

Comparative Analysis of Student Recreation Centers in Northern Nigerian Universities for Adaptable Design Solutions

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DOI: [10.56201/ijemt.v10.no2.2024.pg1.17](https://doi.org/10.56201/ijemt.v10.no2.2024.pg1.17)

ABSTRACT

This study examines the relationship between spatial flexibility and student recreational facilities in Northern Nigeria, with a specific focus on architectural spatial flexibility. The research adopts a qualitative approach to analyze the architectural characteristics of existing student recreational facilities and evaluate their alignment with the spatial flexibility needs of students. The methodology incorporates a systematic literature review, case study research, and data collection from various sources. The case studies conducted at Ahmadu Bello University, University of Jos, and Tafawa Balewa University assess internal space distribution, building servicing, and building façade and structure. The findings indicate that current student recreational centers lack flexibility in their internal spaces due to inflexible construction methods and limited adaptability in spatial layout. Furthermore, building services are often concealed within structural elements, impeding future modifications, and the design of building façade structures affects adaptability. The recommendations propose the incorporation of adaptable features to meet changing spatial needs and prioritize students' social, recreational, and leisure requirements in the design process. This study aims to contribute to the establishment of international standards for adaptable buildings and validate the applicability of research variables in other contexts. Overall, addressing spatial flexibility in student recreational facilities is essential for promoting physical, mental, and social well-being among college students, thereby emphasizing the significance of adaptable architectural design in educational environments.

KEYWORDS: *Adaptable, Spatial flexibility, Student, Recreational facilities, and Design*

1.0 INTRODUCTION

According to Adebayo and Olayinka (2018), the academic performance of children who do not engage in leisure and recreation activities may be affected. The United Nations recognizes the rights of individuals to participate in activities such as relaxation, cultural engagement, leisure, play, recreation, and self-improvement (Babalola & Alayode, 2012). For instance, university students often experience stress due to lectures, homework, projects, and fieldwork. As mentioned by Babalola and Alayode (2012), extracurricular activities have a calming effect on the body, mind, and spirit. Additionally, facilities serve as social spaces, promoting social interaction among

students, instructors, and community members, as argued by Fournier et al. (2010). Engaging in recreational activities enhances physical, mental, and social well-being. Therefore, institutions provide facilities for students and faculty members to engage in physical activity or relax in order to alleviate academic stress.

Adebayo and Olayinka (2018) emphasize the importance of students having access to campus resources for physical exercise and recreational activities in order to return to school with enthusiasm. The availability, academic involvement, motivation, budgetary limitations, and health concerns are all factors that influence students' recreational activities during the academic term and are influenced by the amenities provided by universities (Andrade & Bragança, 2019). According to Abdullah & Mohamad (2015), leisure facility services promote physical fitness, outdoor enjoyment, and sports participation. However, Nigerian institutions face the challenge of enrolling a larger number of students, resulting in a higher demand for recreational and sporting facilities (Adebayo & Olayinka, 2018). Inadequate infrastructure necessitates expansion and innovative ideas (Adebayo & Olayinka, 2018).

Similarly, active participation from the central authority is necessary at Bauchi State University Gadau, which is currently the fastest-growing institution in the state. These institutions transform into educational establishments where students and specialists delve into various topics. The presence of a recreational center is crucial, as Bauchi State University Gadau lacks a dedicated student center. Acharya (2013) argues that modern architecture needs to adapt to the constant changes, transfers, exchanges, relocations, and adaptability of society. Prompt construction responses are needed to accommodate temporal alterations (Adebayo & Olayinka, 2018). Flexibility is an essential attribute for quick adjustment and adaptation. The gradual enhancement of flexibility imbues a space with distinctiveness and adaptability while preserving its original purpose (Ayuba & Agah, 2018).

Recreational spaces are used for refreshing the mind and body after work, through activities that entertain, stimulate, or provide mental relief. Recreational and sports centers on campuses have the potential to enhance and promote the balance needed in students' academic lives (Grande, 2023). However, Nigerian institutions lack adequate facilities to satisfy the social and intellectual needs of students. This is particularly evident on the main campuses of Bauchi State University Gadau, where the current situation consists of an old classroom block that houses the student union secretariat. To meet commercial and recreational requirements, temporary kiosks have been allowed to clutter the campus, resulting in a polluted and unhealthy environment. The lack of essential facilities forces students to travel to Gadau and the distant Azare township to use public facilities, thereby endangering their lives on the highways. Therefore, an architectural intervention is required to meet spatial needs and achieve multifunctional utility. The design of the student recreational center at Bauchi State University Gadau should prioritize spatial flexibility and anticipate future needs. On the basis of that, this study intends to carry out a comparative analysis of three selected student recreational centres in Nigerian tertiary institutions.

