farms while on the southern side there is a road and personal properties on the other side of the road. The west has commercial structures heading all the way to the main to Kyuso.

Fig 4.0.8 Neighboring regions from kyuso hospital (source, author 2019)

Key features from Mwingi;

Fig 4.0.9 Kyuso hills 100m north side of kyuso hospital (source, author 2019)

Fig 4.1.0 river rocks (source author,2019)

Fig 4.1.1 Wet River sand kyuso river (source, author 2019)

Fig 4.1.2 Gai hill kyuso sub county (source, author 2019)

Fig 4.1.3 Rocks near kyuso hospital

(Source, author 2019)

Fig 4.1.4 Kivila hill, 3km from kyuso town

(Source, author 2019)

4.3 Presentation of findings

According to the information gathered by the researcher during the research it was noted that Kyuso hospital was not constructed or designed under any therapeutic theme or rule. There is little consideration of the ambeatic nature of the space as well. It was noted that there was little application of sustainable materials in the interior architecture, furniture, exhibition and display and landscaping. This can be observed from the general layout and design of the space since there is visual conflict between the outdoors and the indoors. For instance, the outdoors lack clearly defined walking paths and relaxing areas which aid in the comfort of the patients in the hospital. Lack of positive destructions like water features and healing gardens raises a point of concern for the patients in kyuso hospital. This section will analyze the nature of the four thematic areas; interior architecture, exhibition and display, furniture design and landscaping. The presentation will be based on the firsthand information gathered by the researcher in Kyuso sub county hospital.

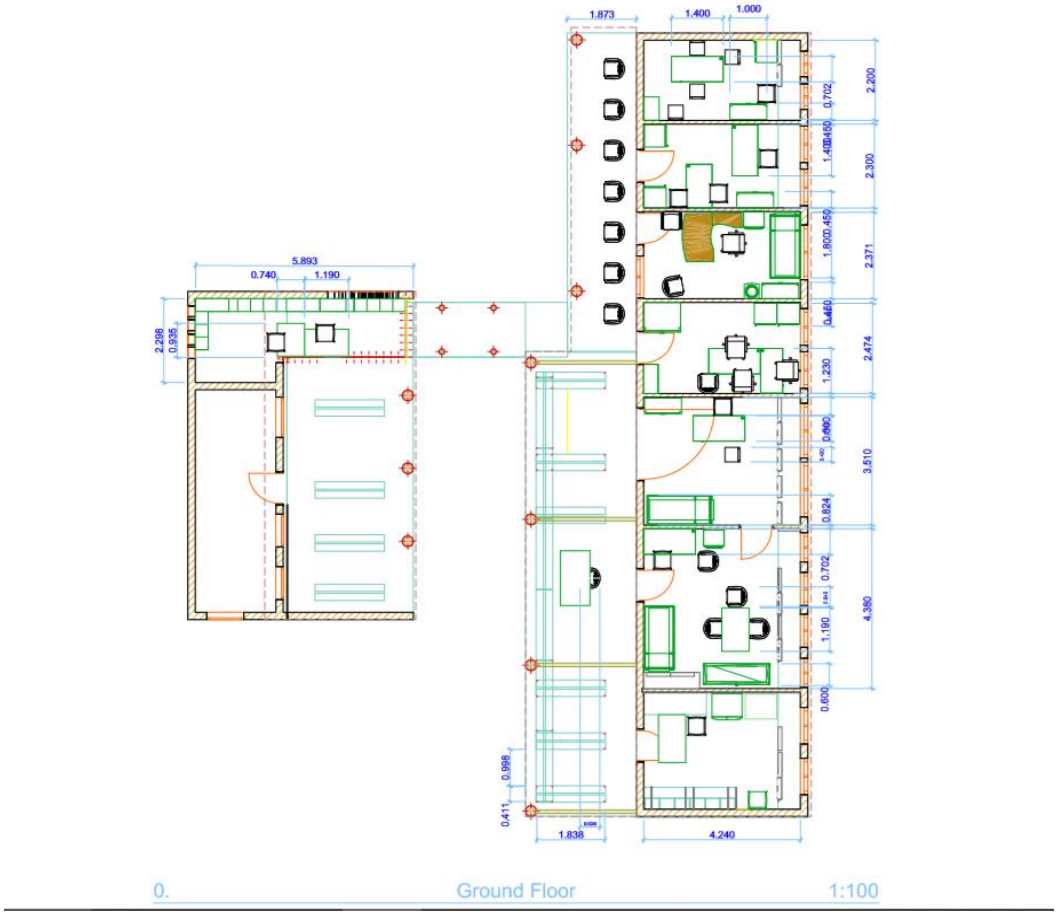


Fig 4.1.5 current site plan layout (source, author 2020)

Interior architecture.

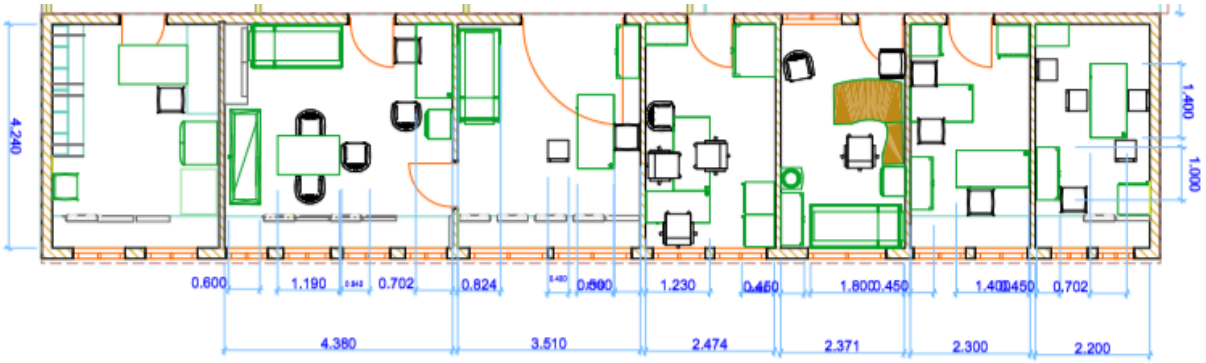


Fig 4.1.6 current site interior architecture layout (source, author 2020)

