

**IMPLEMENTATION OF PASSIVE DESIGN STRATEGIES IN THE  
DESIGN OF A BEVERAGE FACTORY IN OTA, OGUN STATE**

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**JULY, 2024**

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**BY**

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ARCHITECTURE, COLLEGE OF SCIENCE AND TECHNOLOGY,  
COVENANT UNIVERSITY, OTA, OGUN STATE, NIGERIA**

**JULY 2024**

## **ACCEPTANCE**

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Science (M.Sc.) in the Department of Architecture, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria and has been accepted by the School of Postgraduate Studies, Covenant University, Ota, Ogun State, Nigeria.

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**(Dean, School of Postgraduate Studies)**

**Signature and Date**

## **DECLARATION**

**I, GANYA, ZOE AYELO (18CA024547)**, declare that this dissertation is a representation of my work, and is written and implemented by me under the supervision of Dr. Anthony B. Sholanke of the Department of Architecture, Covenant University, Ota, Nigeria. I attest that this dissertation has in no way been submitted partially or wholly to any other University or Institution of higher learning for the award of a Master's Degree. All information cited from published and unpublished literature has been duly referenced.

**GANYA, ZOE AYELO**

**Signature and Date**

## **CERTIFICATION**

This is to certify that this dissertation titled " **IMPLEMENTATION OF PASSIVE DESIGN STRATEGIES IN THE DESIGN OF A BEVERAGE FACTORY IN OTA, OGUN STATE,**" is an original research work carried out by **GANYA, ZOE AYELO (18CA024547)**, in the Department of Architecture, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Dr. Anthony B. Sholanke. This dissertation has met the required standard for the award of Master of Science (M.Sc.) in Architecture.

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## **DEDICATION**

This research work is dedicated firstly to El Deah, GOD Almighty. HE is sheer grace and mercy, haven given me favour throughout the duration of carrying out this research. Secondly, to my loving and supportive parents, Arc. & Mrs Steve and Victoria Ganya.

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## LIST OF ABBREVIATIONS AND ACRONYMS

<b>3D</b>	Three-Dimensional
<b>APA</b>	American Psychological Association
<b>ASHRAE</b>	American Society of Heating, Refrigerating and Air-Conditioning Engineers
<b>BBCC</b>	Building Bioclimatic Charts
<b>BPS</b>	Building Performance Simulation
<b>BREEAM</b>	Building Research Establishment Environmental Assessment Methodology
<b>BTU/h ftoF</b>	British Thermal Units per hour foot and degree Fahrenheit
<b>CAD</b>	Computer-Aided Design
<b>CATIA</b>	Computer-aided Three-dimensional Interactive Application
<b>CHREC</b>	Covenant University Research Ethics Committee
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>COVID-19</b>	COronaVirus Disease of 2019
<b>DELMIA</b>	Digital Enterprise Lean Manufacturing Interactive Application
<b>e.g.</b>	Exempli Gratia/For Example
<b>EPS</b>	Expanded Polystyrene
<b>et al.</b>	et alia/others
<b>FMS</b>	Flexible Manufacturing System
<b>GO</b>	Genetic Optimization
<b>HVAC</b>	Heating, Ventilation and Air Conditioning
<b>IAQ</b>	Indoor Air Quality
<b>IEQ</b>	Indoor Environmental Quality
<b>IESve</b>	Indian Engineering Services Virtual Environment
<b>IoT</b>	Internet Of Things
<b>ISO</b>	International Organization for Standardization
<b>IT</b>	Information Technology
<b>km</b>	Kilometre
<b>LCA</b>	Life Cycle Assessment
<b>LEED</b>	Leadership in Energy and Environmental Design
<b>m</b>	Metre
<b>m/s</b>	Metre per second
<b>MPIs</b>	Microplastics
<b>NAFDAC</b>	National Agency for Food and Drug Administration and Control
<b>NBC</b>	Nigerian Bottling Company
<b>NEC</b>	Near-Infrared Switching Electrochromic
<b>NESREA</b>	National Environmental Standards and Regulations Enforcement Agency
<b>NIRP</b>	National Industrial Revolution Plan
<b>OHS</b>	Occupational Health and Safety
<b>OPIC</b>	Ogun State Property and Investment Co-operation
<b>PA</b>	Passive Architecture
<b>PBD</b>	Passive Building Design
<b>PIR</b>	Polyisocyanurate
<b>Plc</b>	Public Limited Company
<b>PPE</b>	Personal Protective Equipment
<b>PV</b>	Photovoltaic
<b>RFID</b>	Radio Frequency Identification

