
EVALUATING THE FUNCTIONALITY AND PERFORMANCE OF CIRCULATION LAYOUTS IN IKEJA CITY MALL

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ABSTRACT

This study examines how circulation layout influences movement efficiency, spatial legibility, and commercial performance in Ikeja City Malls. Although circulation is widely recognized as a critical architectural element, many malls in rapidly urbanizing contexts continue to experience congestion, poor wayfinding, and uneven footfall due to inadequate spatial planning. Using a qualitative case study approach, the research analyzes Ikeja City Mall, Lagos, Nigeria, through direct observation, spatial configuration assessment, and evaluation of retail visibility and movement patterns. Findings indicate that the mall's linear-loop circulation system supports intuitive navigation and efficient access to major anchor tenants but generates congestion at key nodes and produces uneven distribution of foot traffic, resulting in underperforming peripheral retail zones. Areas surrounding escalator cores, entrance lobbies, and anchor frontages experience intense movement concentration, particularly during peak periods, while secondary corridors remain underutilized. The study further identifies node placement, vertical circulation distribution, visibility, and wayfinding clarity as critical determinants of circulation performance. It concludes that improved integration of circulation elements and spatial sequencing can significantly enhance user experience, spatial efficiency, and commercial outcomes. The study recommends the adoption of hybrid circulation strategies, improved positioning of vertical connectors, enhanced visual connectivity, and evidence-based design approaches to support more effective and user-centered shopping mall environments, particularly within high-density urban settings.

Keywords: Circulation layout; spatial planning; mall circulation; pedestrian movement; wayfinding; accessibility; functionality; performance evaluation; shopping mall; Ikeja City Mall; Lagos; Nigeria.

INTRODUCTION

In retail architecture, circulation has evolved from a simple means of moving people to a strategic instrument that shapes shopper experience, tenant performance, and overall commercial success. As shopping malls increasingly reposition themselves as hybrid social, commercial, and leisure environments, the logic of how people navigate these spaces has become a defining marker of design quality and economic viability. Shopping malls are designed to provide consumers with a convenient and diverse shopping experience. They feature a variety of retailers, electronics shops, department stores, specialty stores, restaurants, and entertainment options like cinemas or arcades (Botsali, 2007). Shopping malls have transformed from mere retail containers into complex, multifunctional urban environments social hubs where commerce, leisure, and spatial design intersect to shape human behaviour and commercial success. Circulation layout the design of pathways, corridors, vertical links, and movement networks is fundamental to this transformation, because it governs how people move, how they perceive space, and how retail outlets are experienced (Adibi, 2023). The design of circulation systems and spatial layouts within shopping malls plays a critical role in shaping the overall user experience and satisfaction (Çavka, 2023)

The configuration of this circulation systems directly influences visibility of shops, distribution of foot traffic, ease of navigation, and ultimately consumer behaviour and satisfaction (Oktaviana & Anggraeni, 2020; Fhadilla & Firmandhani, 2022). Despite its strategic importance, circulation design often remains under-evaluated in real-world malls, especially in rapidly urbanizing contexts where expansion may outpace thoughtful spatial planning (Riaz et al., 2024). As a result, many shopping malls suffer from congested walkways, poor way finding, uneven retail exposure, and general inefficiency of movement problems that undermines both user experience and commercial potential. This gap between theoretical recognition of circulation importance and practical design performance highlights the need for systematic, empirical evaluation of circulation layouts in shopping malls. Circulation layout is a core component of spatial planning in shopping mall design, many malls continue to exhibit poor movement logic, inefficient wayfinding, and circulation bottlenecks. In numerous developing urban environments, circulation systems are not grounded in empirical user-behaviour studies or structured assessment of spatial performance (Moussa & El-Sayed, 2021). The result is the proliferation of malls with disjointed movement paths, poorly positioned vertical circulation elements, congested nodes, underutilized zones, and inconsistent visibility of retail outlets. The absence of systematic evaluation and design-based analysis has created a gap in understanding how different circulation layouts actually function in real-world conditions. This lack of empirical evidence limits architects, developers, and facility managers in optimizing circulation for efficiency, accessibility, and commercial performance.