Most of the layouts on the different blocks in the hospital have paid less attention in terms of furniture ergonomics and human circulation. The orientation of furniture in the blocks are different and don't adhere to the basic rules of design. There is presence of Unnecessary furniture in the blocks as well as unused storage cabinets. The windows are made of louvers which are rustic and old in nature. The windows are small and therefore allow minimal light into the small rooms in the administration block. There windows lack blinds hence lack of maximum privacy especially in the consultation rooms.

Fig 4.1.7 injection room (source author, 2019)

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Ceiling

Most of the ceilings in the hospital blocks are not covered exposing the truss frameworks. Some of the ceiling boards are old and worn out. Some are made of asbestos which is a poisonous material in relation to human health. Some of the ceilings are too high hence visually not appealing to the users.

Fig 4.1.8 Exposed ceiling trusses (source, author2019) *Fig 4.1.9 Asbestos ceiling (source, author2019)*

Flooring

The floors are made of cement with no other kind of surface finishing making them unattractive. These floors are slippery therefore potential hazards to patients and workers in the institution at large. Some are worn out in nature and cannot withstand high human traffic.

Fig 4.2.0 Simple cement floor (source author, 2019) *Fig 4.2.1 worn out floor (source author, 2019)*

Lighting

Fluorescent tubes and energy saving bulbs are the main lighting systems used in the hospital making the lighting conditions poor and monotonous. This hinders the lighting conditions for the patients to maneuver around the institution freely hence a major problem. The energy saving bulbs are dim and this hinders visibility in the rooms and offices.

Fig 4.2.2 Energy saving bulbs (source author 2019) *Fig 4.2.3 fluorescent tube (source author 2019)*

Furniture designs

The chairs are made from plastic and steel. They are worn out in nature and the cushions are torn. The plastic chairs are broken some without back rests and are uncomfortable in nature for the users.

Fig 4.2.4 Outdoor furniture (source, author 2019)

Fig 4.2.5 broken plastic chair (source, author 2020)

Storage cabinets

The storage cabinets are made from steel which is worn out in nature. The hinges are unlockable due to rusty hinges and doors. Some are also made of wood and are open. the drawers are un ergonomically designed due to weight and size. Some of the rooms have less cabinets hence minimal storage causing a lot of clutter in the rooms and leading to visual discomfort to the patients.

Fig 4.2.6 Open drug shelves (source, author 2019)

Fig 4.2.7 Wooden & steel cabinets

(source author, 2019)

Exhibition and display

The reception area is a two-receptionist space made from rusty metal grills that run around it. The grill is about 2m high with an opening at the front area hardly accessible to short or older people. There is a small door at the right side of the reception which makes it hardly inaccessible to the users. There is no signage to indicate that it is the reception area. Inside are cabinets for file storage cabinets while other

extra files are stored in carton boxes. At one end of the reception is an empty space. Visually there is less investment in the layout and interior of the space at large. At the front is a waiting area where people sit and wait to be attended to which is also part of the reception area. At one end of the wall is a television set meant for entertainment to the people at the waiting area. The waiting area has wooden benches painted in blue and reinforced with metallic legs which don't have back rests and are uncomfortable in nature. There is an empty open space near the reception area which is also used when there are many people at the waiting benches which is bare and with no seating benches. The queuing area is a long corridor with benches that are wooden and uncomfortable since they have no backrests.

Fig 4.2.8 Queuing area (source author, 2019)

Fig 4.2.9 Cabinets on the wall (source author 2019)

Fig 4.3.0 waiting area (source author 2019)

Fig 4.3.1 (reception area) Metallic grills with an opening (source author, 2019)

landscaping

The landscape is oriented in such a way that the first structure is the gate house which is made of iron sheet and reinforced with steel rods. The path ways all head straight from the gate towards the different facilities in the site. The pathways are not fully defined and are bare and dry in nature. There is absolutely no signage to indicate the walkways to different blocks, entrance or name of the hospital which makes it difficult for way finding. The landscape is bear with less vegetation cover especially grass.

The parking is too small with accommodation of up to three vehicles.

There are no distinct areas such as social interaction group areas, canteen areas or places of respite and relaxation.

Fig 4.3.2 Entrance (source, author 2019)

Fig 4.3.3 vegetation (source, author 2019)

Fig 4.3.4 Small parking (source author, 2019)

Fig 4.3.5 bare dry walkway (source author, 2019)

4.4 Conclusion

This chapter outlined the current situation of the hospital under study. It stated the different facilities in the space and how exactly the situations on the ground were. This information will help the researcher in formulating solutions to the problems at hand.

CHAPTER FIVE

5.0 SUMMARY FINDINGS CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter will aim to discuss in depth and present a summary of the previous chapter. Based on the research questions and information gathered in chapter one the author will make appropriate recommendations concerning biomorphic designs, and use of locally available sustainable materials discussed in depth in the literature review chapter two. The recommendations will major on interiors of the administration block, the reception and queuing area, the outdoor canteen, sitting areas, parking and walkways as well as furniture designs suitable for Kyuso sub county hospital.

