Proposed Vocational Training Center, Ibadan, Oyo State
(Integration of Green Design Principles in a Vocational Training Center)

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Certification

This is to certify that, Joshua Oluwatunmise ONI with matriculation number LCU/PG/004060 carried out this research work titled 'Proposed Vocational Training Center, Ibadan, Oyo State (Integration of Green Design Principles in a Vocational Training Center)' in the department of Architecture, Faculty of Environmental Design and Management, Lead City University, Ibadan, Oyo State, for the award of Master Degree (MSc) in Architecture. The thesis is an outcome of an independent and original work. I have duly acknowledged all the sources from which the ideas and the extracts have been taken. The project is free from any plagiarism and has not been previously submitted to any other institution.

……. ……

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Dedication

This research project is dedicated to God Almighty who by His grace has enabled me to be able to carry out this project successfully.

Acknowledgement

My sincere gratitude goes to Lead City University, School of Post Graduate Studies and the Department of Architecture, for providing the academic platform and resources that supported this project.

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Abstract

This research explored the strategic integration of green building principles within vocational training centers, proposing a transformative model where the facility itself served as a living laboratory for sustainable practices. The key areas of focus included leveraging passive design and renewable energy sources to enhance energy efficiency, implementing water conservation strategies, and selecting eco-friendly building materials. Additionally, the research investigated the integration of sustainability education directly into the curriculum, developing modules specifically tailored to various vocational programs. By equipping graduates with knowledge and practical experience in sustainable practices, this approach aimed to foster a generation of skilled workers capable of contributing to a more sustainable future. Data collection methods involved reviewing relevant articles, journals, and case studies to identify best practices and assess real-world applications of green design in vocational training centers. The research concluded by highlighting the multifaceted benefits of green vocational training centers, including reduced operational costs, improved learning environments that promote eco-consciousness, and the development of a skilled workforce prepared for the demands of the growing green economy.

Keywords: Curriculum Development, Eco-Friendly Materials, Green Building, Resource Management, Sustainability Integration, Vocational Training,

Word Count: 171 words

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Chapter One

Introduction

1.1 Background to the Study

Throughout history, vocational education has provided students with hands-on experience to prepare them for employment. Some scholars trace its origins back to apprenticeship-based education systems that emerged as early as 626 BC (Smith, 2015). Regardless of its true origin, today's vocational education has evolved into a sophisticated system that balances classroom learning with practical work experience (Jones, 2020).

Vocational school, was identified with various names e.g. trade centers, career colleges, and technical colleges, train students for skills-based careers. Students interested in fields such as event planning, accounting, graphic design, plumbing, or law enforcement can enroll in vocational technical schools. These Career and Technical Education (C.T.E.) programs prepare students for either immediate entry into their chosen careers or for further education, such as four-year degree programs (Miller & Scott, 2021).Students have been training for specific vocations for thousands of years, just not in the way we think of vocational education today. Women learned domestic skills from their mothers, and young men trained for specific trades under skilled professionals. Apprentices might have learned to shape swords by shadowing a town blacksmith, a practice that highlights the long-standing tradition of skills-based, hands-on learning (Brown, 2020).The most notable development to vocational education came in the early 20th century in United State of America. Before the Great Depression, society was industrializing, Agriculture was less lucrative, and children from rural areas were showing up to attend schools that were already overcrowded. Those schools were even less prepared for the influx of immigrants that were arriving in the United States at the same time. Factories, on the other hand, needed laborers (and so did many in-demand trade professions). Many workplaces employed young people, but the United States passed its first

child labor law in 1916, which began to limit child labor. It was no longer so widely accepted for young children to sit beside their parents and learn a trade hands on (many lobbyists deemed it unsafe and cruel). So, to help factories find skilled employees and to help schools deal with huge student bodies, U.S. high schools began to offer vocational education programs.

The Smith-Hughes Act of 1917 became the first federal legislation to fund vocational education in U.S. schools, establishing vocational education as an acceptable training path for trades such as plumbing, mechanics, and factory work (Smith & Adams, 2015). They completed their training in focused vocational programs associated with high schools. According to American Radio works, on paper, the creation of these Vocational education programs solved major problems (like overcrowded classrooms and the demand for a skilled workforce), However, these programs were criticized for steering poor and immigrant children into trades, while reserving liberal arts education (and access to college) for middle- and upper-class students (American RadioWorks, 2020).This meant that these marginalized groups were not given a chance to study a liberal arts curriculum (which was necessary for students who planned to go on to college), even if they wanted to. Desks in the liberal arts classes at high schools continued to be reserved for middle- and upper-class white students. Underprivileged students were encouraged to learn only the skills necessary to sustain jobs, then enter the workforce as soon as possible. If they tried to change career paths later down the line, they often found that they had little or no training in core subjects, which thereby prevented them from returning to college.

In 1990, the Perkins Act expanded vocational education programs to ensure they not only prepared students for immediate employment but also created a pathway to postsecondary education (Department of Education, 1990; revised in 2018). The Perkins Act defines vocational education as "organized educational programs offering a sequence of courses directly related to the preparation of individuals in paid or unpaid employment in current or emerging occupations requiring other than a baccalaureate or advanced degree" (Public Law 101-392, 2018). The Act aims to enhance the United States' global competitiveness by funding programs that adapt to diverse learning styles

and prepare students for both the workforce and higher education (Miller, 2020). It provides vocational programs to young students as a way for them to start their educational careers, not limit them. Now, students can begin their Career and Technical Education courses in high school or after obtaining their diplomas or GEDs, and they leave prepared to either go right into a career or continue working toward a four-year degree program. The Perkins Act was designed to allow the United States to successfully compete in the global economy by funding programs that meet the needs of family incomes, adapt to different learning styles, and prepare students for both postsecondary education and employment. While a certain untrue stigma surrounding Vocational education persists (namely that no student would choose Career and Technical Education if he or she had other options), these programs now include school-based and work-based learning through supportive business partnerships. Despite lingering stigmas, vocational programs today are recognized for incorporating modern technologies and partnerships with businesses, ensuring students gain valuable work-based learning experiences (Wolfe & Harris, 2019).

In an analysis of the emergence of VET in the United States, Venn (2019) highlighted that the term "vocational" originally meant a “calling,” but this concept has evolved, particularly in response to the economic and technological changes of the 20th and 21st centuries. However, in more recent times, this cannot be said to apply. Societal institutions – religious, political, cultural, economic and social – which were once based on permanency were subsequently caught up in the twentieth century trend of „change“. As the reasons for VET did not remain obvious over time, its status started to be put in question. Indeed, much of the literature on VET focuses on the lack of a clear definition of the term “vocational”.

Moodie (2016) analyzed various definitions of vocational education, noting that it can be understood on multiple levels: epistemological, teleological, hierarchical, and pragmatic. He argues that a definition is needed on all four levels, stating that ‘one may consider vocational education and training to be the development and application of knowledge and skills for middle-level occupations needed by society from time to time’. Such a pragmatic definition seems to match the

approach of UNESCO in its Revised Recommendation on Technical and Vocational Education and Training (TVET), giving preference to the term 'technical and vocational education and training' over the term 'vocational education and training'. UNESCO's (2015) Revised Recommendation on Technical and Vocational Education and Training (TVET) reflects this multidimensional approach, defining TVET as the acquisition of practical skills and related knowledge applicable to various sectors of economic and social life.

1.1.1 Vocational Training Center

Vocational training is generally defined as the part of vocational education that provides specialized professional knowledge and skills, which attribute professional adequacy to the trainee and form the core of every vocational training program. It can be seen as a structured set of activities designed to transmit both theoretical knowledge and the professional skills required for specific types of jobs (Kotsikis, 2007).

Vocational training centers are specialized facilities where individuals, especially youth, acquire practical skills that prepare them for the workforce and labor markets, often under the guidance of experienced tutors (Aliu, 2019).

1.1.2 Types of Vocational Training Centers

Vocational training center can be categorized into two primary types: informal vocational training center and the formal vocational training center

i. Informal Vocational Training Center: This form of training is received in a relaxed and casual manner in this case, informal dresses are been allowed to be worn by trainees. Some of the vocational skill taught here are, tailoring, mechanical repairs, hairdressing, carpentry etc. Training usually takes place in the trainer's shop or workshop, where learners gain hands-on experience under the direct supervision of the trainer (Arroyo, 2020).

Plate 1.1 : Informal vocational furniture workshop.

Source- (Researcher's Fieldwork, 2024)

ii. Formal Vocational Training Center: This form of training is carried out in accordance to the established and prescribed rules. Formal wears such as uniform and overall are usually being worn by trainees. Formal vocational centers have organized systems of instruction, typically conducted in a serene environment. Training occurs in lecture halls, with access to laboratories and workshops provided on the same premises, allowing students to combine theoretical learning with practical application (Seyfried & Pohlenz, 2018).

Plate 1.2 : Formal vocational workshop lecture

Source- (Researcher's Fieldwork, 2024)

1.2 Statement of the Research Problem

Vocational training centers play a pivotal role in skill development and education, but their environmental impact and sustainability practices have received limited attention. The problem under investigation is the lack of comprehensive research on the integration of green design principles in vocational training centers, hindering their potential to reduce environmental footprint, enhance cost-efficiency, and provide a sustainable learning environment. This study aims to address this research gap by examining the feasibility, environmental impact, economic implications, and challenges of incorporating green design principles in vocational training centers and by offering practical recommendations to facilitate their transition towards sustainability.

1.3 Aim and Objectives of the Study

Aim

The aim of this research is to assess the feasibility and effectiveness of integrating green design principles into vocational training centers, with a focus on enhancing sustainability, reducing environmental impact, and improving the overall learning environment.

Objectives

i. To determine the feasibility of implementing green design principles in vocational training centers, including an analysis of cost-effectiveness, resource availability, and potential challenges

ii. To identify and document key green design principles and sustainable building strategies applicable to vocational training centers, considering factors such as energy efficiency, water conservation, and eco-friendly materials.

iii. To evaluate the environmental impact of integrating green design principles by measuring key indicators such as energy consumption, water usage, waste reduction, and indoor air quality within the participating vocational training centers.

1.4 Research Questions

There are some questions which shall be answered in this doctrinal research.

i. What are the major challenges (technical, financial, or logistical) that could hinder the implementation of green design principles in vocational training centers?

ii. How do green design principles impact the operational costs and efficiency of vocational training centers?

iii. What are the perceived benefits and challenges of integrating green design principles from the perspective of administrators, educators, and students?

1.5 Significance of the Study

In an era marked by increasing environmental concerns and the need for sustainable practices, the integration of green design principles in vocational training centers holds significant importance. This study's significance can be summarized as follows:

i. Environmental Impact: This study holds significance as it contributes to the global efforts to reduce carbon footprints and minimize the environmental impact of educational institutions. By integrating green design principles, vocational training centers can become eco-friendly and promote sustainable practices.

ii. Economic Efficiency: The research is vital for policymakers, educational institutions, and stakeholders as it explores the economic advantages of green design integration. It offers insights into potential cost savings and long-term benefits, aiding in resource allocation and financial planning.

iii. Educational Quality: Vocational training centers that implement green design principles can provide a healthier and more comfortable learning environment. This can lead to improved student and instructor well-being, positively impacting the quality of education and skill development.

iv. Global Sustainability Goals: The study aligns with international sustainability goals, such as the United Nations Sustainable Development Goals (SDGs). It supports the SDG targets related to affordable and clean energy, climate action, sustainable cities and communities, and responsible consumption and production.

v. Policy and Decision-Making: Findings from this research can inform policy formulation and decision-making processes at the institutional and governmental levels. It can guide the development of regulations and incentives to promote sustainability in vocational training centers.

vi. Knowledge Advancement: The study contributes to the body of knowledge on sustainable design in educational facilities. It can serve as a reference for researchers, architects, and educators interested in enhancing the sustainability of vocational training centers.

vii. Community Impact: Green design integration may extend beyond the vocational center walls, positively influencing surrounding communities.

This study's outcomes can foster community engagement and environmental awareness. In summary, the research holds significant implications for environmental conservation, economic efficiency, educational quality, global sustainability goals, policy development, knowledge advancement, and community impact. It underscores the importance of integrating green design principles in vocational training centers for a more sustainable and environmentally responsible future.

1.6 Scope of the Study

The scope of this study encompasses a comprehensive examination of the integration of green design principles within the vocational training center to be located in Ibadan, addressing aspects such as environmental sustainability assessment, green design incorporation, curriculum evaluation, community engagement, economic viability, policy analysis, stakeholder perspectives, comparative analysis, and the formulation of recommendations and implementation strategies.

1.7 Operational Definition of Terms

i. **Energy Efficiency**: Utilizing energy-efficient systems and renewable energy sources to reduce the building's carbon footprint.

ii. **Vocation**: generally refers to a strong inclination toward a particular career or occupation, often implying a sense of purpose or calling

iii. **Water Conservation**: Implementing water-saving fixtures, rainwater harvesting, and wastewater recycling to manage water resources efficiently.

iv. **Sustainable Materials**: Using locally sourced, recycled, and sustainable building materials to minimize environmental impact.

v. **Indoor Environmental Quality**: Ensuring adequate ventilation, natural lighting, and use of non-toxic materials to improve indoor air quality.

vi. **Waste Reduction**: Incorporating waste management systems that promote recycling and reduction of construction waste

Chapter Two

Literature Review

This chapter delves into the strategic integration of green design principles in vocational training centers. It explores the conceptual underpinnings, design considerations, and opportunities for empirical research associated with this approach.

2.1 Conceptual Review

The concept of green design refers to an approach to designing products, buildings, and systems that prioritizes environmental sustainability. This involves considering the entire lifecycle of a product or structure, from material selection and manufacturing processes to usage and eventual disposal or recycling. The goal is to minimize negative environmental impacts while enhancing efficiency and functionality. Key elements of green design include the use of renewable resources, energy-efficient technologies, waste reduction, and the promotion of health and well-being for both people and the planet (McLennan, 2004; Kibert, 2016). By integrating green design principles, we can create sustainable solutions that meet present needs without compromising the ability of future generations to meet their own (Williams, 2007).

The concept of integrating green design principles into vocational training centers offers a transformative approach to education and skill development. By fostering a learning environment that prioritizes environmental responsibility alongside technical expertise, these centers can empower students to become leaders in building a sustainable future.

2.1.1 Environmental Benefits

Green design strategies in vocational training centers translate into tangible environmental benefits. “Incorporating features like energy-efficient lighting and appliances, water conservation measures, and sustainable building materials leads to a significant reduction in the center's environmental footprint” (Yang, 2020). This translates to lower operational costs for heating, cooling, and water

usage, contributing to the financial sustainability of the facility. Additionally, it sets a powerful example for the students, demonstrating the practical application of sustainable practices in a professional setting.

2.1.2 Educational Value

"Integrating green design into the built environment and curriculum allows students to gain firsthand experience with sustainable practices" (Aktas & Isık, 2018). Beyond traditional classroom learning, students can participate in hands-on projects. These projects can involve exploring renewable energy systems, implementing energy-efficient construction techniques, or practicing sustainable resource management within their specific trades. By working on projects with a focus on environmental responsibility, students gain practical skills and develop a deeper understanding of the impact their future profession can have on the environment.

2.1.3 Market Relevance

"Sustainability is rapidly becoming a central objective across industries, with businesses increasingly prioritizing eco-friendly practices and technologies" (World Green Building Council, 2023). Students can be prepared for careers requiring an understanding of these concepts by vocational training facilities that incorporate green design into their curricula and physical facilities. They may have a significant competitive edge in the employment market as a result. Additionally, it develops a generation of knowledgeable professionals who see the value of sustainable practices across a range of industries, ultimately paving the way for a more sustainable future.

2.1.4 Fostering Environmental Stewardship

"The integration of green design goes beyond physical structures and educational programs. Vocational training centers can create a culture of sustainable practices by implementing various

initiatives. This can include installing educational signage throughout the building that explains the benefits of green design features" (Aktas & Isık, 2018).

Interactive displays can provide students with a deeper understanding of sustainability principles and their impact on the environment. Incorporating workshops and seminars that explore green practices pertinent to certain professions can also improve student learning and give them hands-on experience. Vocational training institutes have the ability to enable students to become environmentally conscious stewards of the environment throughout their professional lives by creating an atmosphere that values sustainability on many levels.

2.2 Design Considerations

The successful implementation of green design principles in vocational training centers requires careful consideration of various factors across the entire project lifecycle. This section explores key design considerations for each stage of development.

2.2.1 Energy-Efficient Design

Energy efficiency sits at the heart of any green design strategy. "Incorporating passive design principles in vocational training centers allows for harnessing the power of natural resources" (Sharma et al., 2019). This method involves optimizing solar heat gain in winter and natural shading in summer through careful building orientation.