2.0 METHODOLOGY

This research study investigates the correlation between spatial flexibility and student recreational facilities in Northern Nigeria. The study primarily employs a qualitative approach,

centered around a comprehensive literature review, to examine the architectural aspects of spatial flexibility. The objective is to assess the degree to which current student recreational facilities meet students' spatial flexibility needs. To achieve this, the research undertakes a systematic literature evaluation and gathers data from multiple sources. The research strategy involves identifying principles of spatial flexibility and conducting case study research on indoor recreational spaces, specifically examining their adherence to students' spatial flexibility requirements (Kooi, 2022). The data collection process includes identifying the target population, determining sample size and sampling methods, as well as selecting appropriate instruments and techniques. The sample selection criteria entail selecting a Student Recreational Centre sample that complies with two state standards. Data collection tools comprise both primary and secondary data, including interviews, observations, notes, and photographs (Jackson, 2023). An observational checklist is employed to collect data, ensuring that variables meeting the research criteria are considered in the evaluation of the selected case studies (Koko & Okpara, 2022). The case study analysis adopts an illustrative qualitative method, which provides descriptive and detailed information. The collected data is documented in tables for easy assessment. Diagrams, sketches, and pictures are used when necessary to visually represent the data, while photographs are taken and documented to depict the conditions of the cases. The study primarily focuses on the current state and identified architectural variables, with the use of pictures to illustrate the conditions of the cases.

3.0 RESULTS AND DISCUSSION

This chapter presents findings from case studies conducted at Ahmadu Bello University, Zaria, Naraguta, and Abubakar Tafawa Balewa University. The study aims to assess the state of existing students' recreational centers in accordance with students' requirements for spatial flexibility.

3.1 CASE STUDY 1: Aliyu Mustapha Student Centre, ABU, Zaria

The Aliyu Mustapha Student Centre, located in Zaria, was redesigned and converted from an old students' dining hall to a student social/recreational center. The center serves as a recreational space for students and includes various amenities such as business centers, outdoor game areas, football viewing centers, restaurants, cafes, shops, photography studios, outdoor seating areas, grilling areas, and fashion studios. The findings from the case study will be discussed based on the established variables of the study, which include the flexibility of internal space distribution, building servicing, and flexibility of building façade and structure. The building has a square-shaped form, with spaces arranged around a central courtyard and an access road, as shown in the figure below.

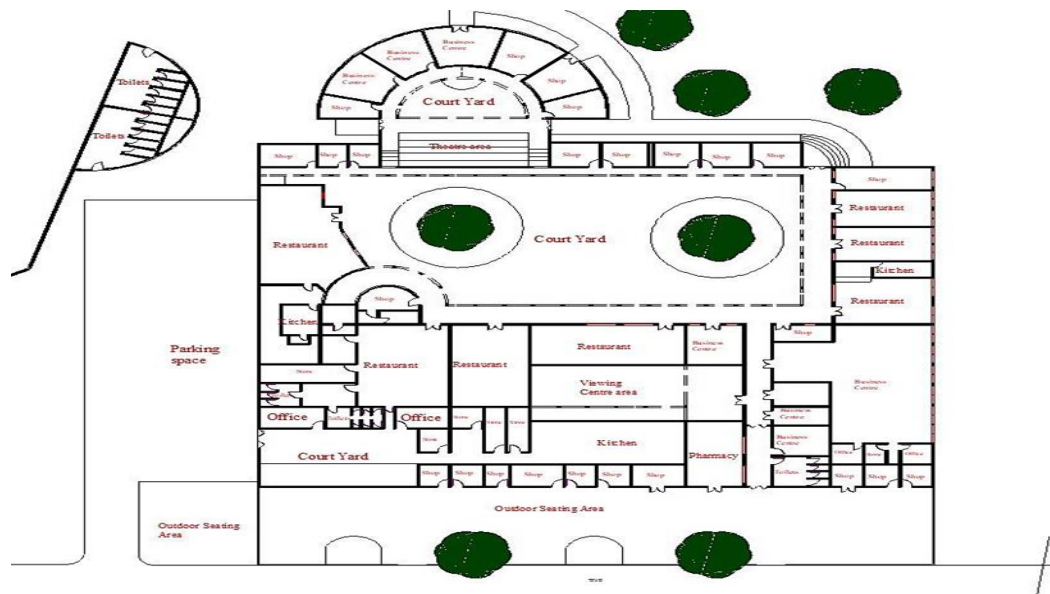


Figure 1: Aliyu Mustapha student center floor plan

Source: Author, (2023)