5.2 Summary of findings

Kyuso sub county hospital is a hospital that offers medical care for the local people both from Kyuso and its neighboring regions according to the researcher's gathered information. According to the analysis of the site's existing space and conditions it can be concluded that little attention has been paid towards the design of the hospital in relation to the end user. There are no therapeutic based design considerations in the facility and this happens to be a major contributing factor towards congestion. This includes both the landscaping designs as well as the interiors. There is less evidence of incorporation of user friendly or ergonomically designed furniture such as tables and chairs. Less attention has been paid towards the allocation of furniture to the different end users in the facility such as the administration block and the reception area.

The landscaping design is extremely poor with less than 25% greenery ground cover which is not a recommended standard. The parking is poorly done as well as the walkways which are not visually appealing and are undefined with bare ground. There are no defined sitting and relaxing areas on the ground. There is lack of a secluded space where sick people can relax and meditate which happens to be a crucial feature in modern day health care system designs. The entrance is poorly done and creates a wrong impression to any user once he/she gets to the hospital. A lot can be done in terms of incorporation of different vegetation types as well as use of stones to define parking and walkways. The entrance can be modified to a two-way opening; the entrance and exit with a modern gate design and a guard house.

The exhibition and display was confined to the reception area as well as the outdoor queuing area. This happens to be the most crucial part of the hospital since it creates the first impression of the hospital's indoor facilities and services. A lot needs to be improved in the reception area so as to positively impact the mood of the patients and the staff members. The visual appeal of the design is to be invested more.

Findings from the research in Kyuso hospital showed that mango wood would be a viable material to be used in the design of furniture and other elements from the interior all the way to the landscaping designs. Mango wood is widely known in the region and usually ends up in the charcoal industry where else it can be used better in the design industry. The use of rocks and stones also would be a suitable material to be used in most of the landscaping designs like the sitting areas and the gardens. The rocks would influence a taste of African design since they are uniquely identified with Kyuso and Mwingi at large. This would also create awareness on the importance of incorporation of locally available materials in the design industry. The rocks are long lasting and have become a nuisance to most people in the region since they affect the farming process therefore their incorporation in the landscaping design would influence many in the use of them as well in designs. respondent's preferences indicated that mango wood would be favorable for the interiors finishes and furniture designs.

For the creative part of design, the author went for Monstera leaves. These leaves have a taste of the modern design trends and happened to be suitable due to their biomorphic physical characteristics. The design of the leaf would affect the overall design of the hospital design so as to bring consistency in terms of design. This is simply to minimize clutter in terms of design.

5.3 Recommendations

The following solutions were then recommended in relation to the problems that arose from the research conducted in Kyuso sub county hospital. They majorly focused on the ability of design to impact healing, aesthetics as well as use of ecofriendly materials.

5.3.1 interior architecture

Interior architecture will encompass the wall, floor and ceiling treatments as well as doors and windows and any other opening confined within any indoor space. Sustainable design can be adopted in the interiors of the study site through selecting building materials manufactured from renewable resources which can hence be reused and recycled and remain durable. The author focused on the different departmental rooms in the administration block. The following plan arrangements were developed to be implemented in the space. For the consultation rooms and the pharmacy; the aim was to develop a more modern space with a cool serene environment for the patients. Human circulation was maximized as well in the spaces.

For the offices, space was minimal and layout was fully put into consideration to maximize end user human circulation. Ceiling designs were put into consideration as well as interior décor. Digital data storage was proposed so as to maximize on the small office spaces.

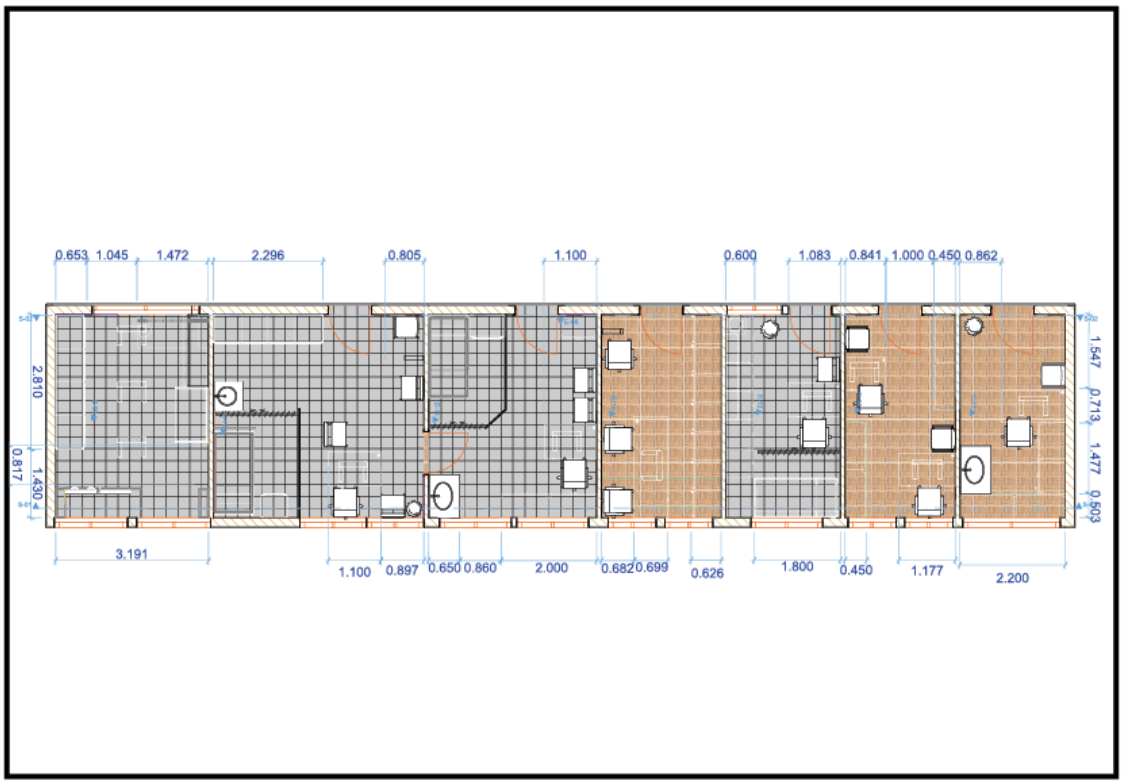

Fig 5.0.1 Administration block plan (source author 2020)