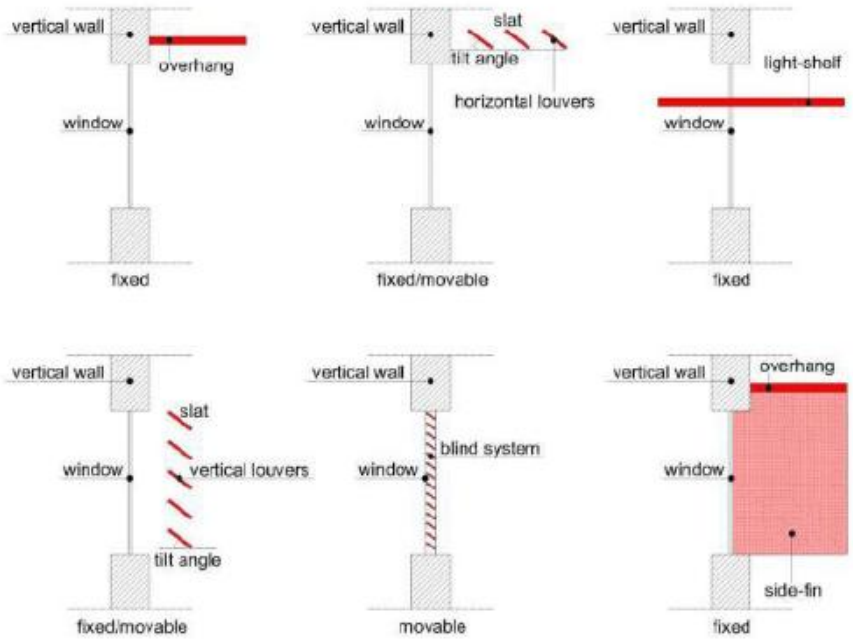

Figure 2.1 : Main shading & ventilation types

Source- (Google search, 2024)

Strategic placement of vegetation and architectural features enhances natural ventilation, reducing reliance on mechanical cooling systems. Nevertheless, a holistic approach extends beyond just passive techniques. “Integrating energy-efficient HVAC systems, state-of-the-art LED lighting, and intelligent building controls can further reduce overall energy demand” (Yang, 2020). These investments not only translate to lower operational costs but also contribute to a cleaner environment. However, a deeper exploration of each element is crucial for successful implementation.

i. **Energy-Efficient HVAC Systems:** Selecting high-efficiency HVAC systems with features like variable speed drives and heat recovery capabilities significantly reduces energy consumption (ASHRAE, 2023). Additionally, proper system design, installation, and maintenance practices ensure optimal performance and minimize energy waste.

ii. **LED Lighting:** Replacing traditional incandescent or fluorescent lighting with LED fixtures offers numerous advantages. LEDs boast superior energy efficiency, lasting significantly longer, and reducing overall lighting-related energy consumption (DOE, 2023). Furthermore, they emit minimal heat, contributing to a more comfortable learning environment.

iii. **Intelligent Building Controls:** Implementing smart building controls allows for automating various functions within the vocational training center (Singh et al., 2019). These systems can automatically adjust lighting levels, heating and cooling settings, and ventilation based on occupancy and real-time conditions. This optimization minimizes energy waste and ensures a comfortable learning environment without unnecessary energy expenditure.

2.2.2 Indoor Environmental Quality

The well-being and productivity of students and staff are paramount concerns. Creating a healthy indoor environment goes hand-in-hand with green design principles. Here are some elements to consider:

i. **Low-VOC Materials:** "Utilizing low-Volatile Organic Compound (VOC) materials in construction and furnishing minimizes the presence of harmful air pollutants" (USGBC, 2023). VOCs can negatively impact indoor air quality and contribute to respiratory problems.

ii. **Adequate Ventilation Systems:** "Maintaining adequate ventilation systems ensures a constant supply of fresh air and reduces the concentration of airborne contaminants within the building" (ASHRAE, 2023). This can involve utilizing natural ventilation strategies whenever possible, supplemented by efficient mechanical ventilation systems.

iii. **Green Cleaning Practices:** Furthermore, incorporating green cleaning practices that utilize non-toxic cleaning products significantly enhances indoor environmental quality. By

choosing cleaning agents that are free from harmful chemicals, we can reduce the presence of volatile organic compounds (VOCs) and other pollutants in the air. This not only improves indoor air quality but also protects the health of building occupants, reducing the risk of respiratory issues, allergies, and other health problems. Additionally, using eco-friendly cleaning products supports sustainability by decreasing the release of toxic substances into the environment, contributing to a cleaner and healthier planet.

2.2.3 Building Envelope Optimization

The building envelope refers to the physical barrier that separates the conditioned indoor environment from the unconditioned outdoor environment. Optimizing the building envelope plays a crucial role in energy efficiency and overall building performance. Here are some key considerations:

i. **Insulation:** Utilizing high-performance insulation materials throughout the building envelope minimizes heat transfer between the interior and exterior (DOE, 2023). This reduces the energy required for heating and cooling, leading to significant operational cost savings. Different types of insulation offer varying benefits, and selecting the most appropriate option depends on the specific climate and building design.

ii. **Air Sealing:** Even the most effective insulation can be rendered ineffective by air leaks. Meticulously sealing air leaks throughout the building envelope prevents conditioned air from escaping and unconditioned air from infiltrating. This can be achieved through various techniques, such as using high-quality sealants and tapes around windows, doors, and other potential leak points.

iii. **Fenestration:** Windows and other glazed elements play a vital role in daylighting and aesthetics. However, they can also be significant sources of heat gain or loss depending on the climate. Selecting energy-efficient windows with features like low-emissivity coatings

and proper window placement can optimize solar heat gain in winter and minimize unwanted heat gain in summer.

2.2.4 Renewable Energy Integration

While maximizing energy efficiency is crucial, vocational training centers can further reduce their environmental impact by integrating renewable energy sources. This demonstrates a commitment to sustainability and provides valuable hands-on learning opportunities for students in relevant trades. Here are some potential options:

i. **Solar Photovoltaic (PV) Systems:** "Solar PV systems convert sunlight into electricity, offering a clean and sustainable source of energy" (NREL, 2023). These systems can be installed on rooftops or other suitable locations to generate electricity for the vocational training center, reducing reliance on the grid and offsetting carbon emissions.

ii. **Wind Turbines:** "In suitable locations with consistent wind conditions, wind turbines can be an effective source of renewable energy" (AWEA, 2023). These systems convert wind energy into electricity, providing a clean and sustainable alternative to traditional energy sources.

iii. **Geothermal Energy:** "Geothermal energy systems utilize the Earth's natural heat to provide heating and cooling for buildings" (DOE, 2023). While not feasible in all locations, geothermal energy offers a sustainable and efficient way to manage the building's thermal comfort.

2.2.5 Building Automation and Control Systems

Building automation and control systems play a vital role in maximizing the efficiency and performance of green design features in vocational training centers. These systems integrate various technologies to monitor and control various aspects of the building, including:

i. **HVAC Systems:** “Building automation systems can optimize the operation of heating, ventilation, and air conditioning systems, ensuring they function efficiently and only when necessary” (Singh et al., 2019). This helps to minimize energy consumption and maintain a comfortable learning environment.

ii. **Lighting Systems:** Smart lighting controls allow for automatic adjustments based on occupancy and external light conditions. This ensures that lights are turned off in unoccupied spaces and optimizes lighting levels for occupant comfort, reducing unnecessary energy use.

iii. **Water Management Systems:** Building automation systems can monitor water usage patterns and identify potential leaks or inefficiencies. This allows for prompt maintenance and helps ensure the responsible use of water resources.

By integrating these various technologies, vocational training centers can create a truly intelligent building that optimizes energy and resource use, minimizes environmental impact, and delivers a comfortable learning environment.

2.2.6 Water Conservation

Water is a precious resource, and its responsible management is paramount in any sustainable design strategy. Vocational training centers can implement a multi-pronged approach to water conservation, maximizing efficiency and minimizing waste.

i. **Water-Efficient Fixtures:** “Installing low-flow toilets, faucets, and showerheads significantly reduces water consumption within the center” (EPA, 2023). These fixtures utilize innovative technologies to deliver the same level of performance while using less water.

ii. **Rainwater Harvesting:** “Capturing rainwater for irrigation, toilet flushing, or other non-potable purposes maximizes water resource utilization” (Aktas & Isık, 2018). This approach

reduces reliance on municipal water supplies and promotes sustainable water management practices.

iii. **Greywater Recycling:** Greywater refers to wastewater from showers, sinks, and washing machines that is not contaminated with sewage. Greywater recycling systems can treat and reuse this water for non-potable purposes such as irrigation or toilet flushing, further minimizing reliance on freshwater sources.

2.2.7 Life Cycle Assessment

"Life cycle assessment (LCA) is a critical tool for evaluating the environmental impact of a building throughout its lifespan" (UNEP, 2007). This approach considers all stages of the building's life cycle, from material extraction and construction to operation, maintenance, and eventual demolition. Conducting an LCA during the design phase allows for selecting materials and systems with lower environmental impact and optimizing the building's overall sustainability performance.

2.3 Empirical Review

Emprical review is a careful survey of what is already availably documented about the problem. It critically examines previous studies done on the areas of current concern or that are closely related to it.

This aims to provide a comprehensive overview of the potential benefits and challenges of implementing green design practices within vocational training facilities, ultimately paving the way for a skilled workforce equipped with the knowledge and skills to navigate a sustainable future.

While the conceptual benefits of integrating green design into vocational training centers are promising, further research is needed to empirically evaluate its effectiveness. This section explores potential areas of inquiry that can bridge the gap between theory and practice, providing valuable insights for educators, policymakers, and design professionals.

2.3.1 Overview Of VET System According To Publications

Santosh Mehrotre states the facts that with sizable growing population India can have enormous opportunities to employ its workforce. But it needs to focus on skill development. He touches key challenges in skill development, VET (Vocational Education and Training in Nigeria) systems and focuses on enhancing National Vocational or Skill Qualification Framework via participation of industries.

Orgwu Angala, writes in her book about the issues related to vocational training and exposure of the students to complexity of technology in Nigeria. Stress is given on to expose students to the complexity of technology. The author looks at vocational training from the view point of measure for reduction in poverty.

Robert Jjuuko, presents qualitative case study based on relevant concepts like Capability Approach, Human Capital Theory and Constructivist Learning theory. He recommends to stress on vocational education to be started from the early years of the schooling.

There is an edited book by Maclean Rupert, Jagannathan, Shanti, Sarvi and Jouko regarding Skill Development inclusion and sustainability, in Asia- Pacific region. It throws light on transforming market place with higher order skills and lifelong learning for enhancing employability and sustainability. The need is to modernise and re-engineer the TVET design and delivery. The authors consider that it is the responsibility of policy makers, researchers, practitioners and private industry. The key element of Private Public Partnership is highly recommended.

Davies, John, Ryan and Mike have authored a book, titled "Vocational Education in 20th and 21st Centuries". It takes the stock of history of Vocational Education and informs mainly about issues related to Apprenticeship Training.

In the book "Brining the Market to Students" the authors consider social effects on service of education in general. They have given the importance of political will for career advancement and employment opportunities. They have mentioned that to enhance and upgrade the Human Social Capital of

American labor force, there is a need of the hour to reform the vocational training and education system in country.

Massion, Jean Paul speak about the scenario of European Union in supporting vocational and technical training. They give the structure of vocational education and departments of an organizations which support TVET. They have covers the issues related to social fund, free mobility of workers, modernizing labor relations, social inclusion, social protection systems, support to disable people. All the member countries of EU are recommended to integrate their efforts for supporting TVET.

Louise Moran, Greville and Rumble write about open and distance learning for VET. In their opinion, this route is supportive for promotion of TVET.

Above 8 books are more relevant for the study and they cover the major important aspects about Vocational Training and center development.

2.3.1.1 Vocational Skills in Traditional Education

Vocational education was an integral part of Nigeria's traditional education system long before the introduction of Western education. The objectives of traditional education in Nigeria, as in the rest of Africa, focused on the acquisition of vocational and physical skills, alongside the intellectual development of young individuals (Fafunwa, 1982). Given the simplicity of the traditional Nigerian society and the low level of technological development, vocational training was available in fields such as farming, fishing, weaving, carving, handicraft, knitting, leatherwork, iron and goldsmithing, trading, and more. Traditional education emphasized the acquisition of specialized skills, and apprenticeships were commonly used to pass on these skills within families, enabling children and youth to master family occupations (Adeyanju & Abimbola, 2019). This system also included training in professions like priesthood, medicine, law, military, and administration, each with its own recognized procedures for vocational training among various ethnic groups in Nigeria (Onuoha & Olowookere, 2020).

2.3.1.2 The Development of Vocational Education In Nigeria

The British educational system heavily influenced Nigeria's formal education system, often neglecting the cultural and vocational interests of the nation (Ekenyong & Nwabuisi, 2001). The apprenticeship system, the earliest form of vocational education practiced in Nigeria, provided employment for youth by teaching them practical skills in specific trades. The extensive development of vocational education began in Russia in 1888, with the introduction of shop classes alongside the apprenticeship system. These shop classes introduced structured problem-solving tasks, where students were individually guided to proficiency in various trades (Okeke & Nwosu, 2019).

In Nigeria, significant changes in the educational system occurred after the enactment of the Morrill Land-Grant Acts in the United States, which indirectly influenced educational reforms following the abolition of the slave trade. Basic vocational skills like carpentry, tailoring, and craft making began to be introduced in some schools, such as Comprehensive High School Aiyetoro, Mubi, and the Technical College in Yaba, Lagos. However, vocational and technical education remained relatively dormant in Nigeria during the initial years of Western education (Oladejo & Arogundade, 2017).

2.3.1.3 The Administration of Vocational Education In Nigeria

Following the establishment of the Protectorate of Southern Nigeria, an education law was promulgated in 1903, leading to the creation of an Educational Department. This law not only regulated primary and secondary education but also mandated that schools provide instruction in industrial work (Okoye & Adjei, 2016). Another key development was the involvement of the Sudan Interior Mission (SIM), which sought and received permission from Governor General Lord Lugard to promote industrial education early in the century (Adegboye, 2021).

Government did not stop at legislating, It went ahead to also provide training. At the turn of the twentieth century, Government departments had started to face staffing problems. Workers with

vocational skills were in short supply in both the public and private sectors. The colonial regime then fund that it was necessary to train its own workers to be able to carry out required assignments. Bayode (1994) argued that vocational and technical education should be geared toward producing individuals capable of working with their heads, hearts, and hands. According to the National Policy on Education (Federal Ministry of Education, 2014), the objectives of vocational and technical education include:

i. Acquiring vocational and technical skills.
ii. Exposing students to career options by exploring opportunities in the workforce.
iii. Enabling youth to understand the increasing complexity of technology.
iv. Stimulating creativity.

Vocational and technical education is regarded as pivotal to Nigeria's national development. When individuals achieve self-reliance at the micro-level, the macro economy becomes more stable and prosperous (Fakolujo & Adewole, 2018).

2.3.3 Case Studies

Examining successful examples of green design implementation in vocational training centers around the world provides valuable insights and inspiration. Here are a few case studies:

i. The LEED Gold Certified Green Training Center in Austin, Texas
ii. The Grimsby Institute in Grimsby, UK
iii. The Hangzhou Vocational College of Energy and Environmental Protection in China

2.3.3.1 The LEED Gold Certified Green Training Center in Austin, Texas

The LEED Gold Certified Green Training Center in Austin, Texas, stands as a beacon of sustainable design and education. This center not only exemplifies the principles of green building

but also integrates sustainability into its core curriculum. This analysis will delve into the architectural features, energy efficiency, and educational impact of the training center, demonstrating its role in promoting sustainability.

The building's distinct architectural features, such as its high-performance building envelope, advanced HVAC systems with intelligent controls, and substantial solar PV system, significantly contribute to its standout design and sustainability, which will be further discussed below;

i. **High-Performance Building Envelope**: A critical component of the Green Training Center's design is its high-performance building envelope. This envelope is designed to minimize energy loss through enhanced insulation, advanced windows, and airtight construction. By reducing the transfer of heat, the building maintains a consistent internal environment, leading to decreased reliance on heating and cooling systems. This feature is pivotal in achieving LEED Gold certification, as it significantly reduces the building's overall energy consumption.