<b>RPET</b>	Recycled Polyester Fibres
<b>SBU</b>	Strategic Business Unit
<b>SDGs</b>	Sustainable Development Goals
<b>S.H.E</b>	Safety, Health and Environment
<b>SO<sub>2</sub></b>	Sulphur dioxide
<b>SON</b>	Standard Organization of Nigeria
<b>SPSS</b>	Statistical Products and Service Solutions
<b>SWOT</b>	Strength, Weakness, Opportunity and Threats
<b>TRNSYS</b>	Transient System Simulation Tool
<b>V<sub>n</sub></b>	Variable Number
<b>VOCs</b>	Volatile Organic Compounds
<b>W/mK</b>	Watts per metre-kelvin
<b>WHS</b>	Workplace Health and Safety
<b>ZEB</b>	Zero Energy Building

## ABSTRACT

Global energy use and greenhouse gas emissions are considerably influenced by the beverage industrial sector. Energy-intensive processes including heating, cooling, and refrigeration are fundamental necessities during the manufacture of beverages in factories. It is therefore important that a beverage factory is designed to lessen its adverse effect on the climate. One of the ways to achieve this is through the use of passive design strategies. With improved indoor environment quality, passive design concept seeks to use less energy, operate more efficiently, and leave a smaller carbon impact. Healthy building designs are more important nowadays for improving sustainability, energy efficiency, and environmental responsibility within the beverage manufacturing business as the globe pushes for a more sustainable environment. Thus, the aim of this study is to examine passive design strategies for achieving healthy and safe work environment with a view to apply lessons learnt in the design of a beverage factory in Ogun State, Nigeria. The objectives of the study include to: determine passive design strategies for achieving healthy and safe work environment; investigate how passive design strategies have been implemented in selected beverage factories; examine the extent to which workers are satisfied with passive design strategies adopted in selected beverage factories in Nigeria; and apply passive design strategies in the design of a beverage factory in Ogun State, Nigeria towards achieving healthy and safe work environment. The research is case study that adopted a mixed-method approach. This involved three selected beverage factories in Nigeria and three foreign case studies. Qualitative data were gathered from relevant literature and the case studies, and content analysed. Whereas, quantitative data were collected through a survey approach from two hundred and sixty-seven respondents in Nigeria. Statistical Product and Service Solutions software was used to analyse quantitative data. The results were presented with tables, figures, plates, architectural drawings, three-dimensional animation and a physical model. The study centred on natural ventilation and natural lighting found to be key passive design strategies for achieving healthy and safe work environment. The study contributes to the growth in the body of knowledge on sustainable design in industrial settings, offering useful ideas for a future where the production of beverages is more environmentally sensitive and effective, through the development of a passive design strategy-based architectural design proposal of a beverage industry in Ogun State, Nigeria. The study promotes Sustainable Development Goal three (Good Health and Well-being), Goal nine (Industry, Innovation and Infrastructure), Goal eleven (Sustainable Cities) and Communities, and Goal thirteen (Climate Action).

***Keywords: Passive Design Strategies, Beverage Factory, Natural Lighting, Natural Ventilation, Healthy Building Design, Indoor Environment Quality, Workplace Health and Safety, Nigeria***