Ceiling and lighting

For the ceiling the hospital administration block has rooms with worn out ceilings while others are bare in nature. The bare ceilings have exposed roof which is made of asbestos and is extremely hazardous to the human health. Several recommendations were made for the different rooms in the administration block and are discussed on each individual space in the next sub topic.

On the lighting systems, the hospital has not explored on the various types and lighting designs. Natural lighting has not been harnessed by the windows either since the windows are small to various rooms ratio size. The hospital has installed fluorescent tubes in most of the rooms. The tubes are not sustainable since they contain mercury which is a dangerous chemical for human health more so to people with acute health problems and this happens to be critical in a healthcare environment. The rooms lack the ambience created by a variety of illumination fixtures especially the consultation rooms which need more lighting. Due to the reasons above, the author recommended the following sustainable materials and elements for the hospital ceiling and lighting respectively.

pharmacy

The hospital pharmacy needs to cover up its structural trusses by painting them. The electrical piping system will be wired in a systematic way or by piping them inside the walls so as to minimize clutter. Ceiling materials such as drop down ceiling beams will be used to enable natural lighting into the space through the vents. For the lighting the wooden planks will include inbuilt lighting systems to light up the space. This would create a brightly lit up scene and a space that can easily be identified from outside as a pharmacy.

Fig 5.0.2 Wooden ceiling beams with inbuilt lights (source google.com)

Consultation rooms

The ceiling will be lowered to a standard height of approximately three meters above ground. Ceiling materials such as the false ceilings will be used to enable temperature control, install lights or to conceal electrical and other networking cables and ugly or too high ceiling. This will be gypsum or perforated acoustic ceiling material. Down lighters will be put into consideration on the ceiling around the perimeter to bring out ambient lighting. Drop down lights will be used just above the working tables to light up the space directly from above. This would create a center of focus to any first time user in the room. The beds will have spot lights on the head boards as well for easy checkups by the doctors when working on patients.

Fig 5.0.3 drop down lights (source Pinterest)

Fig 5.0.4 Gypsum ceiling (source, Pinterest)

fig 5.0.5 perforated acoustic ceiling (source Pinterest)

Medical offices

The ceiling will be lowered to cover up the exposed trusses and wiring systems. False ceiling designs made from gypsum will be used in combination with mango wood ceiling planks. Down lighters will be installed at the corners while main drop down lights will be installed just above the working stations to light up the space and create the main center of focus in the space.

Fig 5.0.6 Wooden planks with gypsum (source Pinterest)

Fig 5.0.7 down lighters (source Pinterest)

Wall finishes and color schemes

Blue is the color of the sky. It possesses a soothing influence upon both the human mind and body. Blue can be used for just about any condition in need of healing since it is considered one of the greatest antiseptic in the color pallet world. This color will play a major role in the design of the walls in Kyuso hospital.

Pharmacy

Current walls are painted in oil based paints which are hazardous for the interior walls since they are highly flammable. The walls will be schemed and painted with antimicrobial paints. The pharmacy walls will be white in color but neutralized with a sky/pale blue color at the wash basin area. Natural mango wood color also will be implemented on the cabinets as well to neutralize the white colored walls. A

nature based wall hanging will also be placed at the wash basin area instead of a mirror. This will act as a positive distraction to the end user. The wall on the wash basin area will be made of an extruded gypsum wall and will be painted in sky blue as illustrated in fig 5.0.8.

Fig 5.0.8 washbasin area (source author, 2020)

Consultation rooms

The walls will be schemed and painted with antimicrobial paints. They will be white in color while the wash basin points will include the blue gypsum wall protrusion with a nature based wall hanging. Also all the working stations will include a blue gypsum wall protrusion as well with nature based wall hangings. The bed section will include point lights on the head board side with gypsum wall extrusion painted in a sky blue color combined with natural mango wood color at the center. The rooms will also be partitioned with gypsum walls which will also be sky blue in color. These partitions will separate the beds from the working stations for privacy purposes as illustrated in fig 5.0.9

Fig 5.0.9 Nature based wall hanging (source, author 2020)

Fig 5.1.0 gypsum wall extrusion & wood (source, author 2020)

Medical offices

The same applied to the medical offices since the walls will be schemed and painted with antimicrobial paints. The walls will be white in color while on all the working stations a false wall will protrude like shown in fig 5.0.9. the gypsum protrusions will have nature inspired wall hangings to act as positive distractions to the users.

Flooring recommendations

The hospital flooring is made up of plaster which is not durable at all. Staff and patients spend most of their time in these environments, and consultation room stations never shut down. Flooring should promote stress reduction, comfort and 24/7 access with materials that allow rapid installation and minimize maintenance.