Plate 2.1 : Façade of The LEED Gold Certified Green Training Center in Austin, Texas

Source: Source- (Google search, 2024)

ii. **Energy-Efficient HVAC Systems with Intelligent Controls:** The HVAC (Heating, Ventilation, and Air Conditioning) systems installed in the center are state-of-the-art, designed to optimize energy use. These systems are equipped with intelligent controls that adjust heating, cooling, and ventilation based on occupancy and environmental conditions. This dynamic adjustment ensures that energy is used only when necessary, thereby minimizing wastage. The intelligent control systems also provide real-time data on energy consumption, allowing for continuous monitoring and improvement of energy efficiency.

iii. **250 kW Rooftop Solar PV System**: One of the most notable features of the Green Training Center is its 250 kW rooftop solar photovoltaic (PV) system. This solar array generates a significant portion of the building's electricity, reducing reliance on grid power and lowering greenhouse gas emissions. The integration of solar power not only contributes to the building's energy efficiency but also serves as an educational tool for students. They can observe and analyze the performance of the solar system, gaining hands-on experience with renewable energy technologies.

The combination of a high-performance building envelope, energy-efficient HVAC systems, and a substantial solar PV system positions the Green Training Center as a model of energy efficiency. These elements work synergistically to minimize the building's carbon footprint and operational costs. The LEED Gold certification underscores the center's commitment to sustainability, highlighting its achievements in energy efficiency and environmental stewardship.

The incorporation of green design principles in the building has also provided opportunities for hands-on learning, community engagement, and outreach, among other benefits, which will be further discussed below;

i. **Curriculum Emphasizing Sustainability Practices**: Beyond its physical attributes, the Green Training Center plays a crucial role in educating future professionals about sustainability. The curriculum is designed to equip students with the knowledge and skills needed to implement sustainable practices in various industries. Courses cover a range of topics, including renewable energy, green building techniques, and environmental management. This comprehensive education ensures that graduates are well-prepared to contribute to the growing demand for sustainable solutions in their respective fields.

ii. **Hands-On Learning Opportunities**: The center provides numerous hands-on learning opportunities, allowing students to engage directly with sustainable technologies and practices. For example, they can monitor the performance of the building's solar PV system, analyze data from the intelligent HVAC controls, and participate in projects that enhance the building's energy efficiency. These practical experiences are invaluable, as they bridge the gap between theoretical knowledge and real-world application.

iii. **Community Engagement and Outreach**: In addition to educating its students, the Green Training Center engages with the wider community to promote sustainability. Workshops, seminars, and public tours are regularly organized to raise awareness about green building practices and energy efficiency. This outreach helps to disseminate knowledge and inspire others to adopt sustainable practices in their own homes and businesses.

In conclusion the LEED Gold Certified Green Training Center in Austin, Texas, exemplifies the principles of sustainable design through its high-performance building envelope, energy-efficient HVAC systems, and substantial solar PV system. Its curriculum, focused on sustainability practices, prepares students for future careers in green industries. By combining cutting-edge technology with hands-on learning opportunities and community engagement, the center serves as a model for sustainable education and a catalyst for broader environmental change.

2.3.3.2 The Grimsby Institute in Grimsby, UK

The Grimsby Institute in Grimsby, UK, stands as a prime example of a comprehensive approach to sustainability in educational institutions. By integrating innovative technologies and eco-friendly practices, the institute not only reduces its environmental impact but also prepares students for green careers.

Plate 2.2 : Grimsby Institute in Grimsby, UK

Source- (Google search, 2024)

This analysis will delve into the various sustainable features of the institute, some architectural features will be further discussed below;

i. Biomass Boiler: One of the standout features of the Grimsby Institute is its biomass boiler, which is fueled by woodchips sourced from sustainable forestry practices. Biomass boilers are an effective way to reduce reliance on fossil fuels, as they utilize organic materials that

can be replenished. The use of sustainably sourced woodchips ensures that the carbon footprint is minimized, contributing to the overall reduction of greenhouse gas emissions.

ii. Rainwater Harvesting System: The institute's rainwater harvesting system is another innovative feature that promotes sustainability. This system collects and stores rainwater for irrigation purposes, reducing the demand for treated municipal water.

iii. Green Roofs: Green roofs are installed on several buildings within the Grimsby Institute. These roofs are covered with vegetation, providing natural insulation and creating habitats for wildlife.

Beyond its physical infrastructure, the Grimsby Institute is dedicated to fostering sustainability through education. The institute offers a variety of green vocational training programs designed to equip students with the skills needed for careers in sustainable construction, renewable energy, and environmental management.

The combination of sustainable infrastructure and green vocational training at the Grimsby Institute has a significant positive impact on the environment. The reduction in carbon emissions, water conservation, and support for biodiversity contribute to the institute's overall sustainability goals. These efforts help mitigate the effects of climate change and promote a healthier ecosystem.

The institute's commitment to sustainability extends beyond its physical campus. By offering green vocational training programs, the Grimsby Institute plays a crucial role in shaping the future workforce. Students gain hands-on experience and knowledge in sustainable practices, making them valuable assets in various industries that are increasingly prioritizing sustainability.

Plate 2.3 : Arial Perspective of Grimsby Institute in Grimsby, UK

Source- (Google search, 2024)

The Grimsby Institute exemplifies a comprehensive approach to sustainability through its innovative infrastructure and commitment to green education. The biomass boiler, rainwater harvesting system, and green roofs are key features that reduce the institute's environmental impact. Additionally, the green vocational training programs ensure that students are well-prepared for careers in the sustainability sector. Collectively, these efforts demonstrate how educational institutions can lead by example in the pursuit of a sustainable future.

2.3.4 Potential Challenges and Research Opportunities

2.3.4.1 Potential Challenges

While the benefits of green design in vocational training centers are compelling, implementing these principles can present challenges. Here are some key considerations:

i. **Higher Initial Costs:** Integrating green design features often comes with a higher initial investment compared to conventional construction (Dixit et al., 2020). However, these costs can be offset by long-term operational savings in energy and water consumption. Additionally, exploring financing options such as green building grants or tax incentives can help bridge the initial cost gap.

ii. **Technical Expertise:** Implementing green design features effectively requires expertise in sustainable building practices. Vocational training centers may need to collaborate with architects, engineers, and contractors who specialize in sustainable design to ensure successful project execution.

iii. **Maintenance Considerations:** Some green design features may require additional maintenance compared to traditional systems. This necessitates developing a comprehensive maintenance plan and ensuring staff are adequately trained to handle these systems properly.

Despite these challenges, numerous opportunities exist to overcome these hurdles. Investing in green design ultimately contributes to a more sustainable future and equips students with valuable skills relevant to the green job market. Furthermore, by raising awareness and promoting the benefits of green design, vocational training centers can encourage broader adoption within the construction industry.

2.3.4.2 Research Opportunities

One crucial area of research focuses on the impact of green design integration on student learning outcomes. Studies could explore whether students in vocational training centers with green design features demonstrate:

i. **Enhanced knowledge:** A deeper understanding of sustainable practices and their application within their chosen vocations (Wong & Yuen, 2017). This could involve comparing knowledge retention and test scores between students in green and conventional training centers.

ii. **Improved skills:** Greater proficiency in implementing sustainable practices within their trades. This could involve evaluating practical skills through performance assessments or case studies that require students to apply green design principles to solve real-world problems.

iii. **Positive attitudes:** A stronger sense of environmental responsibility and commitment to sustainability in their future careers. This could be assessed through surveys or focus groups that gauge student attitudes towards environmental issues and their perceived role in promoting sustainability within their professions.

Another vital area of research involves conducting a comprehensive cost-benefit analysis of green design features in vocational training centers. Here's what such studies could investigate:

i. **Energy and water savings:** Quantifying the actual reduction in energy and water consumption achieved through green design features compared to conventional buildings. This data can be collected through building energy management systems and water meter readings.

ii. **Operational cost savings:** Measuring the long-term cost savings associated with lower energy and water bills due to green design implementation. This analysis should factor in the initial investment costs to determine the overall return on investment (ROI).

iii. **Potential government incentives:** Investigating the availability and effectiveness of government grants, tax breaks, or other financial incentives that encourage the adoption of green design features in vocational training facilities.

By comprehensively evaluating the financial implications of green design, researchers can provide valuable data for decision-making processes. This information can help policymakers and educators assess the feasibility of green design implementation and justify investments based on the potential cost savings and environmental benefits.

2.3.5 Conclusion

These potential research areas represent a starting point for a robust body of empirical research that explores the effectiveness of integrating green design principles in vocational training centers. By conducting these studies, researchers can provide valuable evidence-based data that strengthens the

case for green design and informs future strategies for promoting sustainability within vocational education.

Integrating green design principles in vocational training centers offers a transformative approach to education and skill development. It fosters a learning environment that prioritizes environmental responsibility while equipping students with the technical skills and knowledge needed for a sustainable future. By embracing green design, vocational training centers can become leaders in sustainability, influencing positive change within the construction industry and beyond

Chapter Three

Methodology

3.1 Introduction

Methodology refers to the systematic analysis of principles, methods, rules, and postulates employed within a particular discipline, focusing on the methods that are, can be, or have been applied within that discipline (Wikipedia, 2024).

The strategy employment in this research work involves the analysis and observation of specific environments both local and international and their responses to vocational training centers, they include; As a background for understanding the enormous need for a vocational training center, a research was carried out to measure the viability of the project, acceptability of the development and the degree of need. Therefore, this research methodology explains the process by which data was collected, sources of data collection, analysis of the data and the findings, hereby providing a framework for the design proposal.

The research dealt with 4 major areas of concern in the development of the proposed vocational training center, which includes;

i. Understanding the peculiarities of the study area and site so I can appreciate the peculiarities and develop modification methods.
ii. Investigation of the background of the project, conducting necessary literature reviews and justifying the chosen empirical methodology involving the selection and the comparing of the matched examples.
iii. Selection of appropriate completed examples to compare the proposed with certain innovative design elements to those of standard designs.
iv. Examining the findings on the selected project and discuss the forces and the factors that may be behind the results.

In recent decades, societal changes—particularly technological advancements—have demonstrated that the traditional grammar-based education system in Nigeria no longer meets the needs of society or individuals. This has been evidenced by widespread unemployment and underemployment among graduates of traditional educational institutions, who often struggle to transition into skilled or semi-skilled labor positions (Aderemi et al., 2020). while 'at the same time it is becoming apparent that the majority of them cannot afford the expenses to further their education.

This situation clearly indicates that there is a mismatch between the education system and what the society needs. In this vain Simons (1980) writes: “The concentration on mental and the theoretical exercises rather than manual and practical experience, has prepared most students for neither jobs, nor family, nor responsibilities of citizenship.”

3.2 Case Study Method

In the process of acquiring information for the proposal of a Vocational training center, series of studies and observations were carried out via different data collection methods which include:

i. Primary data collection: This method involved visual observations, oral interviews and analysis of the site for the project.
ii. Secondary data collection: This involved sourcing for information from books, journals, internet, archives, reports, records and carrying out series of case studies of existing similar facilities.

3.2.1 Method of Data Collection

The primary source of data collection which involved the keen study of a few existing vocational training centers and other related structures, visual observation and interviews with a few officials by conducting interviews with staffs and the end user of the existing structures.

Secondary source of data collections which involved sorting for information already collected by agencies or organizations and information got from the web sites (i.e. world wide web), a few archives and journals and by studying literatures on the project topic.

By studying existing similar project on the topic, the existing cases understudied includes:

i. Federal Technical College, Yaba, Lagos.
ii. Industrial Development Center, Osogbo.
iii. Accra Technical Training Center, Ghana.
iv. Vocational training centre, North Lindsey college, England.

3.3 Case Study Analysis

This research investigates design approaches for vocational training centers in Nigeria through four selected case studies. The cases were chosen to explore the influence of culture on center design. The first two focuses on Nigerian institutions:

i. Federal Technical College, Yaba, Lagos.
ii. Industrial Development Center, Osogbo.

And the last two case studies examines international vocational training center:

i. Accra Technical Training Center, Ghana.
ii. Vocational training centre, North Lindsey college, England.

By comparing these diverse facilities, the research aims to identify the core and critical components of a successful vocational training center.

3.3.1 Case Study I

Name: Federal Technical College Yaba, Lagos.

Location: Located at Yaba, Lagos State.

Brief Description / History: The technical college was founded by the Federal Government in the year 1947 to impact vocational skills to the youths at the secondary school level.

Building Materials: Concrete, Glass, Steel and Corrugated Aluminum Roofing Sheet.

Training Courses / Departments:

i. Welding and fabrication.

ii. Leather work.

iii. Wood work.

iv. Ceramics.

v. Computer technology.

vi. Building construction technology.

Spaces Provided: The following spaces were provided for in the school;

i. Administrative block.

ii. Library.

iii. Clinic.

iv. Classrooms.

v. Workshops.

vi. Recreation area.

Merit:

i. The school is easily accessible.

ii. Good drainage system.

Demerit:

i. Car park not well defined.

Pictures

Plate 3.1 : Façade of Federal Technical College Yaba, Lagos

Source- (Author's field survey, 2024)

Plate 3.2 : Building Technology Workshop, Federal Technical College Yaba, Lagos

Source- (Author's field survey, 2024)

Plate 3.3 : Wood Technology Workshop, Federal Technical College Yaba, Lagos

Source- (Author's field survey, 2024)

Floor Plans

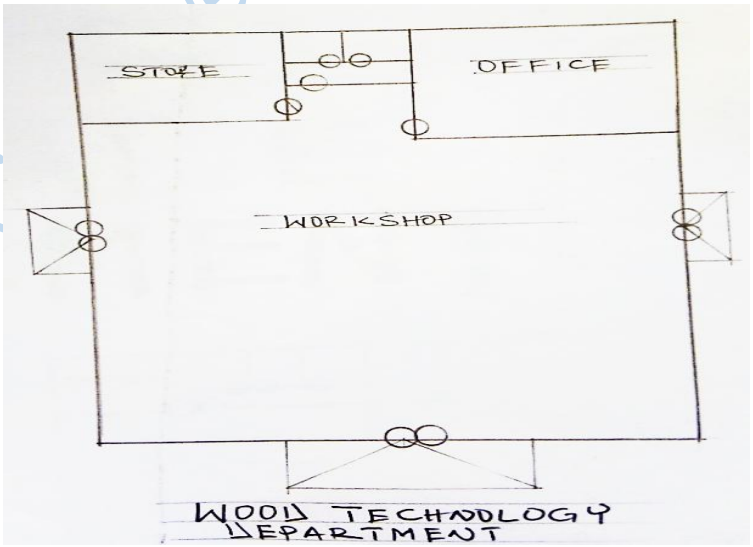

Figure 3.1 : Wood Technology Department Floor plan

Source- (Author's field survey, 2024)

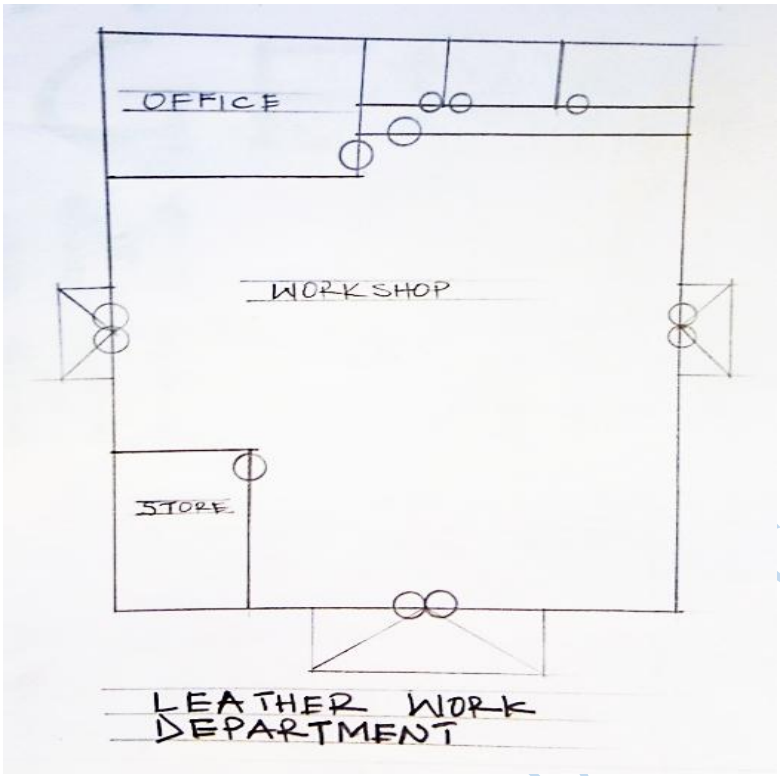

Figure 3.2 : Leather Workshop Department Floor plan

Source- (Author's field survey, 2024)