3.1.1 Internal Space Analysis Finding

Furthermore, Aliyu Mustapha, a student center at Ahmadu Bello University Zaria, has a well-designed building complex with a circulation space and walkway leading to the central courtyard. The building also features a walk way surrounded by the courtyard, which connects to the Ribadu girls' hostel and Mamman Kontagora square. The ventilation and illumination are also well-managed, with windows running through the walls and natural day-lighting in surrounding spaces. The flexibility of internal spaces is measured by the column grid span for communal spaces, which is excellent according to the rating factor. The center façade pattern allows for more internal space configuration, but the internal walls and boundary type between spaces are poor, making it difficult to make changes to floor layouts. However, the unit sizes and accesses for most free span spaces in the center ensure easy access and egress for sub-division. Thus, The level of conformity of the variables already established by the research was analyzed in Table 1 below.

Table 1: Level of Flexibility of Internal Space of Aliyu Mustapha student centre, Ahmadu Bello University Zaria

NB: Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

3.1.2 Level of Flexibility of Building Servicing

Variable	Indicators				Comments
Column grid spans	Free span (3)	>8100mm (2)	5400mm<8100mm (1)	< 5400 (0)	Excellent
	✓				
Façade pattern	900-1350mm, bays <900mm (3)	1350-1800mm, bays between 900-1350 (2)	1350-1800mm (1)	1350 to >1800mm (0)	Good
	✓				
Internal wall system	Foldable walls (3)	Easily movable interior wall (2)	Movable walls, requires disassemble (1)	Immovable interior walls (0)	Poor
				✓	
Unit size and access.	<200m (3)	200-400m (2)	400-600m (1)	> 600m (0)	Good
		✓			

This research examines the flexibility of building servicing variables. The center's services are located between building layers, which are poor according to the rating factor. However, the center's service ducts are external to the building structure, providing easy accessibility for changes in usage and maintenance. The head room for the ceiling in communal spaces, allowing for

flexibility in routing services, is between 3500-4000mm and good according to the rating factor as shown below

Table 2: Level of Flexibility of building servicing of Aliyu Mustapha student centre, Ahmadu Bello University Zaria

Changes to building services	Below one building layer (3)	Above one building layer (2)	Between two building layers (1)	Embedded in the floor (0)	Fair
			✓		
Ease of access to service ducts	Located external to building with complete access (3)	Located in a ground floor plant room with easy external access (2)	Located in a plant room on the roof or within an accessible patio (1)	Embedded in a sub-basement of the building (0)	Excellent
	✓				
Higher ceilings for service route	>4000 mm (3)	3500-4000 mm (2)	3000-3500 mm (1)	< 3000mm (0)	Good
		✓			

NB: Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

3.1.3 Flexibility of Building Façade and Structure

The flexibility of building façade and structure is an important variable in adaptable structure as it allows for expansion and contraction depending on the need and space type. The structural wall of the façade is a load bearing wall which is poor according to the rating factor as it will not allow for changes to be made easily to both internal layout and external elements. The structural design of the center as seen in plate 4 below is a single-storey building which according to the level of conformity to adaptability and flexibility principle is poor, as vertical expansion of floor area of the center is not made possible.

Table 3: Level of Flexibility of building façade and structure of Aliyu Mustapha student centre, Ahmadu Bello University Zaria

Changes to the buildings' façade and structure	Non-bearing facade, no bearing obstacles (3)	Non-bearing facade, bearing obstacles (2)	Bearing facade, no bearing obstacles (1)	Bearing facade with bearing obstacles (0)	Good
		✓			
Structural design to support future expansion	4 or more storeys (3)	3 storeys (2)	2 storey (1)	1 storey (0)	Poor
				✓	

NB: Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

3.2 CASE STUDY 2: NARAGUTA STUDENT CENTRE, UNIVERSITY OF JOS

The University of Jos, is home to the Naraguta student centre, which offers a variety of spaces for students and staff. The centre, which is octagonal in shape, features a central court yard, a football viewing center, restaurants, canteens, cyber cafes, and shops. The building's flexibility in internal space distribution, building servicing, and façade and structure are key factors in its success. The Naraguta student centre is a hub for commercial activities, offering a variety of spaces for students to enjoy. The building complex has four main accesses, including front, back, right-side, and left-side accesses as shown below;