This study therefore seeks to evaluate the functionality and performance of different circulation layouts in Ikeja shopping malls, examining how layout design impacts movement efficiency, spatial organization, retail visibility, and user experience. This study is significant for several reasons. First, it contributes to architectural knowledge by providing evidence-based insights into how circulation layouts operate within real mall environments. Second, it supports built-environment professional's architects, planners, retail designers, facility managers, and developers by identifying design factors that enhance or hinder movement efficiency, user satisfaction, and commercial outcomes. This study focuses on Ikeja City Mall located in urban settings.

LITERATURE REVIEW

Concept of circulation in architectural design

The notion of “circulation” in architecture extends beyond simple pathways: it refers to the structured sequencing of spaces, the logic of spatial connectivity, and the perceptual experience of movement that shapes how people inhabit built environments (Adibi, 2023). In this view, circulation is a design discipline that integrates horizontal and vertical movement, spatial legibility, orientation, access, and user experience. As Adibi (2023) argues in a comparative study of supermarkets in shopping centres, circulation links entrances, retail zones, parking, and facilities in a network – and the quality of that network determines how usable and accessible a building is.

In retail and commercial architecture, effective circulation supports not only movement, but also social interactions, retail visibility, and commercial functionality (Adibi, 2023). On the contrary, poor circulation design can lead to disorientation, inefficient movement, congestion, and under-utilized spaces (Omar, 2014). The study of circulation thus must consider not just geometry (corridors, corridors-to-shops, nodes, vertical cores) but spatial psychology: how users perceive distances, how they make navigational decisions, and how spatial configuration shapes behavior (Adibi, 2023). This conceptualization makes circulation foundational not peripheral for any architectural design, especially for complex public/commercial buildings such as shopping malls. Architecturally speaking, in the design of buildings, a circulation space is usually situated between larger spaces in a building, through which the movement of people to and from another space in the building can be achieved (Kocabaş, 2013). They are spaces which are internal to the structure of buildings, yet external to the principal rooms. Circulation spaces in buildings are comprised of two categories. The first are spaces that facilitate horizontal circulation (linear movement) within the building and such spaces are referred to as horizontal circulation spaces

Circulation layouts in shopping malls

Circulation refers to the movement of people through, around, and within a building or built environment, functioning across three dimensions. In shopping malls high-traffic, multifunctional public facilities the flow of people and goods is constant, making circulation a critical determinant of how effectively the space operates. An efficient circulation system is therefore essential to reduce shopper anxiety, enhance wayfinding, and support enjoyable interaction with retail and leisure facilities. For circulation to function optimally, spaces must be consciously planned, properly dimensioned, and strategically connected.

In shopping malls, movement is facilitated through a combination of circulation elements and vertical-transportation systems such as escalators, elevators, ramps, and staircases. These components must be thoughtfully designed, well-positioned, and clearly integrated to support seamless user movement both horizontally and vertically. The primary spaces dedicated to this purpose entrances, corridors, lobbies, and foyers constitute what are generally known as circulation spaces.

Circulation in malls can be categorized based on the type of movement involved. Horizontal circulation includes corridors, hallways, and lobbies, while vertical circulation encompasses elevators, escalators, stairs, and ramps. Circulation may also be classified by user group,

distinguishing between public circulation spaces, which are accessible to all mall users, and private circulation spaces, reserved for staff or operational purposes.

More broadly, circulation in buildings can be understood through four key factors:

- Type of use (public or private),
- Direction of movement (horizontal or vertical),
- Time of use (morning, mid-day, evening, or continuous), and
- Frequency of use (regular/common or emergency).

Among these, the direction of movement and the type of use are particularly fundamental in large facilities like shopping malls. Together, they play a decisive role in determining the functional success of the building, influencing ease of navigation, spatial clarity, safety, and overall user experience.

Horizontal circulation; This has to do with the movement of people in and around a particular floor level in the shopping mall. The methods involved in this type of circulation are pedestrian walkways, entrances, lobbies and corridors.