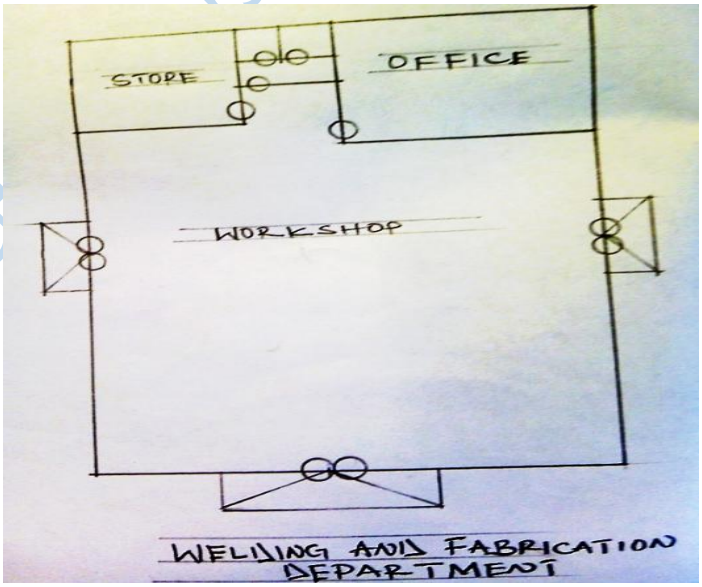

Figure 3.3 : Welding & Fabrication Department Floor plan

Source- (Author's field survey, 2024)

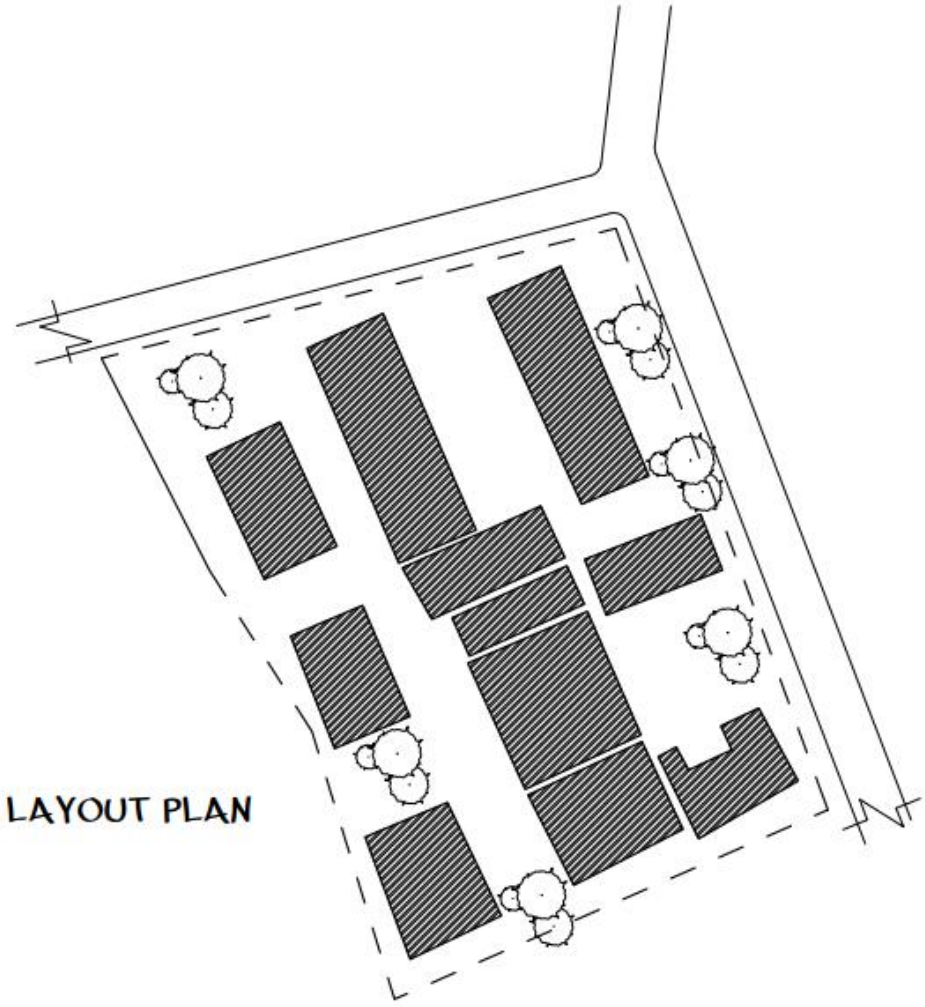

Figure 3.4 : Federal Technical College Yaba layout plan

Source- (Author's field survey, 2024)

3.3.2 Case Study II

Name: Industrial Development Center, Osogbo

Location: Located along Ilesha Road, opposite Saint Charles Grammar School Osogbo.

Brief Description / History: IDC is a purposely built capacity training center for skill acquisition which was established in 1976 by Federal Government of the Republic of Nigeria. The aim is to promote small and medium scale enterprise and for empowerment of youths. It is affiliated with federal Universities and Bank of Industries.

Building Materials for Construction: Concrete, Glass, Steel and Corrugated Aluminum Roofing Sheet.

Training Courses / Departments

i. Leather work.
ii. Textile.
iii. Wood work.
iv. Ceramics.
v. Food and chemical.
vi. Metal workshop.
vii. Foundry.

Spaces Allocation: The following spaces were provided in the training center;

Administrative block: Reception, Industrial training student office, Typist or clerical office, Data room, Accountant's office, Conveniences, Conference room, Zonal coordinators office, Secretary's office, Expatriate's office.

Leather department: Classroom, Accessory store, Showroom, Office, Production hall, Conveniences.

Textile department: Classroom, Production hall (Looping section), Dying section, Store, Toilet, Bathroom, Dressing room.

Wood department: Offices, Classroom, Spraying room, Assembly room, Showroom, Store, Conveniences.

Ceramics department: Classroom, Offices, Conveniences, Workshop.

Food and chemical department: Office, Classroom, Store, Conveniences.

Metal works department: Raw material store, General store, Offices, Conveniences

Merit

i. Proper site zoning and layout.
ii. Availability of functional and standard spaces for the various skills.

iii. Located in a serene and conducive environment which aids proper learning.

Demerit

i. The administrative block and other facilities on the site are located far from the main entrance.

ii. No defined parking spaces.

iii. The site is not well landscaped.

iv.

Pictures

Plate 3.4 : Admin Block, IDC Osogbo

Source- (Author's field survey, 2024).

Plate 3.5 : Leather Department, IDC Osogbo

Source- (Author's field survey, 2024).

Plate 3.6 : Wood Work production Dept., IDC Osogbo

Source- (Author's field survey, 2024).

Plate 3.7 : Metal Fabrication Classroom, IDC Osogbo

Source- (Author's field survey, 2024).

Floor Plans

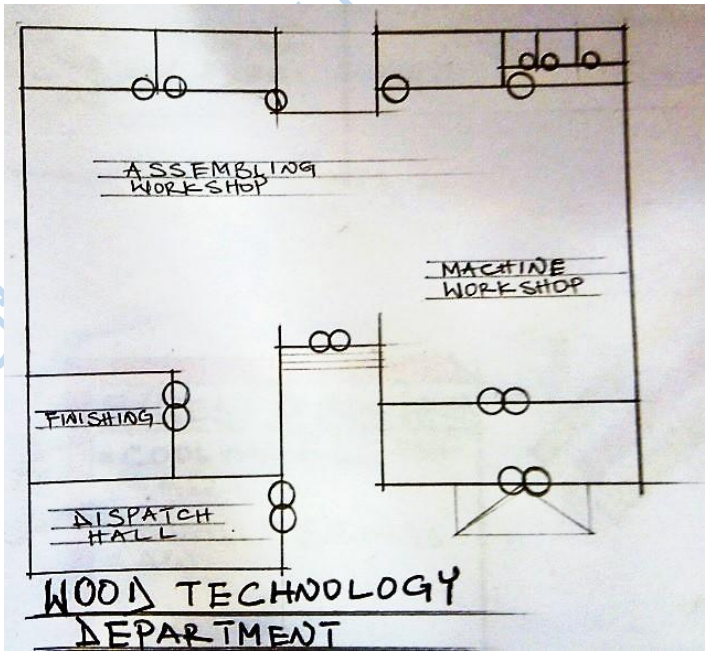

Figure 3.5 : Wood technology Dept.

Source- (Author's field survey, 2024).

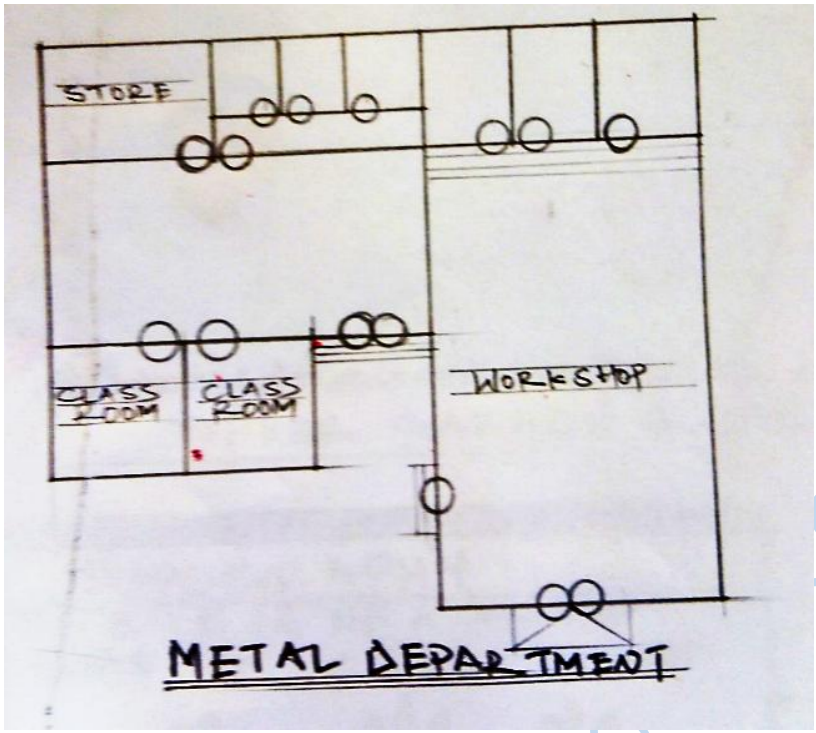

Figure 3.6 : Metal Fabrication Dept.

Source- (Author's field survey, 2024).

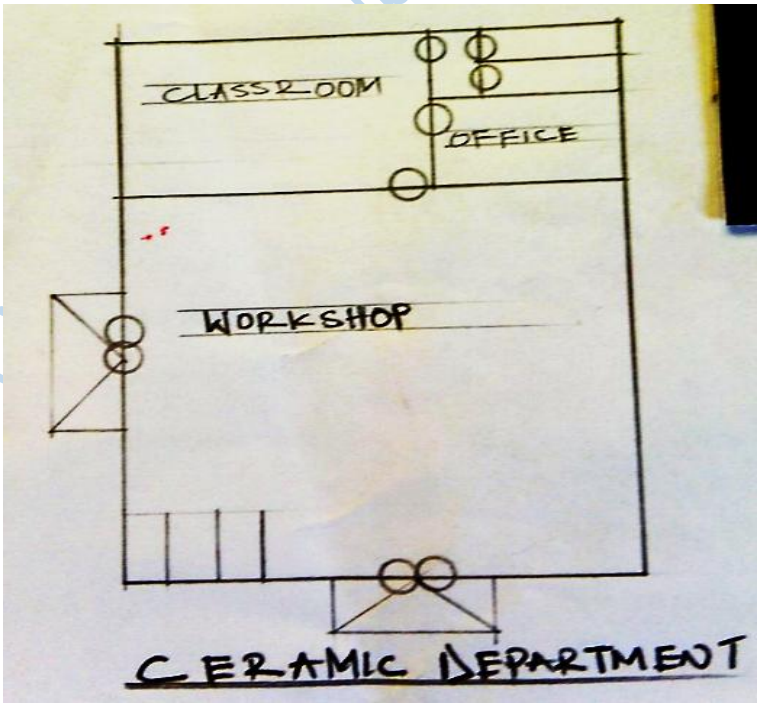

Figure 3.7 : Ceramic Dept.

Source- (Author's field survey, 2024).

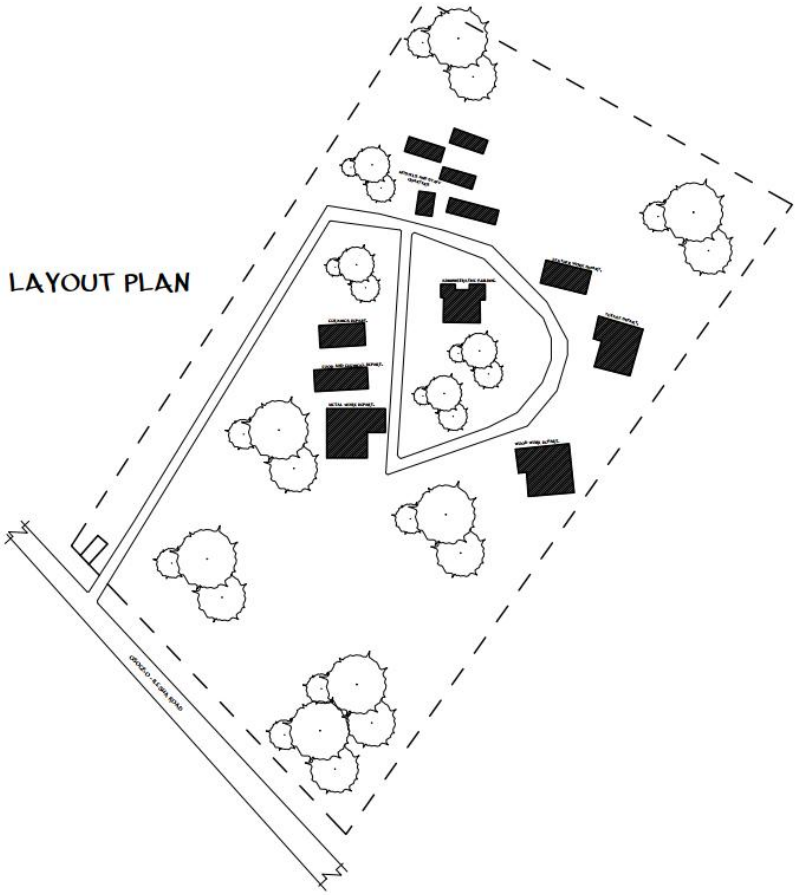

Figure 3.8 : Site Layout of IDC, Osogbo.

Source- (Author's field survey, 2024).

3.3.3 Case Study III

Name: Accra Technical Training Center.

Location: Located along Royal Castel Road, Kokomlemle, Accra, Ghana.

Brief Description / History: The technical training center was founded in the year 1966 and jointly operated by both Canadian and Ghanaian government. It was later handed over to the Ghanaian government in 1976.

Training Courses / Departments;

i. Architectural drafting.

ii. Auto body repairs.

iii. Computer technology.

iv. Creative art technology.

v. Electronics engineering.

vi. Building construction technology.

vii. Small engine repairs.

viii. Wood construction technology.

Spaces Provided: The following spaces were provided for in the school;

i. Administrative block.

ii. Student dormitories.

iii. Staff quarters.

iv. Classrooms.

v. Workshops.

vi. School field.

vii. Game courts.

viii. Kitchen.

ix. Cafeteria.

x. Conveniences.

xi. Gate house.

Merit

i. The center was purposely built for vocational training.

ii. Easy accessibility.

iii. Good drainage system.

iv. Good landscape and well defined parking spaces.

Pictures

Plate 3.8 : Arial View 1 of Accra Technical Training Center

Source- (Author's field survey, 2024)

Plate 3.9 : Arial View 2 of Accra Technical Training Center

Source- (Author's field survey, 2024)

Plate 3.10 : Electronics Engineering Dept

Source- (Author's field survey, 2024)

Plate 3.11 : Architectural Drafting Studio

Source- (Author's field survey, 2024)

3.3.4 Case Study IV

Name: Vocational Training Center, North Lindsey College

Location: Scunthorpe, England

Brief Description / History: North Lindsey College, located in Scunthorpe, England, was established in 1953. It is a further education college that provides a wide range of courses to students from North Lincolnshire and beyond

Building Materials: Concrete and Asbestos Roofing Sheet

Training Courses: Animal Management, Creative Arts, Beauty Therapy, Business and Tourism, Childcare & Education, Construction, Engineering, Health and Social Care, Hairdressing, Hospitality and Catering, Digital Technology, Transport, and Sport.

Space Allocation:

The following spaces were provided in the training center;

i. Director office.
ii. Secretary's office.
iii. HOD of vocational training office.
iv. Workshops
v. Store
vi. Conveniences.
vii. Sport Hall
viii. Dining Hall

Merits

i. The vocational center is easily accessible.
ii. Adoption of the classified, generic and formalized space system of learning.
iii. Aesthetically pleasing
iv. Well planned

Demerits

i. No purpose built parking.