To suit these purposes, many hospitals have moved away from the old school type of flooring like the traditional linoleum and vinyl composition tile (VCT) for nurse's stations and functional treatment areas. Instead, hospitals are turning to luxury vinyl tile (LVT), bio-based tile (BBT) and sheet tile flooring made from low-VOC materials. The author recommended floorings within these categories that have protective coatings, as they would resist scratches and minimize the need for waxing, buffing and chemical cleaning. Free-floating LVT and materials with adhesive backings would also reduce installation times and disruption work flow within these areas. PVC flooring would be the best due to its good acoustic properties and noise reduction as well.

Every working station would also be backed up with carpet flooring at the staff working stations.

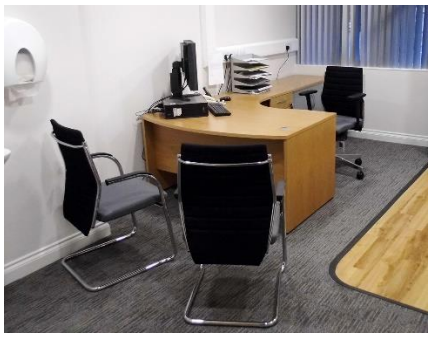

Fig 5.1.1 carpet flooring (source google)

Recommended doors and windows.

The existing doors at the hospital are worn out in nature and don't have any features to allow natural lighting features. The author recommended wooden doors with glass features to allow light into the rooms.

For the windows the rooms currently have louvers which are not only old fashioned but also small hence allow minimal light and air flow into the space. The author recommended large sliding windows to maximize light and air flow into the rooms. He also recommended the use of window blinds to maximize privacy inside the different departments of the administration block.

5.3.2 furniture

The hospital administration has not embraced the use of modern furniture designs. Most of them are old and worn-out while others are not made from any ecofriendly materials. The furniture designs are also not end user targeted and therefore the following recommendations were made;

Eco friendly materials like mango wood and plexiglass will be employed in the design of the furniture. The material's thermal properties and surface treatments will be put into consideration to maximize comfort and a longer lifespan during exposure to extreme conditions. The furniture designs will be function specific so suit all the users of the different departments. Chairs for the doctors and the patients will be user specific due to their different ergonomic properties.

Monstera leaves happened to have the best suitable biomorphic features for furniture design. The designer intents to employ these amazing features onto the furniture designs for the different departments. This will include techniques such as engraving, incising and bending these biomorphic leaf patterns to create modern and aesthetic furniture pieces for the users in kyuso sub county hospital. The following are some of the furniture pieces the designer came up with for the spaces;

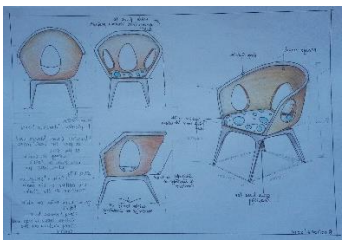

Fig 5.1.2 Patient chair (source, author 2020)

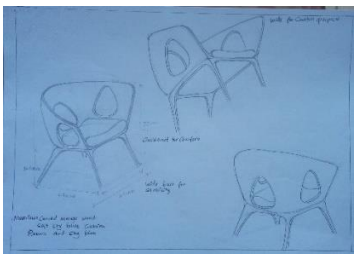

Fig 5.1.3 Patient chair (source, author 2020)

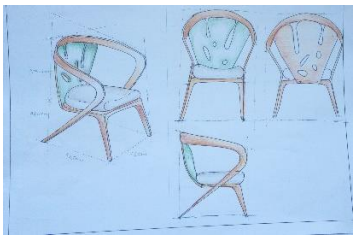

Fig 5.1.4 Patient chair (source author 2020)

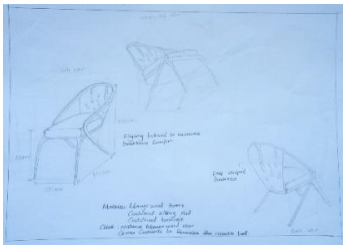

Fig 5.1.5 Patient chair (source, author 2020)

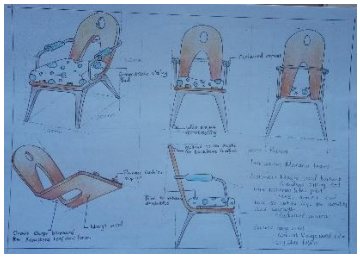

Fig 5.1.6 Patient chair (source, author 2020)

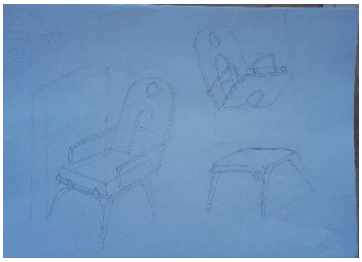

Fig 5.1.7 Patient chair (source, author 2020)

The following were the recommended drug storage cabinets;

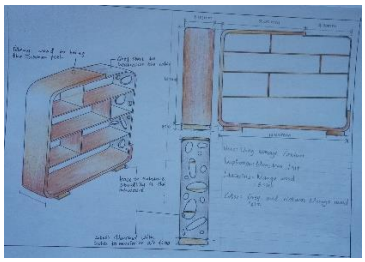

Fig 5.1.8 drug store cabinet (source, author 2020)

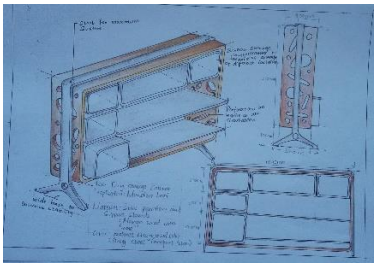

Fig 5.1.9 drug store cabinet (source, author 2020)