Vertical circulation; This has to do with the movement of people between different floor levels in the shopping mall. The methods involved in this type of circulation includes all vertical circulation systems such as elevators, lifts, stairs and ramps

There are different circulation paths suitable for the design of an efficient circulation plan for shopping mall designs. They are the Linear Circulation Path, Radial Circulation Path, Spiral Circulation Path, Grid Circulation Path, Network Circulation Path and Composite Circulation Path.

i. Linear Circulation

Linear circulation organizes the mall along a predominant spine or corridor, with retail units aligned along that axis. This configuration offers straightforward orientation: visitors enter and progress along the main corridor, passing shop after shop in a linear succession (Oktaviana & Anggraeni, 2020).

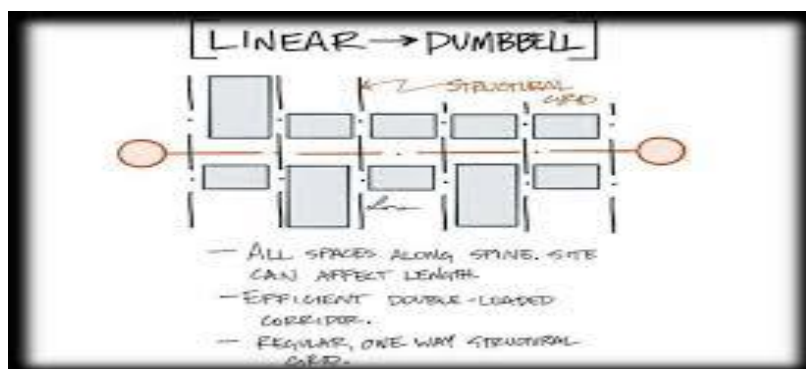


Figure 1: Linear circulation
Source: Google.com

Advantages include clarity of movement path, clear directionality, and ease of wayfinding especially suitable for elongated sites or narrow buildings. However, linear layouts may encourage direct, goal-oriented movement (enter → walk → exit), limiting exploratory browsing or circulation into peripheral zones. This may lead to uneven footfall, neglect of secondary paths, and underutilized ancillary zones.

ii. Loop / Ring Circulation

Loop or ring circulation arranges pathways in a closed circuit often encircling a central atrium or anchor space allowing continuous flow and returning users to a starting point without retracing steps. This layout supports continuous exposure to retail units around the circuit, encourages browsing, and minimizes backtracking (Ihunwo & Enwin, 2021).

Loop circulation can also improve distribution of foot traffic across the mall, reduce congestion on main corridors, and enable secondary circulation branches to serve peripheral or service zones. The closed-loop logic tends to support better spatial coverage, encourage circulation into diverse zones, and enhance visibility for more stores.

iii. Radial Circulation

Radial circulation layouts radiate from a central node or hub (e.g. atrium, central court, vertical core). From that central node, corridors (“spokes”) extend outward to different zones of the mall (shops, amenities, vertical cores). This layout emphasizes a strong central landmark, providing multiple route choices from centre to periphery, offering intuitive orientation and spatial hierarchy.

Radial circulation can enhance cross-zone connectivity and support dynamic movement, especially in large or multi-level malls where central atria function as organizational anchors. It enables balanced access to multiple zones from a central core, often improving wayfinding ease and reducing redundancy of travel routes.

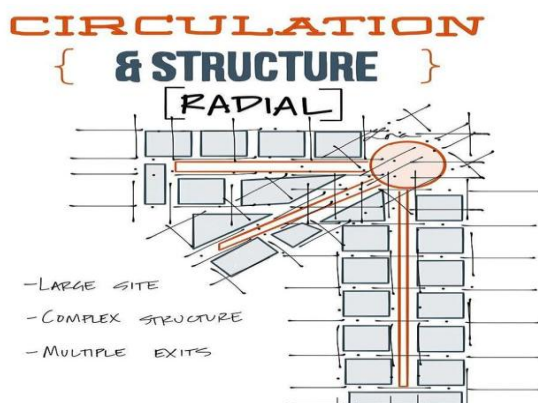


Figure 2: Circulation
Source: Google.com

iv. Grid / Network Circulation (Mesh Layout)

Grid or network-type circulation involves intersecting corridors, forming a mesh of pathways that connect various parts of the mall in multiple ways (Andi et al., 2021; comparative layout studies). This layout affords high flexibility: users can choose different routes, avoid congestion, and navigate to destinations via different paths. It is particularly useful in large, complex malls with multiple anchor points, mixed-use zones (retail, services, recreation), and distribution of shops across the footprint. However, the multiplicity of paths may challenge wayfinding, especially for first-time visitors, unless augmented with effective signage, orientation cues, and spatial hierarchy.