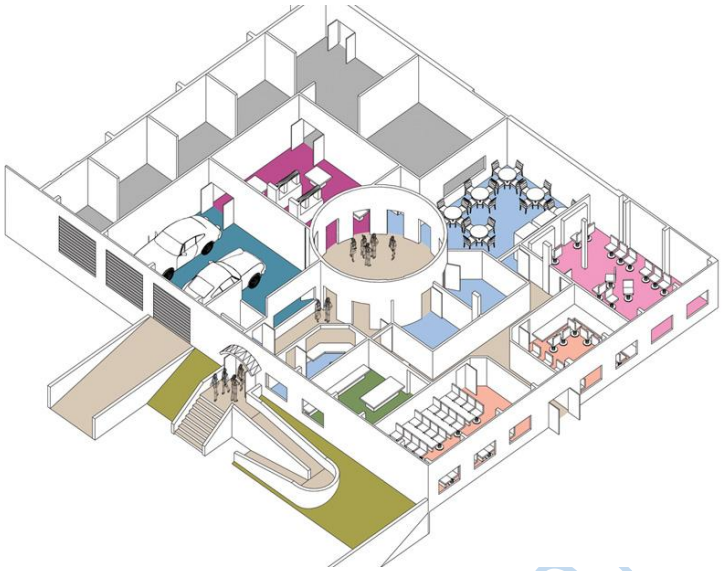

Plate 3.12 : 3D Floor Perspective of Vocational Training Center, North Lindsey College

Source- (Author's field survey, 2024)

Plate 3.13 : Approach View of Vocational Training Center, North Lindsey College

Source- (Author's field survey, 2024)

3.4 Case Study Synthesis

This synthesis explores design approaches for vocational training centers in Nigeria by analyzing four case studies:

i. Federal Technical College, Yaba, Lagos (Nigeria): This public institution offers technical training programs.

ii. Industrial Development Center, Osogbo (Nigeria): This government-run center focuses on skill development for industrial trades.

iii. Accra Technical Training Center (Ghana): This case study provides an international perspective on a similar vocational training institution.

iv. Vocational Training Centre, North Lindsey College (UK): This international case study showcases a vocational training center in a developed nation.

The analysis aims to identify core and critical elements in vocational training center design, considering the influence of culture.

3.4.1 Conceptual Framework

This synthesis employs a framework analyzing design elements in three categories:

i. Learning Spaces: Classrooms, workshops, laboratories, and IT facilities.

ii. Support Spaces: Administrative offices, libraries, student lounges, and communal areas.

iii. Cultural Considerations: Design features that reflect and accommodate the local Nigerian context.

3.4.1.1 Cross-Case Comparison

All case studies highlight the importance of well-equipped workshops for practical training. The Ghanaian and UK cases showcase modern learning spaces with technology integration, potentially a valuable addition for Nigerian centers.

A significant difference lies in dedicated support spaces. The Ghanaian and UK cases have designated career guidance centers and student lounges, absent in the Nigerian cases.

3.4.1.2 Cultural Considerations

While not explicitly mentioned in the Nigerian case studies, incorporating elements of Nigerian culture into the design could foster a sense of belonging and identity among students. This could involve:

i. Art and Architecture: Utilizing traditional Nigerian art forms or architectural styles in the design.
ii. Communal Spaces: Designing open areas that encourage interaction and collaboration, potentially reflecting communal values.
iii. Climate and Sustainability: Adapting designs for Nigeria's climate, potentially using natural ventilation and locally sourced materials.

3.4.1.3 Integration and Interpretation

The core elements of a successful vocational training center in Nigeria appear to be:

i. Well-equipped workshops: Practical training is crucial for vocational education.
ii. Modern learning spaces: Technology integration and adaptable spaces can enhance learning.
iii. Dedicated support spaces: Career guidance centers and student lounges provide holistic student development.

Cultural considerations can further enhance these core elements. Integrating local art, creating spaces for interaction, and adapting to the climate can make the centers more welcoming and relevant for Nigerian students.

3.4.3 Deductions from Case Study

i. The structure should be situated within close proximity to area of population concentration

ii. The administrative block is usually the first point of contact before accessing the learning spaces.

iii. The site should have a defined parking space, vehicular and pedestrian walkways network each enhancing free and easy circulation within the site.

iv. Layout of vocational training centers should adhere strictly to zoning principles.

v. Also, the need to generate revenue in order to financially support the faciltity such as adding a restaurant/cafeteria

Chapter Four

Site Analysis and Design Synthesis

4.1 Study Area

4.1.1 Site Location

The selected site for the proposed development is strategically located within the Oluyole Local Government Area, renowned for its accessibility and connectivity. The site is easily reachable by both vehicular and pedestrian traffic, making it a prime location for various developments.

One of the prominent access points to the site is via the Orita Challenge, a well-known junction within the area. The route through Orita Challenge ensures seamless connectivity to the site, enhancing its accessibility for both residents and visitors. Additionally, the proximity to Taska Filling Station provides a recognizable landmark, further simplifying navigation to the site.

Figure 4.1 : Proposed site

Source- (Google maps, 2024)

4.1.2 Site Selection Criteria

Choosing the right site is a critical step in the design process, as it can significantly influence the success of the project. Several key factors must be considered to ensure that the selected site meets the project's requirements. These factors are discussed in detail below;

i. **Accessibility**

The site must be conveniently accessible to students, staff, and visitors. This includes its proximity to major transportation networks such as roads, public transit, and pedestrian pathways (Bramley & Power, 2020). Ensuring good connectivity can enhance attendance and participation in training programs, making it easier for students to commute from different areas.

ii. **Environmental Impact**:

Evaluating the environmental conditions of the site is essential. Factors such as the site's topography, soil conditions, water table, and existing vegetation need to be assessed (Chen et al., 2021). Sustainable practices should be integrated into the site development to minimize ecological disruption. For a vocational training centre, incorporating green building practices and renewable energy sources can provide educational opportunities in sustainability and environmental management, aligning with contemporary educational goals.

iii. **Basic Infrastructural Facilities**

The existence of basic infrastructural facilities like electricity, water supply, good road, telecommunication network and a host of others is one of the reasonable factors that influenced the site location.

iv. **Community and Social Impact**

Understanding the socio-economic context of the site is important. This involves assessing the potential impact on local communities, social dynamics, and cultural heritage (Dempsey & Burton, 2020). Engaging with stakeholders and considering their input can lead to more

sustainable and socially accepted outcomes. A vocational training centre should foster community relationships and provide training that benefits local industries and businesses.

v. **Strategic Importance:** The location within Oluyole Local Government Area offers several advantages. The area is known for its vibrant community and economic activities, which can significantly benefit any development on the site. The strategic position near major transportation routes and essential amenities underscores the site's potential for various uses, including residential, commercial, and mixed-use developments.

In conclusion, the chosen site in Oluyole Local Government Area stands out due to its exceptional accessibility via Orita Challenge and Taska Filling Station, supported by robust surrounding infrastructure and strategic importance within the region. This combination of factors makes it an ideal site for the proposed development, promising ease of access, high visibility, and substantial growth potential.

4.1.2.1 Site Analysis

Site analysis is the process of studying the contextual forces that influence how we might situate a building layout and orients its spaces, shape and articulate its enclosure, and establish its relationship to the landscape. The site survey begins with the gathering of physical site data. Austin (2014)

In liew of this the Analysis of the site will be discussed with a much indept view;

- **Site Amenities**

  The site has some amenities that will be retained to support the design for example trees on the site will be good for landscape, shading devices and also serve as wind breakers on the site. The grasses will also help to provide a natural environment and help to reduce soil run-off. Electricity is available from IBEDC overhead cables passing along the access road to the site.

- **Site liabilities**

  Apparently there are no site liabilities except for the bushy areas and unwanted trees which will be cut off and cleared before the construction commences.

- **Neighbourhood**

  The vicinity of the site is characterized by a blend of residential, commercial, and public facilities, contributing to the overall attractiveness and utility of the location. The well-developed road network in the area facilitates smooth vehicular movement, while pedestrian pathways ensure safety and convenience for foot traffic.

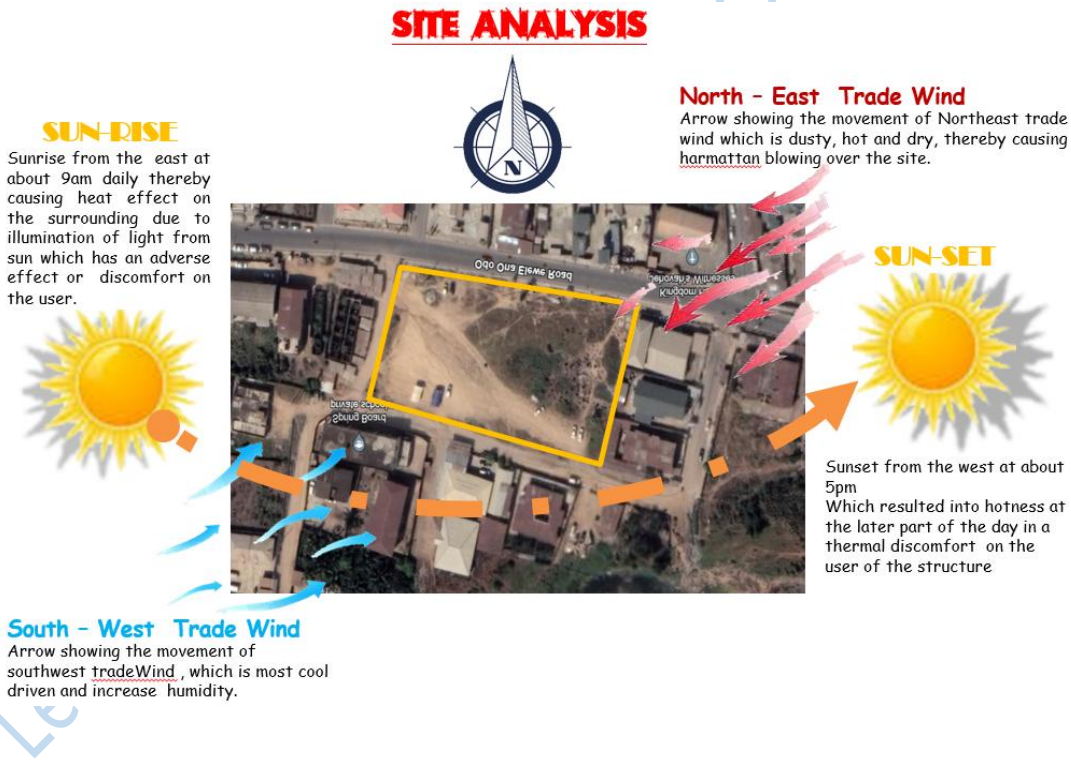

Figure 4.2 : Detailed Site Analysis

Source- (Author's field survey, 2024).

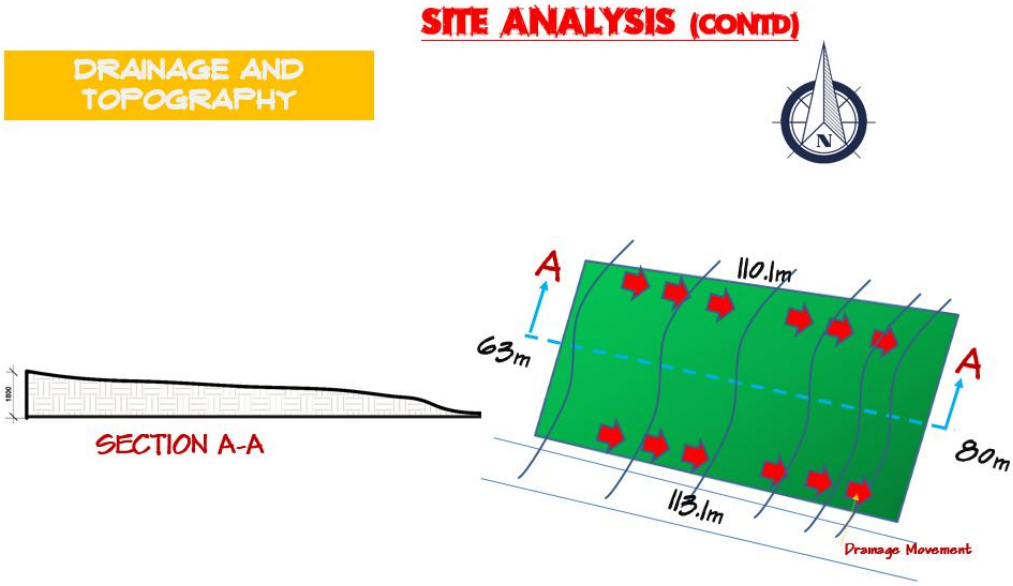

Figure 4.3 : Detailed Site Topography

Source- (Author's field survey, 2024).

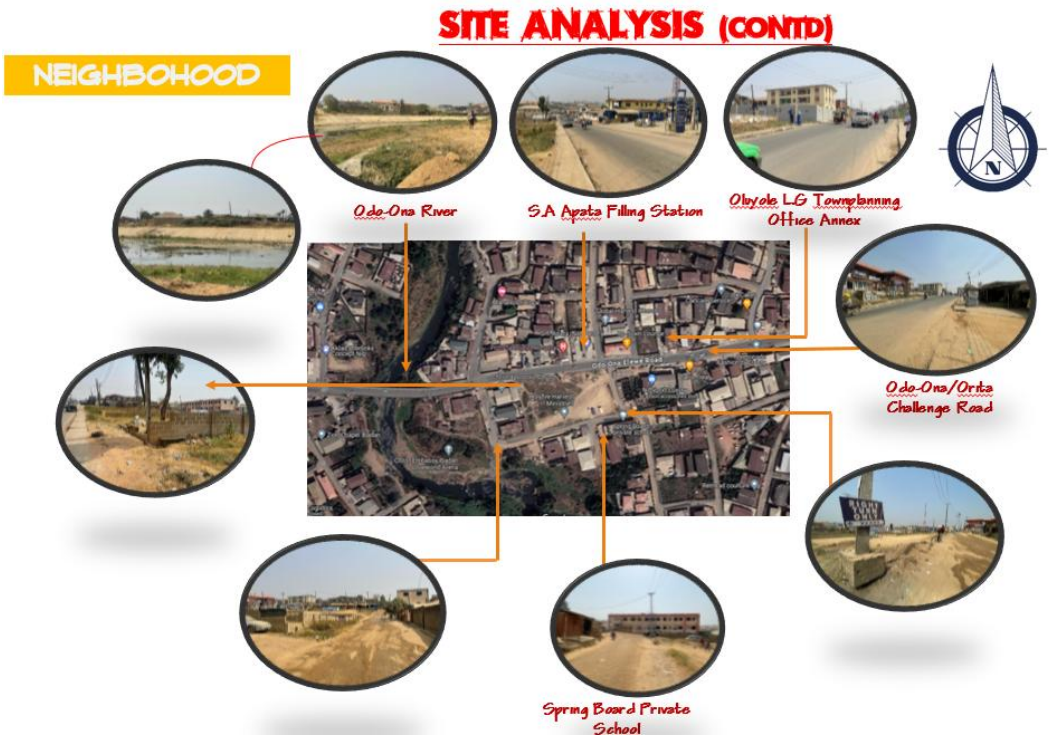

Figure 4.4 : Site Neighbourhood

Source- (Author's field survey, 2024)

4.2 Project Analysis and Design Synthesis

4.2.1 Brief Analysis

In the midst of Nigeria's economic prominence, persistent challenges like juvenile delinquency and youth unemployment persist. Recognizing this, the chairman of Oluyole Local Government, under the leadership of the Oyo State governor, is committed to fulfilling election campaign promises by empowering its youth.

The initiative involves designing, constructing, and managing a purpose-built Vocational Training Center. Through comprehensive design, the center will embody inclusivity, accessibility, and collaboration, fostering a vibrant community of learners.

Technology integration and an industry-aligned curriculum will ensure graduates are equipped with the skills employers seek, while a supportive learning environment empowers individuals to reach their full potential.