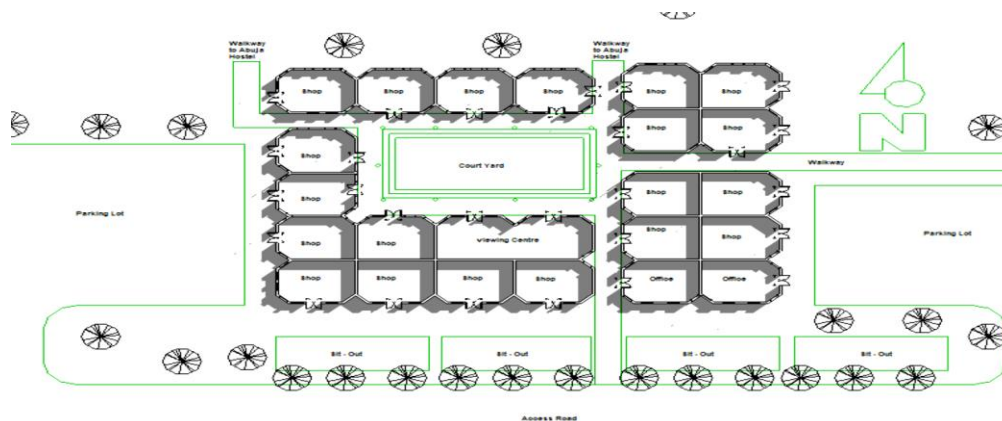


Figure 2: Naraguta Student Centre floor plan

Source: Author, (2023).

Furthermore, the building complex features a circulation space at the approach-side, providing access to shops and walkways, and a walk way surrounded by the central courtyard. The back-side walkway leads to Abuja hostel, while the right-side walkway connects to a parking lot. The left-side walk way also leads to the hostel. The building's shape allows for more wall spaces for openings, with more windows to wall ratios at the edges. The courtyard ensures natural day-lighting in surrounding spaces, enhancing ventilation and illumination.

3.2.1 Flexibility of Internal Space

The research analyzes the flexibility of internal spaces distribution and adaptability in the Naraguta Student Centre, University of Jos. The column grid span for spaces is less than 5400mm, indicating poor conformity. The center façade pattern allows for more internal space configuration between 900-1350mm distance, allowing for excellent conformity. However, internal walls and boundary type between spaces are poor, as built-up walls prevent easy floor layout changes. Unit sizes and accesses for most free span spaces in the center ensure access and egress for sub-division, with unit sizes and accesses less than 200msq, ensuring excellent conformity as shown in table below;

Table 4: Level of Flexibility of Internal Space of Naraguta Student Centre, University of Jos
Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

Variable	Indicators				Comments
Column grid spans	Free span (3)	>8100mm (2)	5400mm<8100mm (1)	< 5400 (0)	Poor
				✓	
Façade pattern	900-1350mm, bays <900mm (3)	1350-1800mm, bays between 900-1350 (2)	1350-1800mm (1)	1350 to >1800mm (0)	Excellent
	✓				
Internal wall system	Foldable walls (3)	Easily movable interior wall (2)	Movable walls, requires disassemble (1)	Immovable interior walls (0)	Poor
				✓	
Unit size and access.	<200m (3)	200-400m (2)	400-600m (1)	> 600m (0)	Excellent
	✓				

3.2.2 Flexibility of Building Servicing

This research examines the flexibility of building servicing variables. The center's services are embedded in the floor, which is poor according to the rating factor. However, the service ducts are external to the building structure, providing easy accessibility for changes in usage and maintenance. The head room for the ceiling in communal spaces, between 3500-4000mm, allows for flexibility in routing services and is good according to the rating factor as shown in table below;

Table 5: Level of Flexibility of building servicing of Naraguta Student Centre, University of Jos
Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

Changes to building services	Below one building layer (3)	Above one building layer (2)	Between two building layers (1)	Embedded in the floor (0)	Poor
				✓	
Ease of access to service ducts	Located external to building with complete access (3)	Located in a ground floor plant room with easy external access (2)	Located in a plant room on the roof or within an accessible patio (1)	Embedded in a sub-basement of the building (0)	Excellent
	✓				
Higher ceilings for service route	>4000 mm (3)	3500-4000 mm (2)	3000-3500 mm (1)	< 3000 mm (0)	Good
		✓			

3.2.3 Flexibility of a Building's Façade and Structure

The flexibility of a building's façade and structure is crucial for its adaptability, allowing for expansion and contraction based on space type and needs. A non-bearing façade with no obstacles is excellent for easy changes to internal layout and external elements. However, a single-storey building's structural design, as shown in plate 6 and 7, does not conform to the adaptability and flexibility principle, as it does not allow vertical expansion of the center's floor area.