v. Network Circulation Path: Features a non-uniform arrangement where multiple nodes are linked by paths extending in any direction, offering flexibility and organic flow.

vi. Composite Circulation Path: In some cases, malls adopt composite circulation systems, combining two or more of these typologies for instance a main loop with radial spokes, or a grid backbone with linear spines. This mixing seeks to capture the strengths of each layout type while mitigating limitations (Jeremiah, N. A., etal2022).

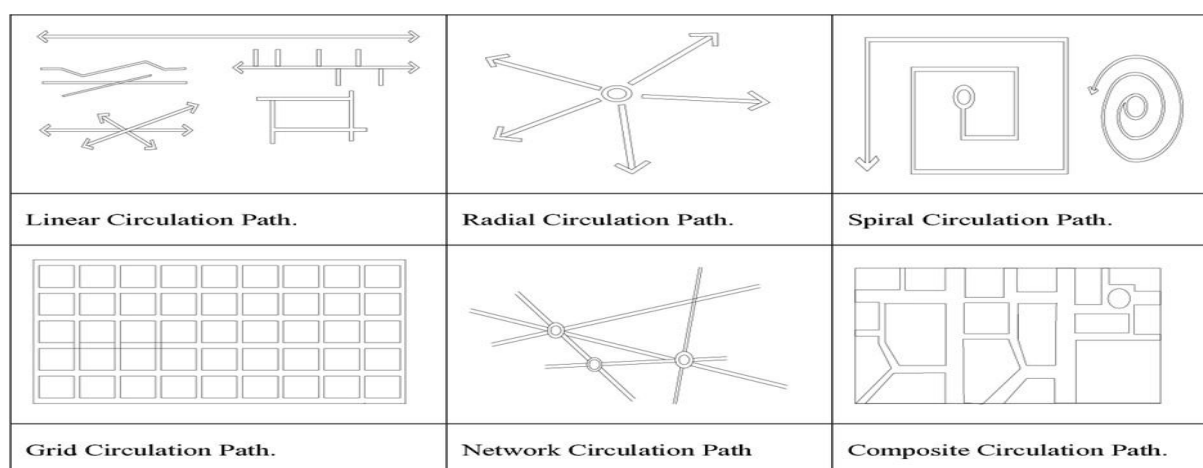


Figure 3: Introverted Design Concept

Source: Ching (2004)

Key design elements influencing circulation performance

Beyond the broad layout typologies, the actual performance of circulation depends heavily on specific design elements. Several studies highlight critical elements:

A. Nodes and Intersections

Nodes junctions where corridors meet, atria, entrance/exit points, intersections, junctions to vertical cores serve as decision points in circulation. Their placement, size, spatial clarity, and orientation determine how easily users choose directions, how flow distributes, and where congestion may arise (Adibi, 2023). In shopping malls, well-designed nodes often coincide

with anchor stores, open spaces (atria), amenity hubs (food courts, rest zones), or vertical access points (escalators/elevators). Strategic positioning of these nodes influences customer circulation patterns, dwell times, and retail visibility. Poorly planned nodes can create bottlenecks, disrupt circulation, cause confusion, or isolate some retail zones undermining user comfort and commercial viability.

B. Vertical Circulation (Stairs, Escalators, Elevators)

In multi-level malls, vertical circulation is as important as horizontal circulation. Placement, number, visibility, and integration of stairs, escalators, and elevators influence vertical movement, floor-to-floor connectivity, and overall circulation logic (Riaz et al., 2024). Vertical circulation cores integrated with good horizontal connectivity can improve accessibility, distribute foot traffic across levels, encourage exploration of upper or lower floors, and avoid overloading of core zones. Conversely, poorly positioned or inadequate vertical circulation can lead to underuse of certain floors, crowding near vertical cores, reduced retail exposure on upper/lower floors, and poor spatial distribution.