In response to this imperative, as a student architect, I am entrusted with the responsibility to design a state-of-the-art Vocational training Center, aligning with the goal of equipping the youth with diverse skills crucial for the economic development of oluyole local govt., Oyo state

4.2.2 Brief Development

The facilities provided for includes

i. Administrative section
ii. Workshops
iii. Ancillary Facilities

Part of the factors taken into consideration at the design stage was the categorization of vocational training complex into three sections;

i. Administrative section
ii. Operational section

iii. Services

The spaces provided in the administrative section includes:

i. Reception
ii. Admission Office
iii. CCTV Room
iv. Principal's Office
v. Secretary Office

The spaces provided in the Operation section includes:

i. Automobile Workshop
ii. Woodwork Workshop
iii. Closed Circuit Television Department
iv. Computer Workshop
v. Fashion Design Studio
vi. Leather Workshop
vii. Catering and Baking Department
viii. Classrooms

The spaces provided in the Ancillary Service section includes:

i. Exhibition Hall
ii. Cafeteria
iii. E-Library
iv. Infirmary
v. Conveniences

4.2.3 Design Criteria

When designing a vocational training center, there are several architectural design considerations that should be taken into account. Here are some of the most important ones:

i. **Accessibility**: The vocational training center should be designed to be accessible to all individuals, including those with disabilities. The center should be designed with ramps, elevators, and other features that make it easy for people with disabilities to move around the facility.

ii. **Flexibility**: The vocational training center should be designed to be flexible so that it can accommodate a variety of different training programs. The center should be designed with movable walls and partitions that can be easily reconfigured to meet the needs of different training programs.

iii. **Safety**: The vocational training center should be designed with safety in mind. The center should be equipped with fire alarms, sprinkler systems, and other safety features that ensure the safety of the students and staff.

iv. **Energy Efficiency**: The vocational training center should be designed to be energy-efficient. The center should be equipped with energy-efficient lighting, heating, and cooling systems that reduce energy consumption and lower operating costs.

v. **Sustainability**: The vocational training center should be designed to be sustainable. The center should be equipped with features such as rainwater harvesting systems, solar panels, and green roofs that reduce the environmental impact of the facility.

vi. **Technology**: The vocational training center should be designed to incorporate the latest technology. The center should be equipped with computers, projectors, and other technology that enhance the learning experience for the students.

vii. **Aesthetics**: The vocational training center should be designed to be aesthetically pleasing. The center should be designed with colors, textures, and materials that create a welcoming and inspiring learning environment.

4.2.4 Conceptual Development

In developing my concept, I drew inspiration from the wheels on a gear, approaching it from a philosophical standpoint. This design symbolizes interconnectedness, precision, and the seamless functioning of different components working together to achieve a common goal. The "wheel of progress" imagery underscores themes of growth, advancement, and the collective effort needed to drive both individuals and the center toward success. Just as the wheel propels the gear, the vocational training center aims to foster personal and professional development, creating a collaborative environment that continuously moves forward toward excellence.

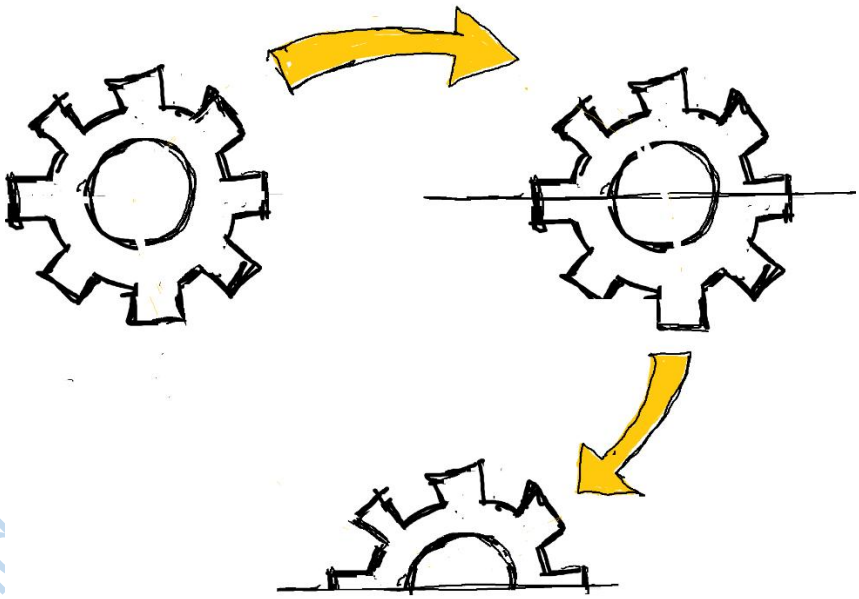

Figure 4.5 : Conceptual Development

Source- (Author's field survey, 2024)

4.2.5 Functional Relationship

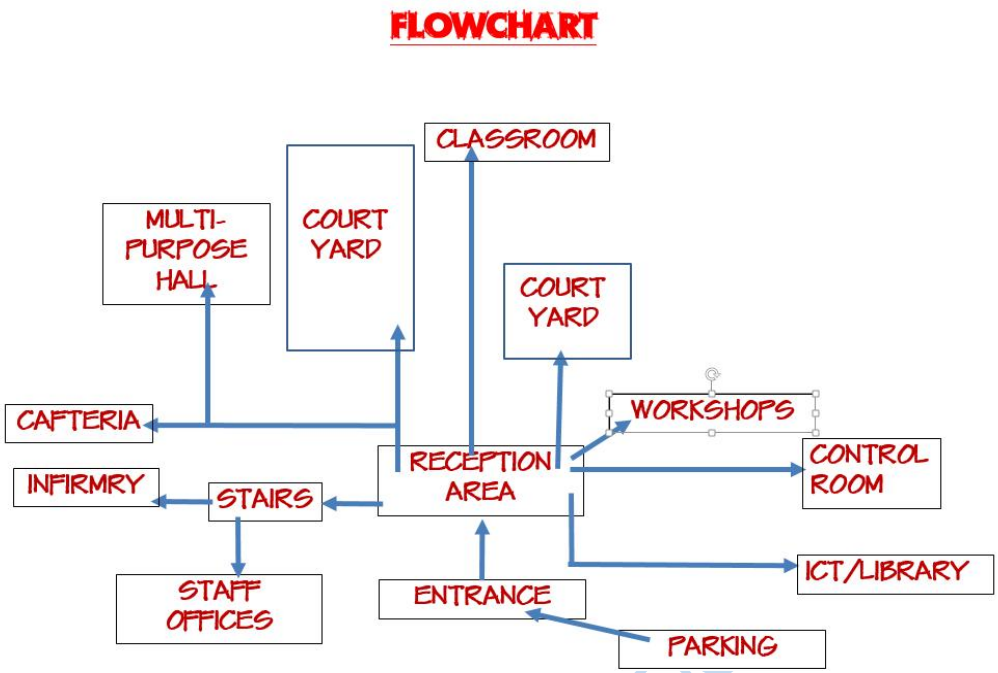

Figure 4.6 : Flow Chat

Source- (Author's field survey, 2024)

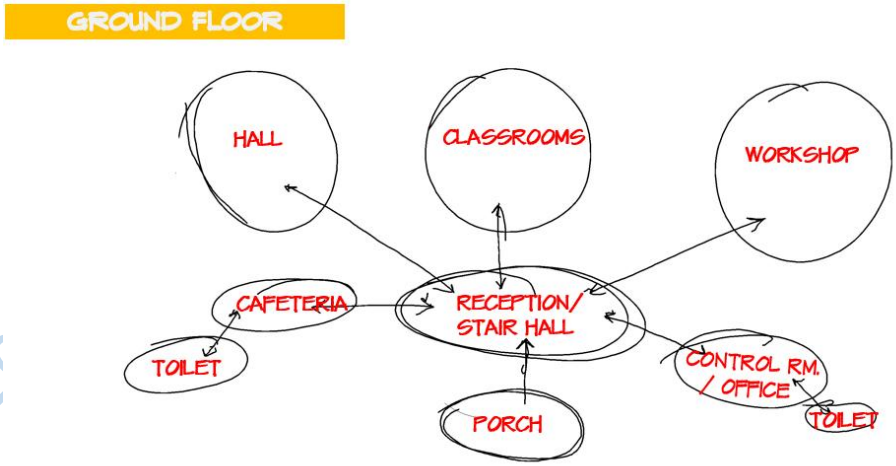

Figure 4.7 : Ground Floor Bubble Diagram

Source- (Author's field survey, 2024)

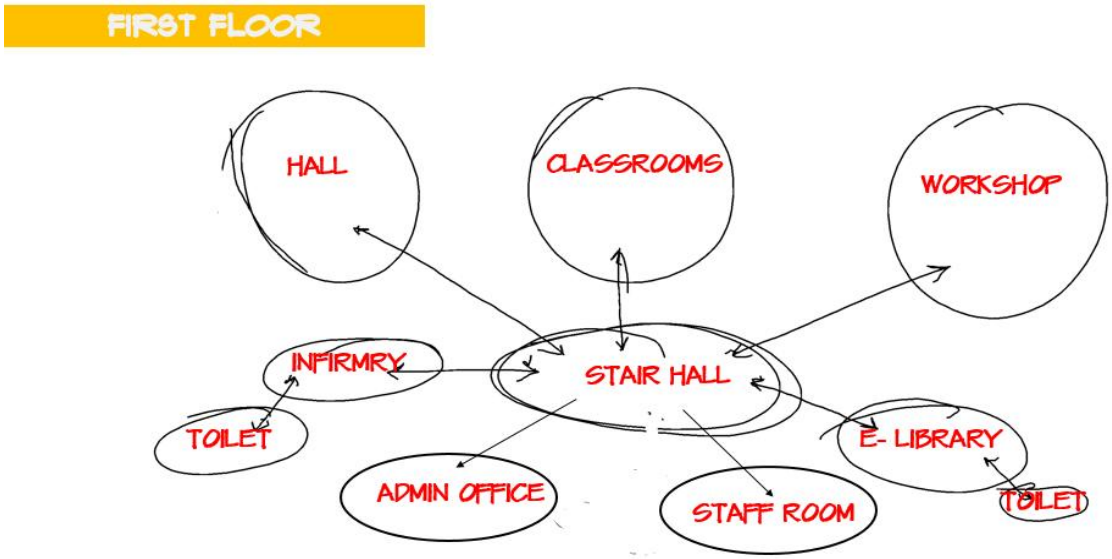

Figure 4.8 : First Floor Bubble Diagram

Source- (Author's field survey, 2024)

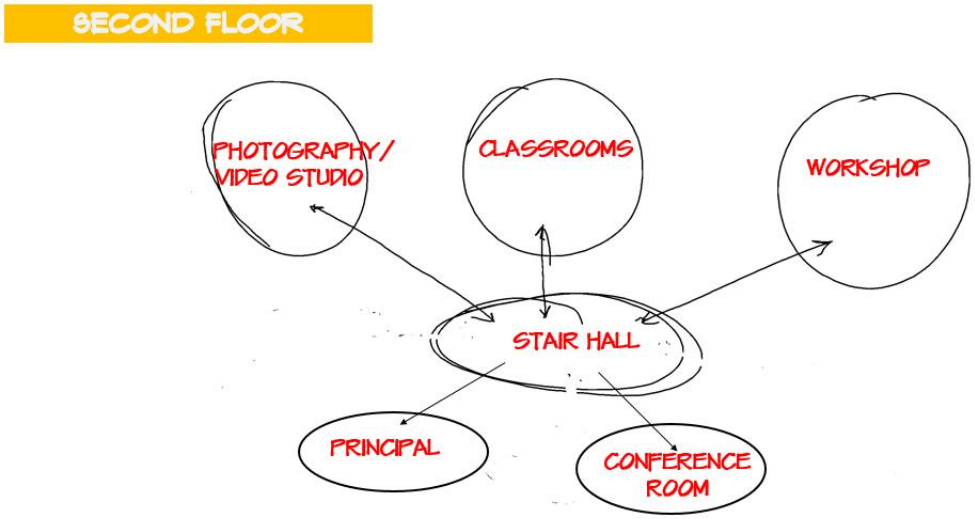

Figure 4.9 : Second Floor Bubble Diagram

Source- (Author's field survey, 2024)

4.2.6 Space Allocation/ Schedule of Accomodation

SHEDULE OF ACCOMODATION

S/N	SPACE NAME	SPACE FUNCTION	FURNITURE OF SPACE	NO OF SPACE	TOTAL AREA
01	RECEPTION/ CONCOURSE	ENQUIRY, WAITING AREA, DISTRIBUTION AREA	CHAIR, RECEPTION DESK, STOOLS	I	870SQM
02	ICT	COMPUTER LEARNING CENTRE, CBT EXAMINATION CENTER	DESK, CHAIR, SHELF	I	141SQM
03	OFFICES	STAFF PRIVATE ROOM,	DESK, SHELF, CHAIR	II	294SQM
04	INFIRMRY	ADMINISTER FIRST AID	BED, TABLE, CHAIR	I	102SQM
05	CAFTERIA	FOOD COURT, EATING/ RELAXATION AREA	TABLE, CHAIR	I	141SQM
06	MULTI-PURPOSE HALL	EVENT ROOM, CONFERENCE ROOM	CHAIR, TABLE	I	320SQM
07	CLASSROOMS	LEARNING AREA, STUDENT MEETING ROOM	DESK, TABLE	7	452SQM
08	WORKSHOP	TECHNICAL ROOM, LEARNING AREA	TABLE, STOOL, MACHINES	8	1083SQM

Figure 4.10 : Shedule of Accomodation

Source- (Author's field survey, 2024)

4.2.7 Construction Method and Materials

When designing the vocational training center, we focused heavily on sustainability by choosing eco-friendly materials and using green construction methods. Several factors guided our material choices, including aesthetics, durability, climate compatibility, availability, functionality, and compliance with local regulations and bylaws.

i. **Foundation**: We used reinforced concrete for the foundation and structural supports, ensuring a solid and durable base for the entire building. This choice guarantees the building's stability and longevity.

ii. **Landscape**: To make the outdoor areas both attractive and environmentally friendly, we utilized permeable paving materials like precast concrete interlocking stones and concrete curbs. These materials help manage rainwater runoff and support groundwater replenishment.

iii. **Shading Devices**: We incorporated aluminum composite panels and PTFE membranes for shading, which cover steel structures. These materials are effective in reducing heat gain, improving energy efficiency by providing shade while allowing natural light to filter through.

iv. **Walls**: The walls combine concrete blocks and glazed curtain wall systems, with internal partitions made of glass to let in natural light and create a sense of openness throughout the center.

v. **Wall Finishes**: For the interior walls, we opted for low-VOC paints like Airlite, which not only look good but also improve indoor air quality by reducing mold, microbes, and germs. This contributes to a healthier environment for everyone inside.

vi. **Windows**: We installed large casement windows in office areas to maximize natural light and ventilation, cutting down on the need for artificial lighting and improving indoor air quality.

vii. **Lift and Stairs**: In main entry and exit points, as well as VIP areas, we used reinforced concrete and steel stairs.

viii. **Floor Structural System**: Given the large spans of columns throughout the building, we chose a waffle grid floor system. This system is particularly effective in supporting extensive spans and is ideal for high-traffic areas like workshops and training rooms.

ix. **Floor Finishes**: Durability and sustainability were key when selecting flooring materials. We chose terrazzo finishes and interlocking tiles for external areas because of their durability, and vitrified tiles for internal spaces due to their aesthetic appeal and long-lasting nature.

x. **Doors**: The building features various types of doors, including steel roller shutter doors, aluminum and glass doors, wooden panel doors, and fire-rated exit doors. These doors were selected to ensure safety, security, and ease of access throughout the center.

xi. **Roof**: The roof structure is supported by steel trusses and secondary beams, with polycarbonate panels in certain areas to let in natural light. This design maximizes energy efficiency by reducing the need for artificial lighting.

xii. **Ceiling**: Different spaces in the building have different ceiling materials. Offices and frequently used areas have POP (Plaster of Paris) false ceilings for their aesthetic and acoustic benefits, while other areas use sustainable materials suited to their specific functions.

By integrating these methods and materials, the vocational training center is designed to be environmentally friendly, energy-efficient, and conducive to learning. This approach not only meets the center's functional needs but also promotes sustainability and resource conservation.

4.2.8 Building Services

A vocational training center requires a carefully designed infrastructure to support its diverse functions and promote a sustainable and efficient environment. Incorporating comprehensive building services with green design principles is essential to achieve this goal.

i. **Climate Control**

A high-efficiency Heating, Ventilation, and Air Conditioning (HVAC) system is critical for maintaining comfortable temperatures throughout the year. Combining this with natural ventilation can help reduce energy use, especially in favorable climates. Maintaining proper temperature control in classrooms, workshops, and communal areas is vital for creating a productive learning environment.

ii. **Plumbing and Drainage**

A well-designed plumbing system is essential for restrooms, kitchen areas, and specialized training facilities like those for culinary arts or healthcare. Effective drainage systems are necessary to maintain hygiene and prevent water-related problems. Using water-saving fixtures and rainwater harvesting systems promotes sustainability and reduces water consumption and costs.

iii. **Electrical Systems**

Adequate electrical wiring and outlets are needed throughout the center to power lighting, training equipment, and various appliances. Implementing energy-efficient lighting solutions, such as LED lights and motion sensors, helps minimize energy consumption. Additionally, integrating renewable energy sources like solar panels can further enhance the building's sustainability.

iv. **Security Systems**

A robust security system, including cameras and alarms, is crucial for ensuring occupant safety and deterring potential threats. Fire safety systems, such as smoke detectors and sprinklers, are also essential. Emergency lighting and clearly marked exits should be included in the safety plan to ensure quick evacuations if needed.

v. **Sustainable Building Materials**

Choosing sustainable building materials, such as those with recycled content, low-VOC paints, and locally sourced options, reduces the environmental impact of construction. Incorporating green roofs and walls can improve insulation and reduce energy consumption, contributing to a more sustainable building.

