

**ADOPTION OF CIRCULAR DESIGN STRATEGIES BY
BUILDING DESIGN FIRMS IN LAGOS, NIGERIA**

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MARCH, 2024

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**A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE
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DEPARTMENT OF ARCHITECTURE, COLLEGE OF SCIENCE
AND TECHNOLOGY, COVENANT UNIVERSITY, OTA, OGUN
STATE, NIGERIA.**

MARCH, 2024

ACCEPTANCE

The thesis titled “**ADOPTION OF CIRCULAR DESIGN STRATEGIES BY BUILDING DESIGN FIRMS IN LAGOS, NIGERIA**” carried out by **SULEMAN, TAOFEEK ADEDOTUN**, in partial fulfilment of the requirements for the award of a Doctor of Philosophy (Ph.D) degree in Architecture in the College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria is accepted for literary presentation.

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DECLARATION

I, **SULEMAN TAOFEEK ADEDOTUN (20PCA02244)**, declare that I carried out this research under the supervision of Dr. Isidore C. Ezema and Prof. Peter A. Aderonmu of the Department of Architecture, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria. I attest that this thesis has not been presented, either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this thesis are duly acknowledged.

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Signature and Date

CERTIFICATION

We certify that this thesis titled “**ADOPTION OF CIRCULAR DESIGN STRATEGIES BY BUILDING DESIGN FIRMS IN LAGOS, NIGERIA**” is an original research work carried out by **SULEMAN, TAOFEEK ADEDOTUN (20PCA02244)** in the Department of Architecture, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Dr. Isidore C. Ezema and Prof. Peter A. Aderonmu. We have examined and found this work acceptable as part of the requirements for the award of Doctor of Philosophy (Ph.D) degree in Architecture.

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DEDICATION

I dedicate this work to Almighty God for the respite of life and source of strength throughout this programme and to my parents, siblings, wife, and children for their intellectual and moral support, motivation, and encouragement.

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LIST OF ABBREVIATIONS AND ACRONYMS

3R	Reduce, Reuse, and Recycle
AEC	Architecture, Engineering, Construction
ARCON	Architects Registration Council of Nigeria
BDF	Building Design Firm
BIM	Building Information Modelling
BSAT	Building Sustainability Assessment Tool
BTS	Bartlett's Test of Sphericity
CBD	Circular Building Design
CBM	Circular Business Model
CDS	Circular Design Strategies
CDW	Construction and Demolition Waste
CE	Circular Economy
COREN	Council for the Regulation of Engineering in Nigeria
CPDP	Continuous Professional Development Programme
CSF	Critical Success Factors
CSR	Corporate Social Responsibility
C2C	Cradle-to-Cradle
C2G	Cradle-to-Grave
DOI	Diffusion of Innovation
DfD	Design for Disassembly
DT	Digital Technology
EC	European Commission
EDGE	Excellence in Greater Design Efficiencies
EMF	Ellen MacArthur Foundation
EoL	End-of-Life

EPR	Extended Producer Responsibility
EU	European Union
GBCN	Green Building Council of Nigeria
GBRS	Green Building Rating System
GDP	Gross Domestic Product
GHG	Greenhouse Gas
I4.0	Industrial Revolution 4.0
KMO	Kaiser-Meyer-Olkin
LEED	Leadership in Energy and Environmental Design
NBE	Nigerian Built Environment
NPV	Net Present Value
LCA	Life-Cycle Assessment
LE	Linear Economy
PCA	Principal Component Analysis
RFID	Radio Frequency Identification
RO	Resource Optimisation
ROI	Return on Investment
CSB	Certified Sustainable Building
SCB	Sustainable Circular Building
SDG	Sustainable Development Goal
SPSS	Statistical Product and Service Solutions
UK	United Kingdom
USA	United States of America

ABSTRACT

The global prominence of the circular economy model is a notable sustainability trend. Within this model, the design stage plays a critical role as the foundation. The adoption of circular design strategies (CDS) has been gaining appreciable traction in the architecture, engineering, and construction industry in Europe and Asia. However, limited adoption has greeted these strategies in Sub-Saharan Africa, specifically, in the Nigerian built environment. This is due to the dearth of empirical studies on CDS adoption and implementation, especially at the building design firms' level. Hence, this study evaluated the adoption of CDS by firms towards identifying pathways for their increased uptake in Nigeria. Providing empirical knowledge on the adoption of CDS can contribute towards reducing material extraction and consumption, and the global economy circularity index. Roger's Diffusion of Innovation theory was used deployed as the study's conceptual framework. A pragmatic philosophical paradigm was adopted for the study. Convergent parallel mixed research method was deployed and concurrent triangulation approach facilitated the integration of results. Quantitative data were collected through a questionnaire survey from 216 firms which were analysed by applying descriptive and inferential statistical methods using Statistical Product and Service Solutions version 21. An interview guide and observation protocol were employed in collecting qualitative data from ten firms involved in the design of certified sustainable buildings (CSBs) and nine CSBs, respectively. The qualitative data were manually analysed through a content analysis involving In-vivo coding and themes' identification. The findings indicated that the disposition of firms towards CDS adoption is dependent on improving value and expertise, effective stakeholder management, collaboration, policy, and the tendency for economic capacity. The firms exhibit a moderate level of CDS awareness. However, they have only adopted certain strategies related to slowing and narrowing resource loops to a high extent. The adoption of strategies related to closing-resource loop is very low. The study further revealed the factors that influence CDS adoption by firms to include awareness, benefits, firm's disposition, barriers, firm's profile, and communication channels. Internet-driven peer networking channels were found to be the most effective means of diffusing CDS knowledge. Finally, CSBs in the study area have adopted certain CDS associated with designing out waste and slowing-resource loops, while the CSBs are still deficient in adopting CDS associated with closing-resource loop. Firms need to look inwards into the alignment of their visions, culture, and process in ensuring they conform with new market demand and embrace changes where appropriate, especially, in environmental sustainability consciousness in their design processes. Additionally, the roles, responsibilities, and support of the government, academia, and the industry were identified in contributing towards achieving the set agenda. The findings indicated that the adoption of CDS in building developments directly contributes to the sustainable development goal 12 – responsible consumption and production. This study contributed to knowledge by identifying the key characteristics that dispose firms towards CDS adoption. Furthermore, the firms and CSBs have least adopted closing-resource loop strategies in design. Similarly, recommendations to practice, academia, and policies were suggested to enhance resource optimisation in the NBE through the uptake of the strategies by firms. Further studies can investigate appropriate circular business models and circular project management approaches applicable in Nigeria.

Keywords: *Circular Design Strategies; Circular Economy; Design Firms; Lagos-Nigeria; Resource Optimisation*