C. Visibility and Sightlines

Visibility- what users can see along paths, from nodes, from vertical cores affects orientation, wayfinding, and retail exposure. Sightlines help users understand spatial layout and navigate intuitively. Good visibility supports perceptual clarity, encourages browsing, and reduces navigational uncertainty (Adibi, 2023; Ihunwo & Enwin, 2021).

D. Signage and Wayfinding

Even with well-designed circulation geometry, without clear signage, orientation cues, or wayfinding systems, users (especially first-time visitors) may face disorientation, poor navigation, and discomfort (Ihunwo & Enwin, 2021). Wayfinding must be aligned with circulation layout logic nodes and intersections should be supported with signage; vertical cores should be visible; escape routes, amenities, and anchor stores clearly indicated. Effective wayfinding enhances circulation performance, reduces confusion, and improves user satisfaction.

METHODOLOGY

Research Design (Case Study Approach)

This study adopts a qualitative case study approach, widely recognized in architectural and spatial research for its capacity to explore complex phenomena within real-world contexts (Yin, 2018). The approach is particularly suitable because circulation performance in shopping malls is influenced by multiple interacting factors including layout typology, node placement, visibility, and vertical circulation that are best analyzed in situ rather than in hypothetical or laboratory settings. Data collection was conducted in March 2025 through direct observation, spatial analysis, photographic documentation, and evaluation of circulation patterns and retail visibility, enabling a comprehensive understanding of user movement and spatial organization. The case study method also allows for critical comparison with literature on circulation design, facilitating identification of strengths, weaknesses, and best practices for optimizing mall circulation (Adibi, 2023; Oktaviana & Anggraeni, 2020).

Case Study Selection

The study purposively selects two shopping malls for detailed investigation:

- i. One international and local case study.

Selection Criteria for Case Study Malls

Ikeja city malls were purposively selected based on the following criteria:

1. **Functional diversity** – Malls must host a variety of retail formats (anchor stores, small shops, food courts, recreational facilities).
2. **Layout complexity** – Inclusion of different circulation typologies (linear, loop, radial, or grid).
3. **Accessibility** – Open to public observation and willing to allow research data collection.
4. **Urban context** – Located in Lagos State, representing high-density urban commercial environments typical of Nigerian cities.
5. **Recent construction or renovation** – To ensure relevance to contemporary design practices.

Case Study: Ikeja City Mall

Ikeja City Mall (ICM) is located along Obafemi Awolowo Way, Alausa, Ikeja, Lagos State, positioned within the main commercial and administrative district of Lagos. Its location offers high accessibility from multiple arterial roads, including Mobolaji Bank Anthony Way and the Lagos-Abeokuta Expressway, making it one of the most accessible regional shopping destinations in Lagos. Constructed and opened in December 2011, the mall was developed by Actis in partnership with Paragon Holdings, representing one of Nigeria's earliest modern enclosed shopping mall typologies.

The mall occupies a gross leasable area (GLA) of approximately 22,000 m² and is designed on two major levels- a ground floor and an upper retail floor, with additional service and utility spaces tucked behind the retail blocks. ICM accommodates a strong mix of tenants, including prominent anchor tenants such as Shoprite (as the main grocery anchor), Silverbird Cinemas, and several international brands like KFC, Adidas, Mango, and Puma. The retail mix blends fashion, food and beverage, electronics, entertainment, financial services, and lifestyle brands, creating multiple visitor magnets across the mall.

The mall's spatial character is defined by a central open corridor, a medium-sized entrance plaza, and an entertainment zone containing the food court and cinema complex. Its double-height areas, glazed façade, and open internal atrium enhance visibility and natural lighting, contributing to improved user comfort and visual orientation. The placement of the food court and cinemas on the upper floor also strongly influences circulation patterns, drawing weekend and evening footfall to the upper level.