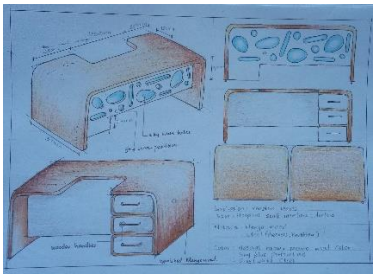

Fig 5.2.0 office table (source, author 2020)

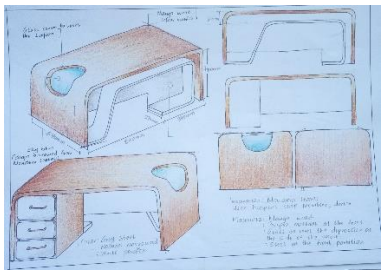

Fig 5.2.1 office table (source, author 2020)

5.2.3 Exhibition and display

The exhibition and display happens to be the first place patients, families and visitors get to see in a hospital. This creates the first impression to any incoming individual and a lot has to be invested to create a positive impact to any individual. The reception area and the queuing area acted as the best choice for the exhibition and display and by this the designer recommended the following strategies to be employed in the space;

The layout;

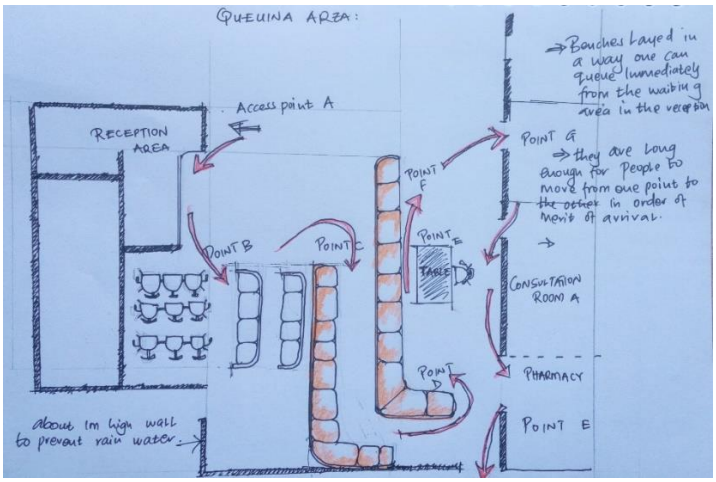

Fig 5.2.2 proposed queuing area layout (source, author 2020)

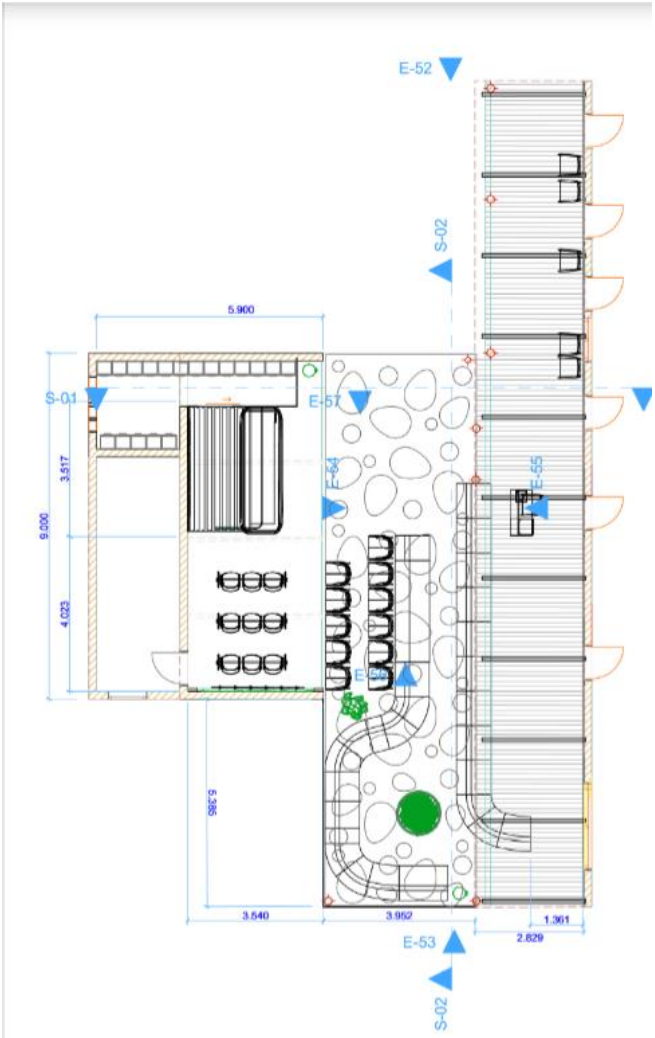

Fig 5.2.3 proposed queuing & reception area layout (source, author 2020)

The reception area storage space will be maximized through introduction of a tinted glass partition and change of the reception desk orientation. The reception desk includes a positive distraction feature which is a fish tank to the users at the waiting area as illustrated;

Fig 5.2.4 Fish tank on the reception desk (source Pinterest)

Seats will be placed oriented towards the reception desk and extended towards the open space. Wall on ivy will be introduced at the wall adjacent to the reception desk to act as a mood changer in the scene.

Fig 5.2.5 Plants on wall with spotlights (source google.com)

The empty open space will be converted to an enclosed usable space due to the minimal space at the queuing area and the waiting area. By this the designer recommended use of an enclosed roof that connected the administration block and the reception area. So as to make it lively and interesting the adaptational characteristics of the leaf like its ability to penetrate lights down to the ground via the punched holes the designer employed the same on the roofing so as to allow light down to the benches below. The roof will be perforated and would be made from steel. Plexiglass will be used at the top to prevent direct heat down the ground and this would create interesting sunlight shadow patterns down the floor below it. Queuing benches will be placed partly below the created ceiling while the other would be close to the corridor near the exit point at the pharmacy. The sofas would be cushion based with pillows and neutral colors like grey. In between the two queuing benches the designer recommended a drop down glass cylinder from the roof which will be punched with holes and plants planted inside the glass. Nature

tends to bring a therapeutic effect and this would work effectively to the people at the queuing benches. There will also be seats along the corridor next to the doors of the different rooms in the administration block.