By thoughtfully planning and integrating these building services with a focus on green design principles, the vocational training center can create a comfortable, safe, and sustainable environment. This approach not only meets the needs of the community but also supports long-term operational efficiency and environmental stewardship.

Chapter Five

Conclusion

5.1 Project Appraisal

The proposed vocational training centre in Ibadan, Oyo State, aims to be a model for integrating green design principles into educational facilities. This section evaluates the project's effectiveness, sustainability, and feasibility.

i. **Effectiveness:** The design focuses on creating a productive learning environment while minimizing environmental impact. Key features include passive solar design for natural heating and cooling, energy-efficient HVAC systems, and solar photovoltaic (PV) panels to generate electricity. These elements ensure a comfortable and efficient learning space.

ii. **Sustainability:** Sustainability is a core objective. The use of eco-friendly materials, low-VOC products, and water-saving fixtures like low-flow toilets and faucets helps to reduce the building's environmental footprint. Life cycle assessments (LCA) confirm that these choices provide long-term environmental benefits.

iii. **Feasibility**: Although green design features may have higher initial costs, they lead to significant long-term savings in energy and water consumption, along with lower maintenance costs. Cost-benefit analyses show that these investments are justified over the building's lifespan.

5.2 Conclusion

The proposed vocational training centre in Ibadan showcases how green design principles can be effectively integrated into educational buildings. This project demonstrates that it is possible to create a sustainable, efficient, and effective learning environment that benefits both students and the environment.

By incorporating renewable resources, energy-efficient technologies, and waste reduction strategies, the centre significantly reduces its environmental impact. Additionally, it serves as a practical educational tool, giving students hands-on experience with sustainable practices.

The success of this project can inspire similar initiatives in other regions, promoting sustainable practices in educational infrastructure across Nigeria and beyond.

5.3 Recommendations

Based on the findings of this project, the following recommendations are made:

i. **Policy Support:** Advocate for government policies that support green building practices in educational facilities, including providing incentives and funding for sustainable projects.
   Develop clear guidelines and standards for implementing green design in schools.

ii. **Continuous Improvement:** Implement regular monitoring and evaluation to ensure sustainability goals are met and identify areas for improvement.
   Stay updated with new technologies and practices to continually enhance building efficiency and sustainability.

iii. **Educational Integration:** Integrate sustainability and green design principles into the curriculum to provide students with a comprehensive understanding of these concepts.
   Offer practical training opportunities to prepare students for careers in sustainable industries.

iv. **Community Engagement:** Raise awareness about the benefits of green design through community outreach and participation.

Encourage the community to take part in maintaining and improving the centre's sustainable features.

v. **Replication and Scaling:** Use this vocational training centre as a case study to inspire similar projects in other educational institutions.

Share best practices and lessons learned with other schools and educational authorities to promote the widespread adoption of green design principles.

Following these recommendations can help the proposed vocational training centre in Ibadan set a benchmark for sustainable educational infrastructure, contributing to a more environmentally conscious and resilient society.

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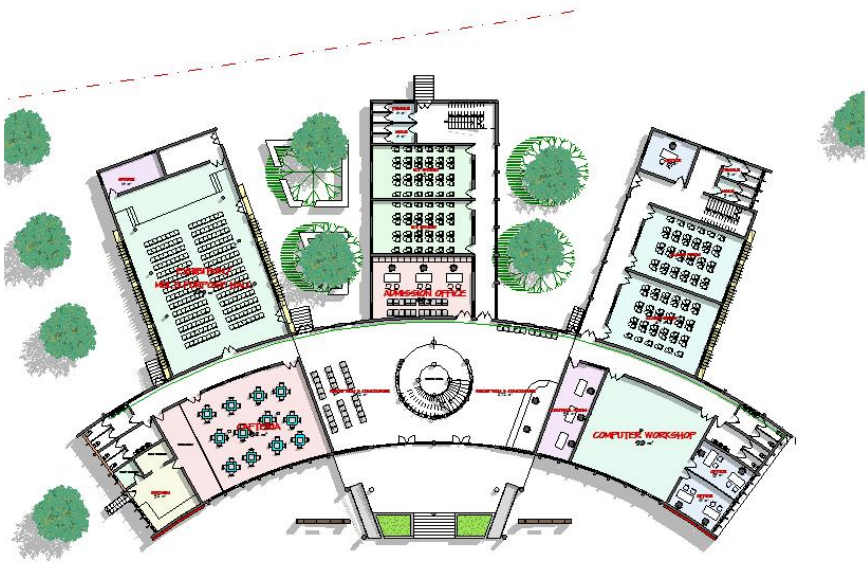
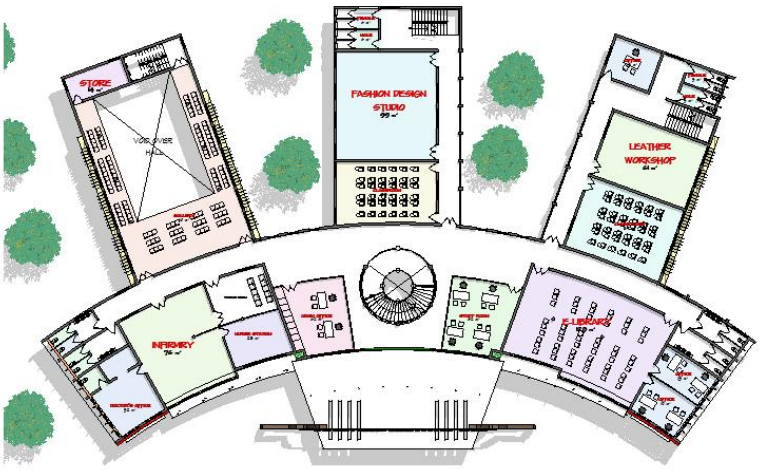
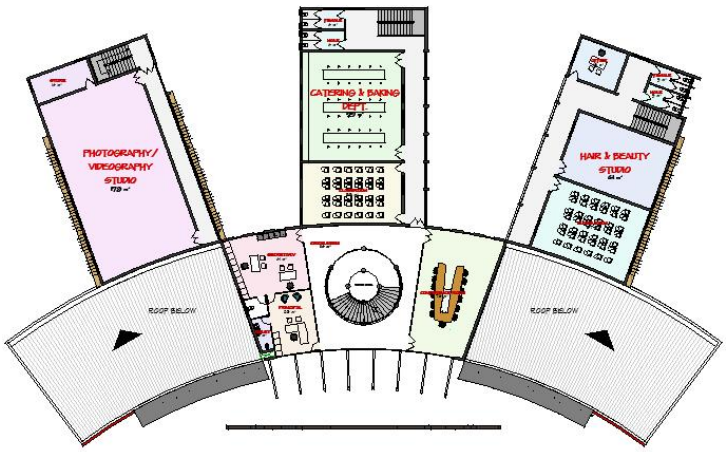
Appendices - Appendix 1 – Presentation Drawings



GROUND FLOOR PLAN



FIRST FLOOR PLAN



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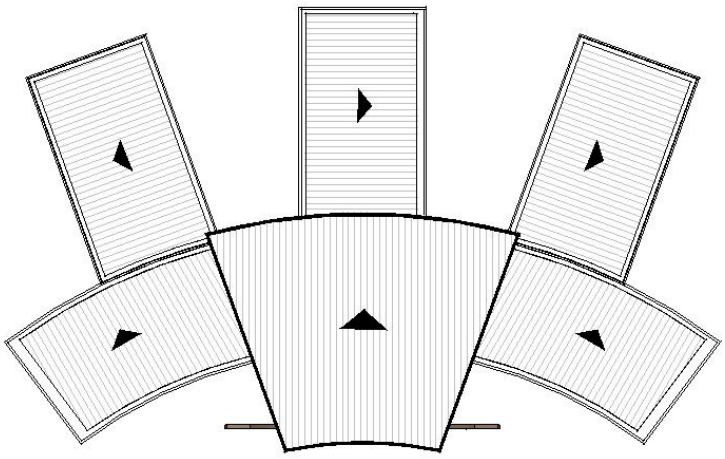

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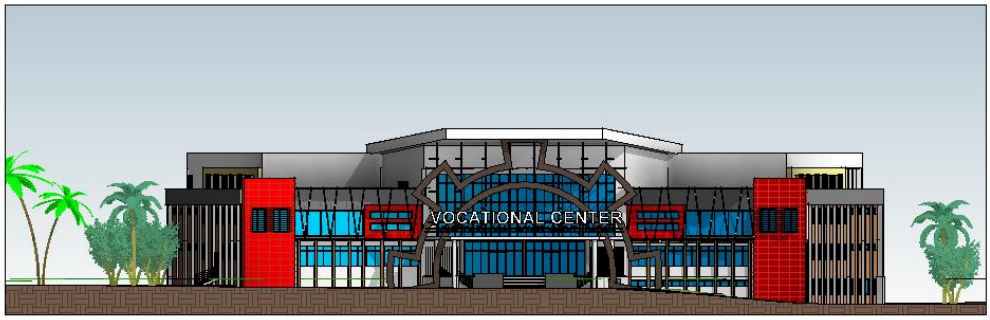
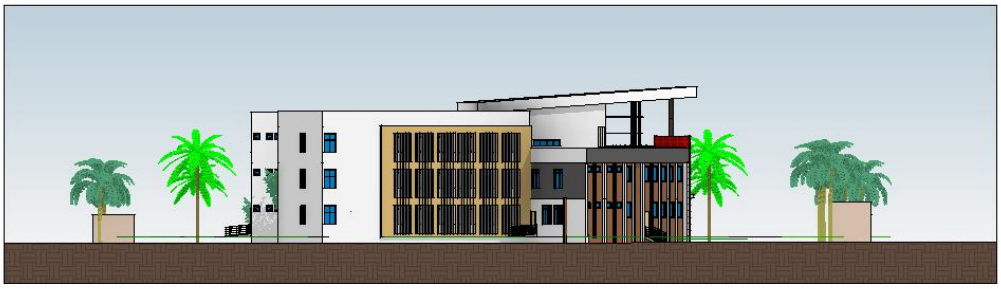
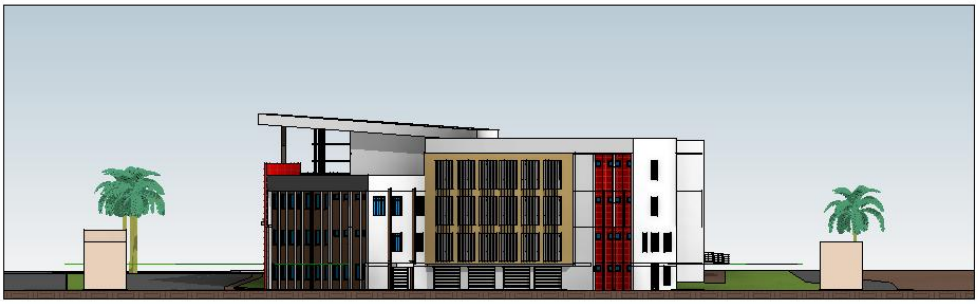


APPROACH VIEW



RIGHT - SIDE VIEW



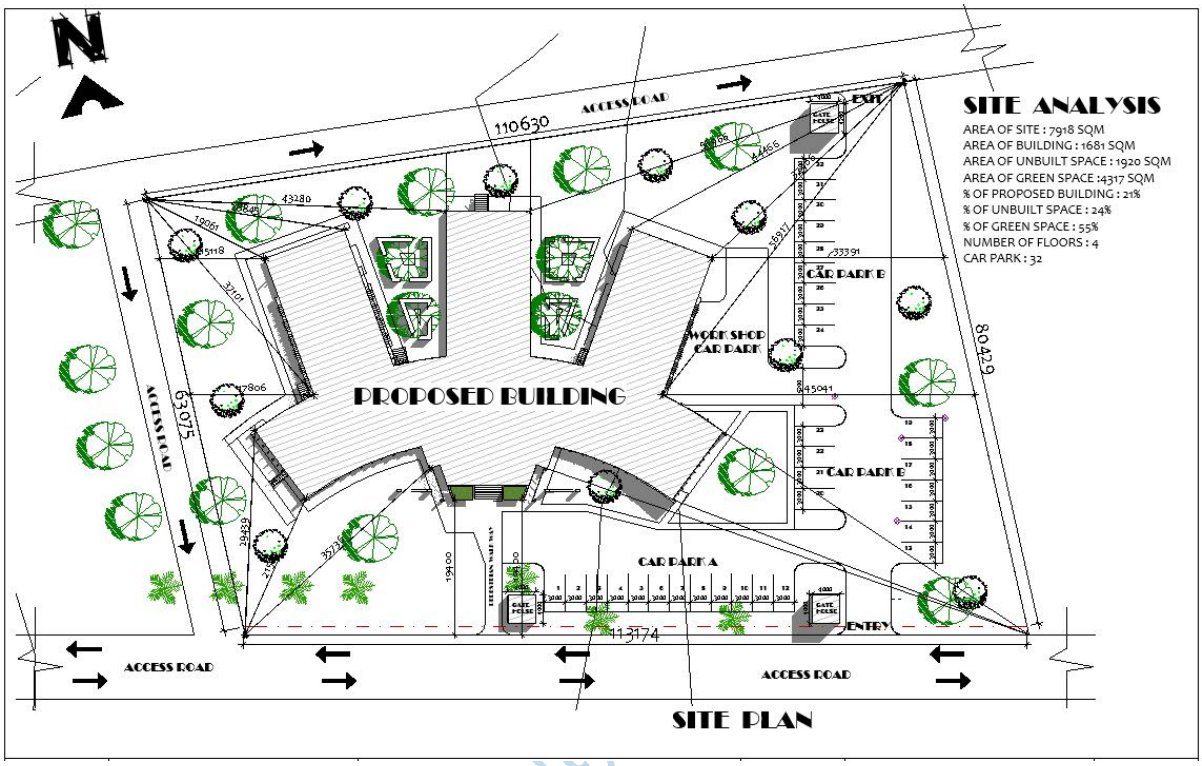
LEFT-SIDE VIEW

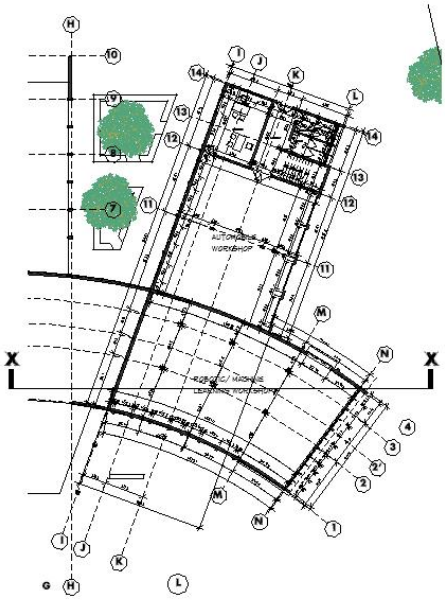
REAR VIEW

PERSPECTIVE 1

PERSPECTIVE 2

Appendices - Appendix 2 – Working Drawings





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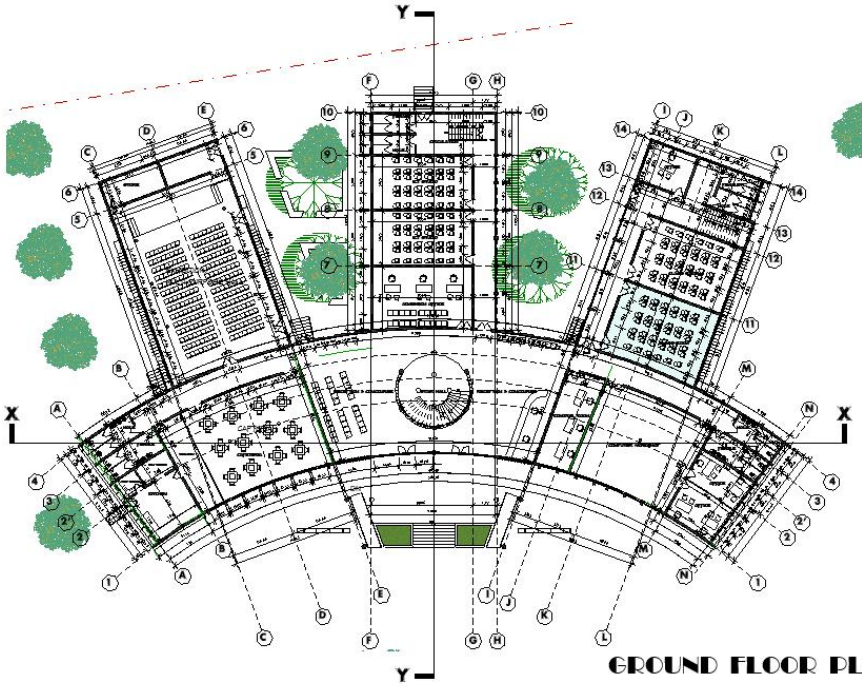