Figure 4: Escalator In ICM

Source: Fieldwork

a. Circulation Layout Description

Ikeja City Mall employs a linear-loop hybrid circulation layout, where a long central spine runs longitudinally through the building while secondary connectors create a subtle loop around the anchor tenants. The main corridor begins at the prominent front entrance, extending through the retail strip and branching into secondary passageways leading to peripheral stores, restrooms, service spaces, and the upper-level entertainment zone. At the ground floor, circulation is primarily linear, with the main movement channel linking the entrance plaza directly to Shoprite and other large tenants. Secondary corridors diverge from this spine, forming gently curved routes that help redistribute foot traffic. On the upper level, the presence of the cinema and food court encourages a loop-like flow, as visitors move between escalators, viewing areas, and food outlets before returning toward the main spine. Vertical circulation consists of multiple escalators strategically positioned near the front entrance and central atrium, one elevator block accessible to all users, and several staircases placed at corridor junctions. While the placement of escalators toward the front and central zones ensures continuous upward flow, the limited number of vertical circulation points toward the rear of the mall restricts ease of movement in those areas. Visibility and way finding are enhanced through straight sightlines along the main corridor, branded store façades, and overhead signage. However, some secondary corridors and corner stores receive lower visibility due to inward-facing layouts and limited signage depth.

b. Functional Evaluation

Observed movement patterns show that Ikeja City Mall supports relatively smooth flow during off-peak hours, especially along the main retail spine. Shoppers tend to enter through the main plaza, proceed along the central corridor, and naturally gravitate toward Shoprite or the upper-level entertainment zone. The clear organization of retail on either side of the main

spine enhances shop visibility and encourages browsing. However, during peak periods particularly weekends, holidays, and evenings congestion frequently occurs near the mall entrance, the escalator zone, and around key tenants such as Shoprite and the cinema. The narrowness of some portions of the main corridor contributes to this congestion, especially when footfall increases simultaneously from both floors. Accessibility to anchor tenants is generally strong, as their placement anchors both ends of circulation. However, peripheral retail zones especially those adjacent to the service corridors and corners experience visibly lower traffic. These underutilized pockets indicate circulation dead-ends and insufficient directional guidance.

Retail visibility is highest along the main spine, where long sightlines and glazed storefronts create an inviting shopping experience. In contrast, stores located along inward-facing or recessed corridors do not benefit from the same exposure, reducing their commercial performance potential.

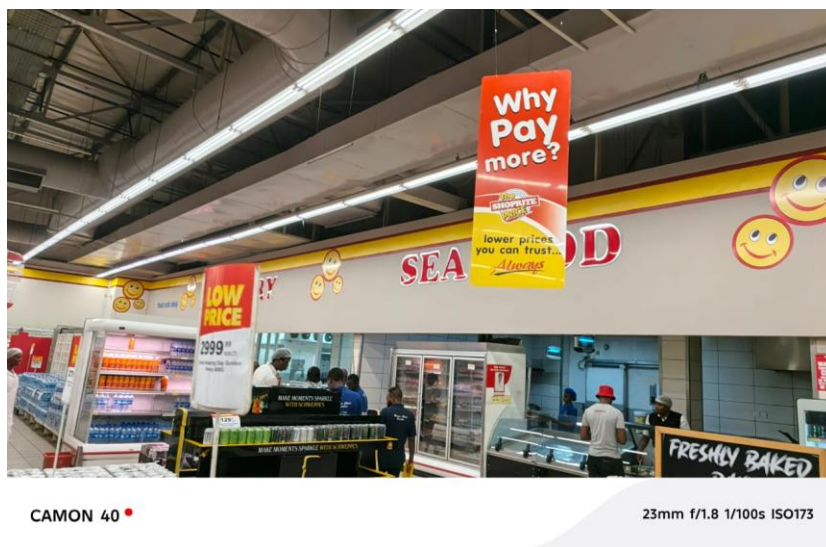


Figure 5: Showing the Anchor stores

Source: Authors' Fieldwork (2026).

c. Performance Assessment

Footfall distribution assessments reveal a clear pattern:

- Highest traffic zones: Entrance lobby, main corridor, escalator landing, Shoprite frontage, cinema and food court zone.
- Moderate traffic zones: Mid-corridors, fashion retail clusters.
- Low traffic zones: Peripheral niches and corner units tucked away from the main view.