Fig 5.2.6 open space with enclosed vegetation (source google)

Fig 5.2.7 Perforated ceiling design (source google)

For way finding the designer recommended use of signage boards next to every door with a number for ease of access with minimal or no difficulties.

Fig 5.2.8 Signage for way finding on doors (source author, 2020)

5.2.3 Landscaping

The overall landscape of the space is relatively flat and this would work to the advantage of the designer. Several changes were made and the site layout was redesigned involving different considerations in terms of navigation and access to the different landscape features. The different spaces interconnected as illustrated in form of bubbles below;

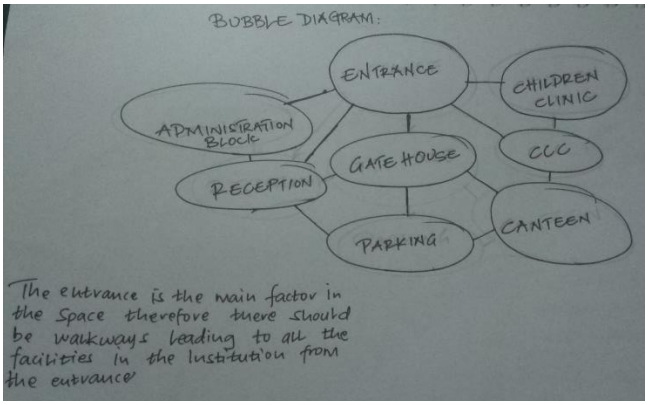

Fig 5.2.9Bubble diagram (source, author 2020)

This was the recommended site layout;

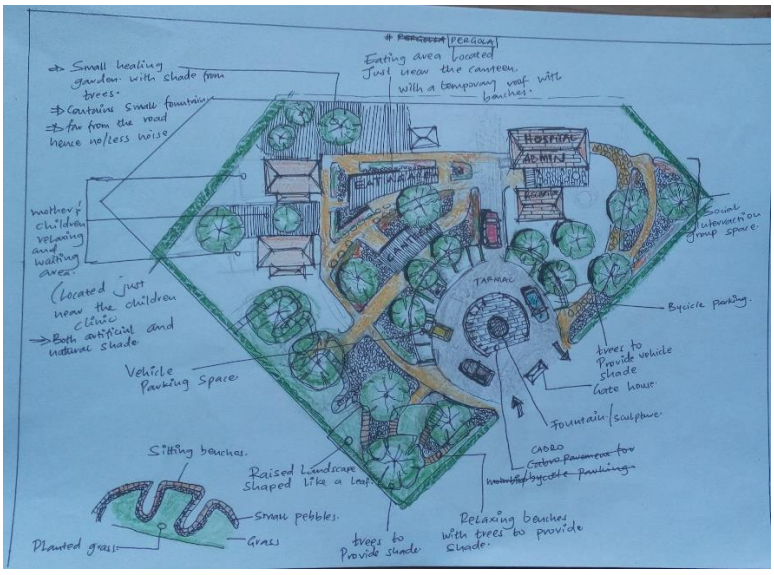

Fig 5.3.0 landscape plan (source, author 2020)

The designer made the other recommendations as follows;

entrance

There is no signage at the hospital gate and therefore this gate will have the name of the hospital whereby people would clearly see it. The use of a bigger gate with an entrance-exit way with a gate house at the center. This would minimize vehicular traffic hence free movement and circulation of both human and vehicles.

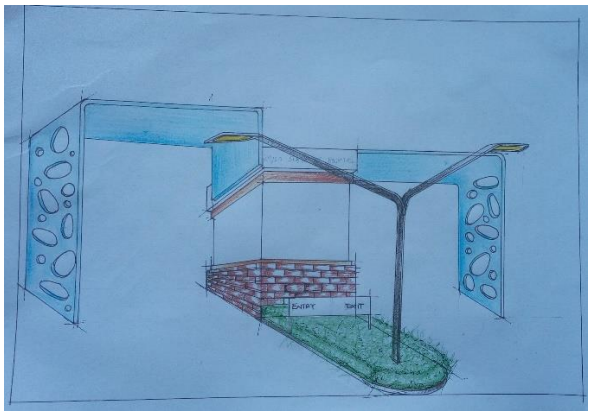

Fig 5.3.1 hospital two-way; entrance and exit (source, author 2020)

Parking

A round parking will perfectly match the nature of the landscape and visually enhance beauty. Vehicular parking and motorbike/ bicycle parking will all be at the same place. Water tends to be a calming feature from the natural environment and by this; the center of the round parking will be installed a fountain just near the gate for aesthetic purposes as illustrated in fig 5.2.7 below;

Fig 5.3.2 Round parking (source, google)

Walkways

Hard pavement material like cabro or natural stone was recommended. This would also favor the patients with wheelchair when navigating from one point to another. Small pebbles would also boost the visual

nature of the walkways as illustrated in fig 5.3.3 The designer recommended use of bollard lights on the walkways to ease navigation during the night. The lights would also borrow inspiration from the Monstera leaves so as to blend the surrounding with the man-made lights as well as other existing features in the environment.