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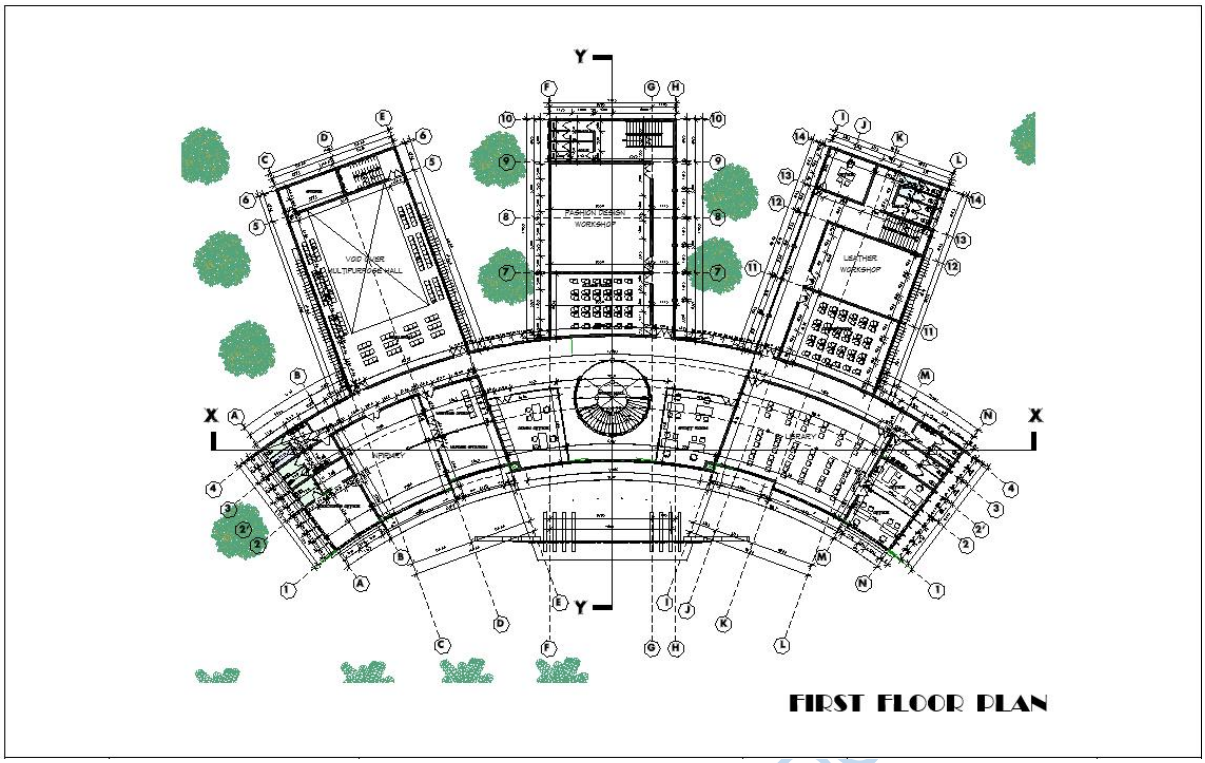
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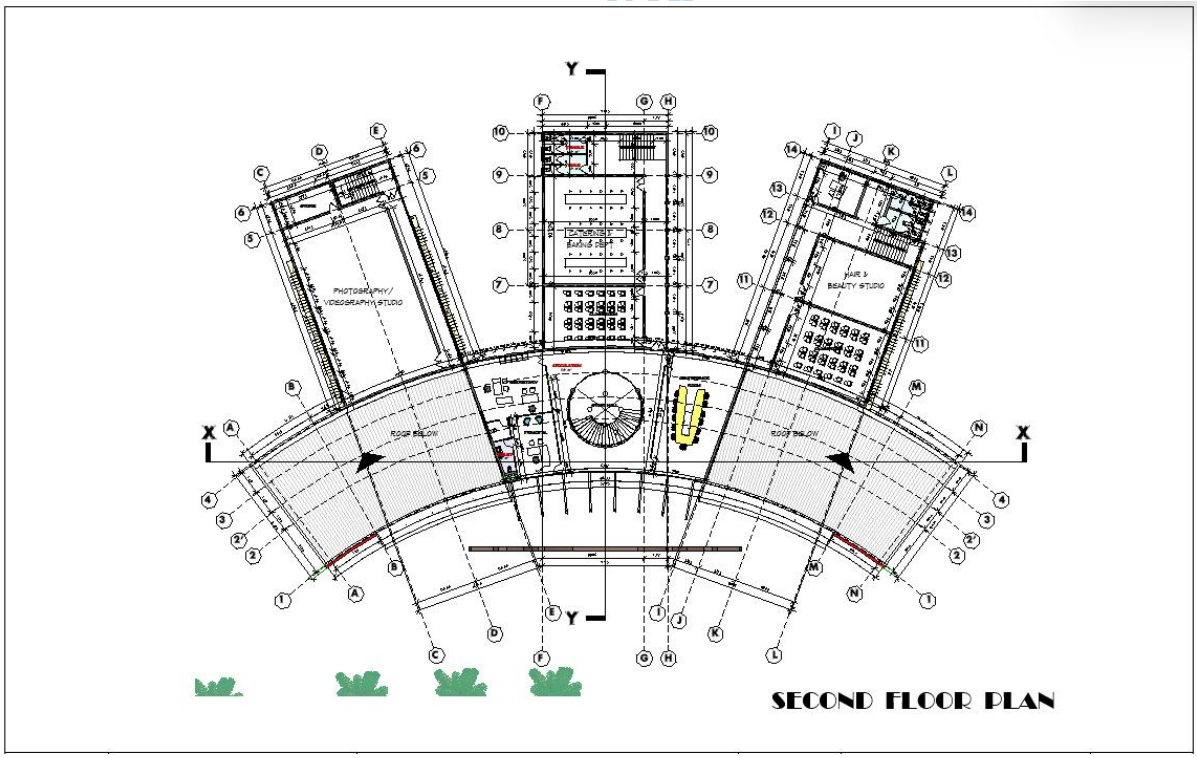
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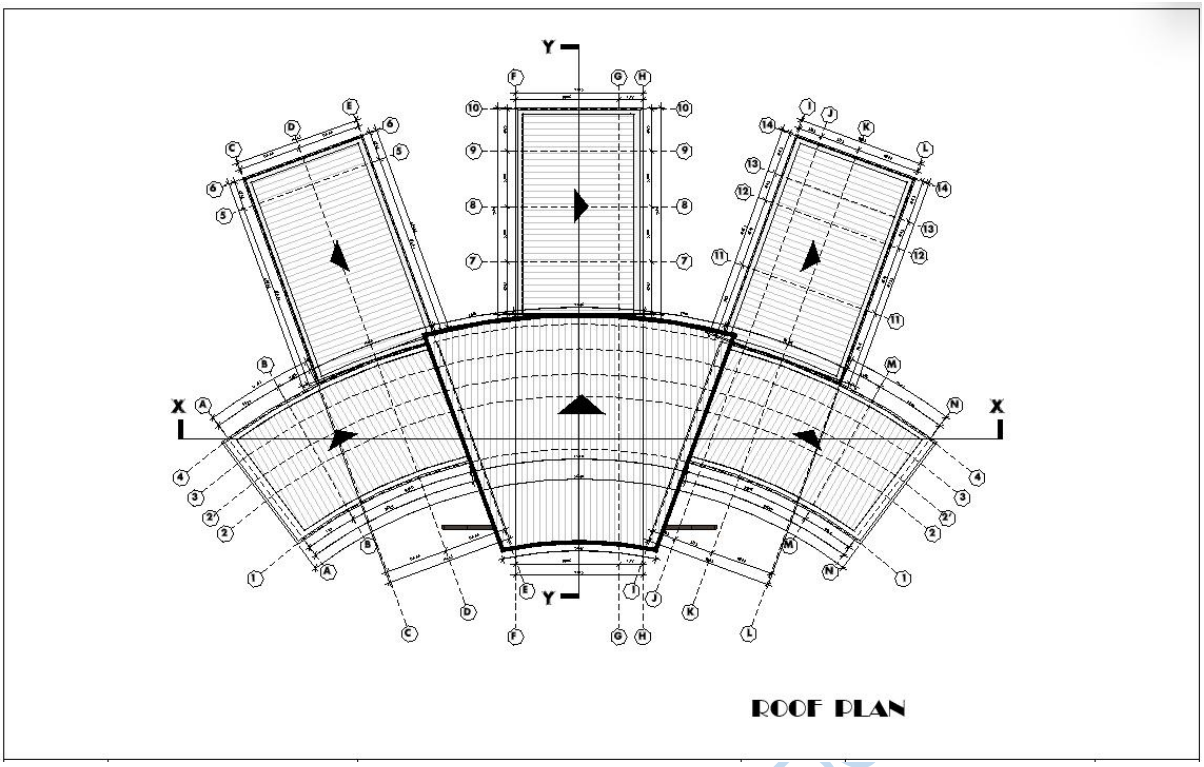

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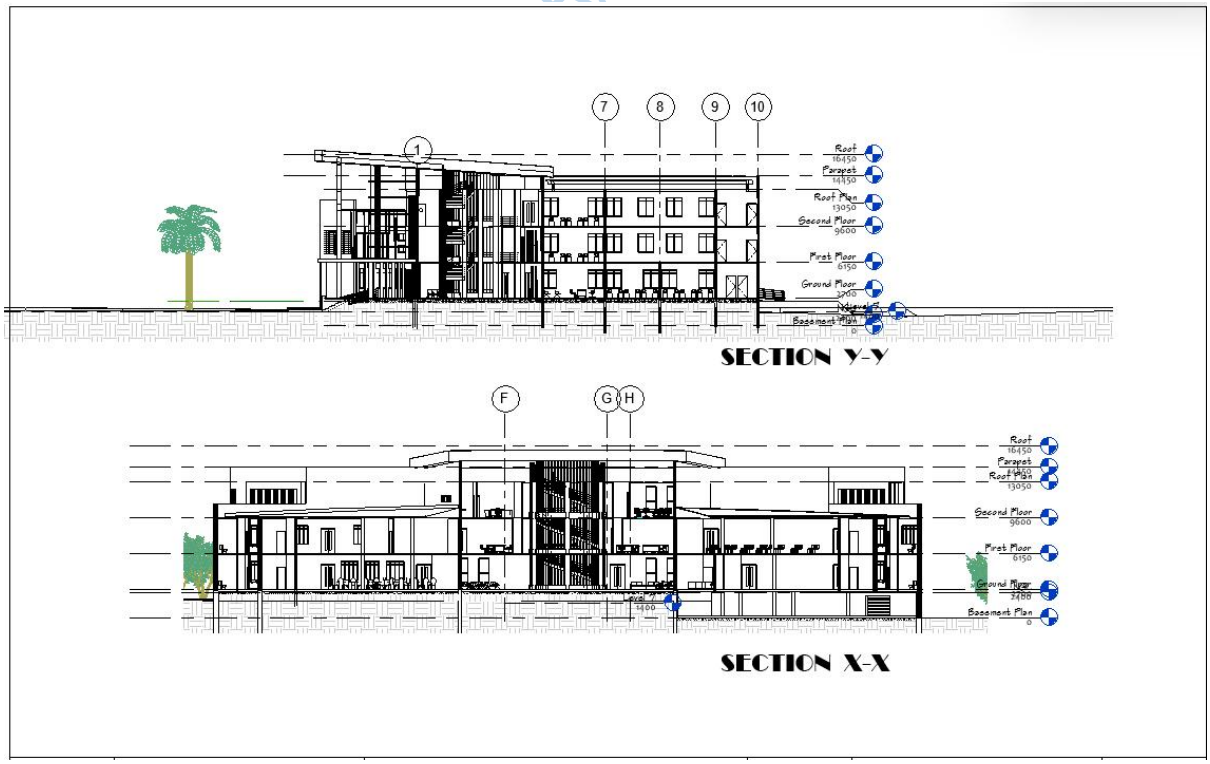
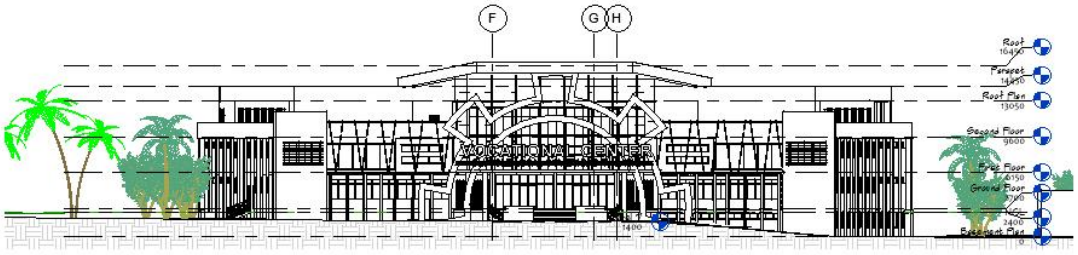
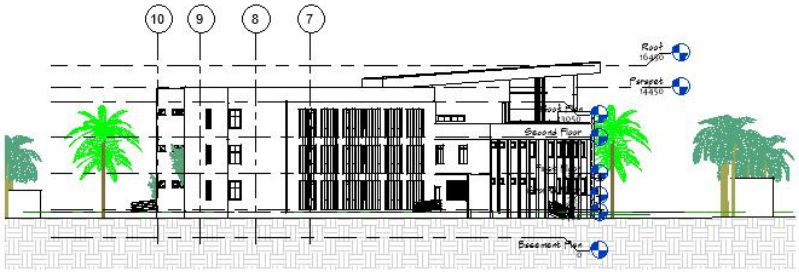


SECTION Y-Y

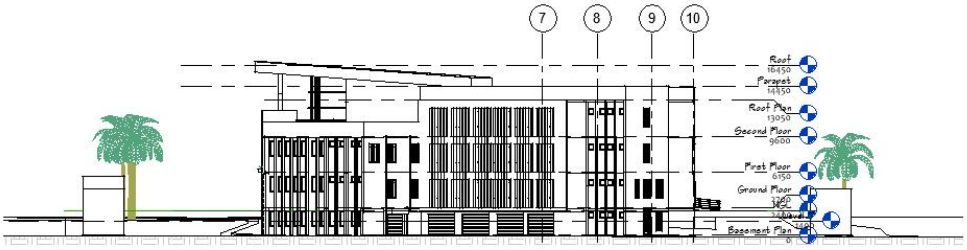
SECTION X-X



APPROACH VIEW



RIGHT - SIDE VIEW



LEFT-SIDE VIEW

REAR VIEW

Bio-data

A. Personal Data

1. Full Name : **ONI Joshua Oluwatunmise**
2. Address : **No 18B, Oloruntedo Estate, Behind Bollads Event Center, Ibadan, Oyo State**
3. Email Address : **onitunmise@gmail.com**
4. Phone Number : **+2348136218238**
5. Date of Birth : **11th November 1995**
6. Place of Birth : **Osogbo**
7. Nationality : **Nigerian**
8. Marital Status : **Married**
9. Name and Address of Next of Kin: **ONI Joanna ;**

No 18B, Oloruntedo Estate, Behind Bollads Event Center, Ibadan, Oyo State

B. Educational Background

1. Educational Institutions Attended with Dates and Qualification:

Qualifications	Institution	Date
MSc. Architecture	Lead City University, Ibadan, Oyo State.	2022- (Ongoing)
BTech. Architecture	Ladoke Akintola University of Science and Technology, Ogbomosho, Oyo State.	2020
West African Secondary School Certificate	Our Lady and St. Francis Catholic College, Osogbo, Osun State.	2011
Primary School Leaving Certificate	Excel Nursery and Primary School, Osogbo, Osun State.	2005

C. Awards and Fellowships - Nil

D. Work Experience With Dates

Work Experience	Date
Eleven Hills Limited, Ibadan , Oyo State.	Aug. 2021- Present
Bhoux Limited, Victoria Island, Lagos State.	Mar. 2021- May 2021
Federal School of Survey, Oyo, Oyo State.	Mar. 2020- Feb. 2021
Federal Ministry of Power, Works and Housing, Osogbo, Osun State.	May 2018- Oct. 2018

E. Publications - Nil

…… ……

Signature **Date**

The University Compliance Certification

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Signature **Date**

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