The existing layout supports good orientation and user comfort, especially due to its natural ventilation pockets, open internal sightlines, and spacious front entrance. Users report ease of navigation, although peak-hour congestion occasionally reduces comfort around high-traffic

nodes. Commercially, the circulation layout favors prominent brands positioned along the spine, while stores in poorly exposed corridors face reduced visibility and footfall. The distribution of circulation does not fully support uniform commercial performance, leading to disparities in retail success within the mall. Overall, Ikeja City Mall demonstrates moderately high circulation efficiency, benefiting from its clear linear structure, but constrained by congestion at major nodes and uneven flow distribution toward the rear and side corridors.

d. Strengths and Weaknesses

Strengths

- i. Strong circulation spine that supports intuitive navigation.
- ii. Effective placement of anchor tenants, driving continuous movement along the main corridor.
- iii. Good visibility and long sightlines along primary paths.
- iv. Strategically located escalators ensuring upward traffic flow and ease of access to the entertainment zone.
- v. High-quality spatial experience, enhanced by good lighting, façade treatment, and interior openness.

Weaknesses

- i. Congestion hotspots, especially near escalators, Shoprite, and the front entrance.
- ii. Limited vertical circulation options toward the rear reduces user movement in that zone.
- iii. Underperforming secondary corridors due to poor visibility and reduced footfall.
- iv. Uneven commercial exposure, with corner and recessed stores receiving minimal traffic.
- v. Circulation pressure during peak periods, affecting comfort and safety.

DISCUSSION

This study investigated the functionality and performance of circulation layouts in shopping malls, with a focus on Ikeja City Mall in Lagos, Nigeria. The research highlighted several critical aspects that influence how shoppers navigate and experience these retail spaces. The type of circulation layout was found to have a significant impact on user experience. Linear layouts, as seen in Ikeja City Mall, allow for straightforward and predictable navigation but tend to limit exploratory movement, reducing opportunities for shoppers to discover peripheral stores. Vertical circulation also emerged as a critical factor in mall performance. Strategically positioned escalators, elevators, and staircases improve movement efficiency and accessibility between floors. Centralized vertical access points, in particular, help reduce congestion and allow for smoother circulation, ensuring that visitors can reach different zones comfortably. Spatial legibility further shapes the user experience. Features such as atriums, clear sightlines, and thematic zoning create visual anchors that help visitors orient themselves within the mall. Open layouts and intuitive wayfinding systems contribute to a positive shopping experience by minimizing confusion and guiding visitors naturally through the space.

CONCLUSIONS

This study has examined the functionality and performance of circulation layouts in Ikeja City Mall in Lagos, Nigeria. The findings confirm that circulation design is not merely a technical requirement for movement but a central architectural strategy that significantly shapes user experience, spatial legibility, and commercial performance. As contemporary malls increasingly function as hybrid spaces combining retail, leisure, and social interaction, the effectiveness of circulation systems becomes even more critical to their overall success. Circulation layout typology strongly influences shopper behavior and movement patterns. Linear-dominant layouts, as observed in Ikeja City Mall, promote clear and predictable navigation but tend to encourage direct, goal-oriented movement, which limits exploration and reduces footfall in peripheral retail zones. Similar findings have been reported by Oktaviana and Anggraeni (2020) and Adibi (2023), who note that while linear systems enhance wayfinding clarity, they often produce uneven spatial utilization and commercial exposure. Vertical circulation emerged as a critical determinant of spatial performance, particularly in multi-level malls. The strategic placement and visibility of escalators, elevators, and staircases significantly influence vertical movement patterns, floor-to-floor connectivity, and overall circulation efficiency. Centralized and visually prominent vertical circulation elements were found to enhance user orientation and encourage exploration of upper levels, consistent with the findings of Riaz et al. (2024) and Moussa and El-Sayed (2021). In contrast, limited or poorly distributed vertical circulation points contribute to congestion, underutilization of upper floors, and uneven commercial performance.

Spatial legibility, visibility, and wayfinding systems were shown to play decisive roles in shaping user comfort and navigational efficiency. Clear sightlines, well-defined nodes, intuitive spatial sequencing, and effective signage reduce cognitive load, improve orientation, and enhance the overall shopping experience. In Ikeja City Mall, while the main circulation spine supports strong visual clarity, secondary corridors and recessed retail zones suffer from reduced visibility, resulting in diminished footfall and weaker commercial outcomes. Overall, the study confirms that circulation performance directly mediates the relationship between architectural form and commercial success in shopping mall design. Poorly structured circulation systems generate congestion, spatial inefficiencies, and uneven retail exposure, whereas well-integrated circulation networks enhance movement efficiency, spatial coherence, and economic viability.