Fig 5.3.3 walkway with small pebbles and shrubs (source Pinterest)

Sitting areas

The landscape would be subdivided into different areas including social interaction groups, sitting areas, a healing garden and the canteen area. Suitable material choices would be used as well as vegetation types to suit the different areas. Choice of furniture for these spaces would also be put into consideration to withstand the harsh conditions of the environments.

Lighting

Both bollard and flood lights would be used all over the scape. The healing garden will use string lights to create a different serene ambient of the space.

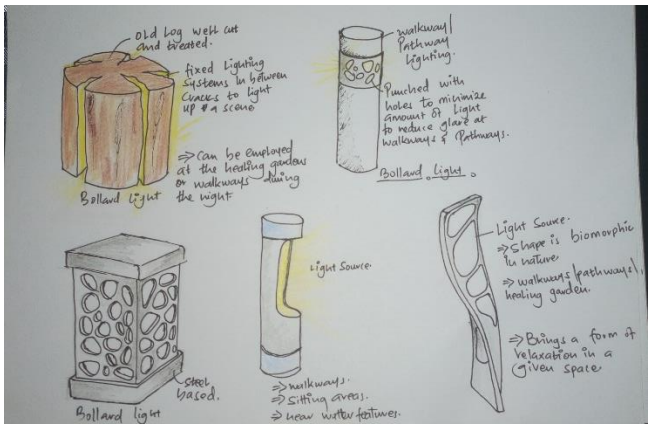

Fig 5.3.4 Bollard light designs (source, author 2020)

Vegetation & landscape materials

Both hardscape and soft scape landscape vegetation types were considered. The total vegetal cover will be more than 25% and this will make the landscape appealing.

Stones and sand will also be used in combination of different plant types will be used and this would be sustainable and require little or low maintenance.

These were the recommended vegetation styles of planting;

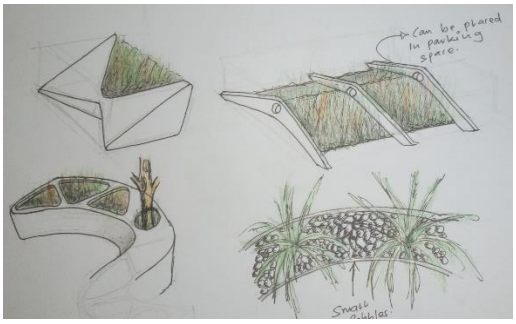

Fig 5.3.5 vegetation décor types (source author)

5.4 Conclusion

This chapter discussed the various recommendations the author gave in relation to the findings gathered from the site under study. The designs clearly demonstrated the use of locally available materials into the day to day life and how well the designs would impact the patients' health conditions and shorten hospital

stays through impacting self-healing. Aesthetics was also a key factor the author recommended and this would transform the look of Kyuso sub county hospital.

5.5 suggestion for further study

The hospital has wards, emergency centers and physiotherapy stations that are situated at the back of the administration block. They are huge and could not be covered extensively due to lack of enough time. The researcher hereby recommended further in depth study to solve the major challenges experienced at the spaces.

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APPENDICES

Appendix 1: Interview Guide

UNIVERSITY OF NAIROBI

College of Architecture and Engineering

School of The Arts and Design

Section A: senior management. 1. What was the considered inspiration for design of kyuso hospital?

2. What is your opinion on therapeutic and aesthetic design and has it been used in the design of kyuso hospital?

3. What influenced the design and material selection for the current design?

4. After brief introduction on therapeutic design, would you recommend the use of biomorphic and sustainable design to achieve this?

5. Would you reconsider redesigning Kyuso sub county hospital by use of biomorphic design and use of locally available materials? If Yes which areas would you recommend to be considered first?

Section B: patients. 1.What is your take on the interior and exterior spaces of Kyuso sub county hospital?

2. After brief introduction on biomorphic and sustainable design in achieving a therapeutic and aesthetic space, would you recommend use of these two in redesigning of kyuso sub county hospital?

3. Do you prefer employment of more relaxing areas with therapeutic ambiences?

4. Which areas of the hospital would you like to be redesigned and renovated?

5.What are some of the challenges you have faced while using the interior and exterior spaces of the hospital?

Section C: hospital Staff

1. What is your take on the current state and design of kyuso sub county hospital?

2. What design concerned feedback do you get from your patients about the current design of the hospital?

3. After a brief description of biomorphic design to achieve a therapeutic and aesthetic space with use of locally available materials, would you recommend the hospital to be redesigned based on that?

4. What areas of the hospital would you recommend to be redesigned first?

5. What are your opinions on therapeutic design using locally available materials?

Section D: Residents of the Area

1. Have you ever been to kyuso sub county hospital?

If Yes, what was your opinion on the designs of the interior and exterior spaces?

2. After a brief description of biomorphic design to achieve a therapeutic and aesthetic space with use of locally available materials, would you recommend the hospital to be redesigned based on that?

3. Which areas would you recommend to be redesigned first?

4. If the hospital was redesigned, what would it mean for you as a resident of the area?

Appendix 2: Focus Group Guide

UNIVERSITY OF NAIROBI

College of Architecture and Engineering

School of The Arts and Design

Section A: Interior Design Students

1. After viewing some photographs of Kyuso sub county hospital, what are your views on the current state and design of the interior and exterior spaces?

2. What is your opinion on current conditions towards achieving a therapeutic and aesthetic space?

3. What is your take on achieving a therapeutic space as well as an aesthetic space?

4. After a brief introduction to biomorphic design do you think it will be a good way to achieve a therapeutic and aesthetic space?

5. Would you recommend use of sustainable materials and biomorphic inspired designs to be used in redesigning of Kyuso sub county hospital?

6. Which spaces would you recommend to be redesigned first?