RECOMMENDATIONS

Future shopping mall designs should adopt hybrid circulation layouts that integrate linear, loop, and radial systems in order to balance clarity of movement with exploratory browsing and equitable foot traffic distribution. Such composite configurations have been shown to enhance spatial coverage, reduce circulation dead-ends, and improve retail visibility, particularly in large, multifunctional retail environments (Ihunwo & Enwin, 2021; Jeremiah et al., 2022).

Vertical circulation elements should be strategically positioned as central spatial anchors within the mall layout. Clearly visible and evenly distributed escalators, elevators, and staircases improve vertical connectivity, reduce congestion, and encourage balanced movement across floor levels, thereby enhancing overall circulation efficiency and spatial performance. Design strategies that enhance spatial legibility, including long sightlines, open

atria, coherent zoning, and effective wayfinding systems, should be prioritized to improve user orientation and navigational comfort. Improved visibility and intuitive spatial sequencing have been shown to reduce disorientation, enhance browsing behavior, and increase retail exposure. Existing shopping malls should implement targeted circulation retrofitting strategies such as reconfiguring corridor widths, improving signage systems, and activating underutilized zones to enhance movement efficiency and commercial performance, particularly in high-density urban contexts.

REFERENCES

- Adibi, M. R. (2023). The relationship between circulation and space in architecture: An investigation on the integration of supermarkets in shopping centers. *AIS – Architecture Image Studies*, 4(1), 32–51. <https://doi.org/10.48619/ais.v4i1.683>
- Andi, A., Abednego, I. A., & Gultom, B. J. B. (2021). A space syntax guide to optimize shopping mall: A systematic review. *International Journal of Environment, Architecture, and Societies*, 1(01), 19–30. <https://doi.org/10.26418/ijeas.2021.1.01.19-30>
- Botsali, A. R. (2007). *Shopping mall design: Circulation, spatial organization, and user movement patterns*. Middle East Technical University.
- Cavka, H. B. (2023). An investigation of shopping mall design requirements. *Engineering Proceedings*, 53(1), 42.
- Fhadilla, P. M. M., & Firmandhani, S. W. (2022). Study of public open space circulation patterns in mall building. *Journal of Architectural Design and Urbanism*, 5(1), 46–53. <https://doi.org/10.14710/jadu.v5i1.14455>
- Jeremiah, N. A., & Uchenna, P. (2022). Enhancing circulation and movement to optimize efficiency in shopping malls in Abakaliki. *Global Scientific Journal*, 10(5). ISSN 2320-9186.
- Kocabaş, Ş. (2013). *Evaluation of circulation paths in public buildings in terms of accessibility: Re-functioned public historic buildings in the Nicosia Walled City* (Master's thesis). Eastern Mediterranean University, North Cyprus.
- Oktaviana, J., & Anggraeni, D. W. (2020). The influence of circulation patterns on visitor distribution in a shopping mall: Case study Palembang Icon Shopping Center, Palembang City. *Journal of Artificial Intelligence in Architecture*, 1(1). <https://doi.org/10.24002/jarina.v1i1.5142>
- Omar, F. 'A. (2014). *Study on layout configuration design effect on the circulation in enclosed shopping mall* (Bachelor's thesis). Universiti Teknologi MARA.
- Onugha, O., Ibem, E. O., & Aderonmu, P. A. (2016). Assessment of the impact of circulation design on guests' satisfaction with hotel facilities in Port Harcourt, Nigeria. *International Journal of Applied Engineering Research*, 11(8), 5797–5805.
- Osman, K. M., & Suliman, M. (1993). The space syntax methodology: Fits and misfits. *Architecture & Comportment / Architecture & Behavior*, 10(2), 189–204.
- Riaz, H., Amina, N., Khan, M. A., Iqbal, A., Irfan, A., Ishitaq, H., ... Shahbaz, I. (2024). Role of spatial efficiency, layout planning, and sustainability in the success of shopping malls. *Advances in Civil and Architectural Engineering*, 15(28), 58–75.