Table 6: Level of Flexibility of building façade and structure of Naraguta Student Centre, University of Jos

Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

Changes to the buildings' façade and structure	Non-bearing facade, no bearing obstacles (3)	Non-bearing facade, bearing obstacles (2)	Bearing facade, no bearing obstacles (1)	Bearing facade with bearing obstacles (0)	Excellent
	✓				
Structural design to support future expansion	4 or more storeys (3)	3 storeys (2)	2 storey (1)	1 storey (0)	Poor
				✓	

3.3 CASE STUDY THREE: TAFAWA BALEWA UNIVERSITY STUDENT CENTER, (TBUSC) BAUCHI

Tafawa Balewa University Student Center (TBUSC) Bauchi is a comprehensive campus facility that offers a variety of facilities for students and staff. The center is divided into various spaces, including a commercial facility building, a students viewing center, a student union garden, and outdoor sporting areas. The center also features a football viewing center, restaurants, canteens, cyber cafes, shops, and an outdoor sit-out and garden. The case study focuses on the flexibility of internal space distribution, building servicing, and façade and structure. The building form consists of rectangular blocks, primarily housing shops and business centers. The squared-shaped students' viewing center is situated within the boys' hostel, and the building complex has circulation spaces around it due to its standalone structure and connected free walk-way spaces as shown below;

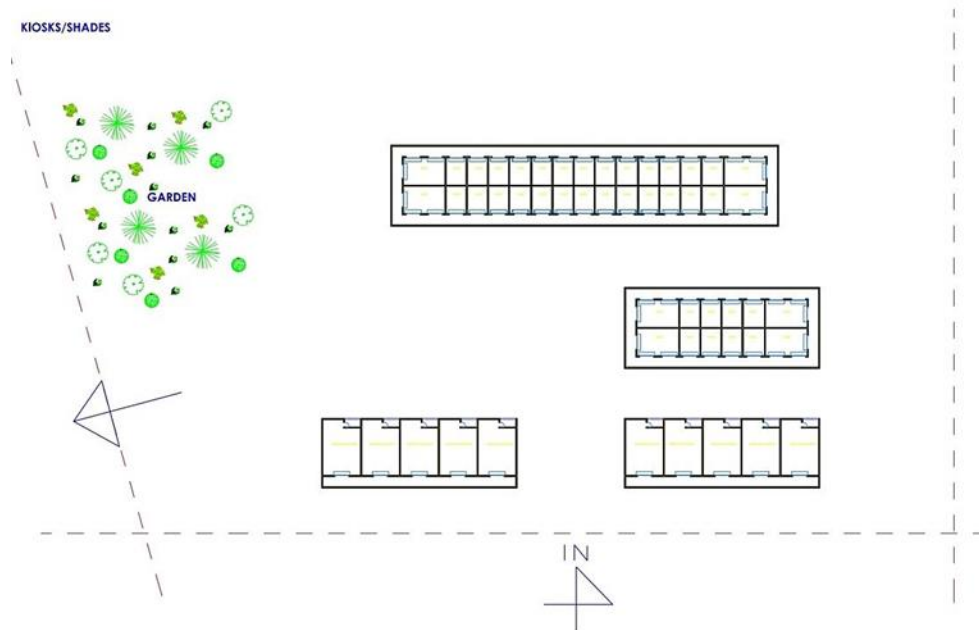


Figure 3: Tafawa Balewa University student center floor plan

Source : Author, (2023).

3.3.1 Flexibility of Internal Space

The research analyzes the flexibility of internal spaces distribution and adaptability in Tafawa Balewa University student center, Bauchi. The column grid span for spaces is less than 5400mm, indicating poor conformity. The center façade pattern allows for more internal space configuration between 900-1350mm distance, which is excellent. However, internal walls and boundary type between spaces are poor, as built-up walls prevent easy floor layout changes. Unit sizes and accesses for spaces in the center are less 200msq, ensuring access and egress for sub-division. Overall, the center façade pattern is excellent for allowing for more flexible internal space configuration.

Table 7: Level of Flexibility of Internal Space of Tafawa Balewa University student center, Bauchi
Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

Variable	Indicators				Comments
Column grid spans	Free span (3)	>8100mm (2)	5400mm<8100mm (1)	< 5400 (0)	Excellent
				✓	
Façade pattern	900-1350mm, bays <900mm (3)	1350-1800mm, bays between 900-1350 (2)	1350-1800mm (1)	1350 to >1800mm (0)	Good
	✓				
Internal wall system	Foldable walls (3)	Easily movable interior wall (2)	Movable walls, requires disassemble (1)	Immovable interior walls (0)	Poor
				✓	
Unit size and access.	<200m (3)	200-400m (2)	400-600m (1)	> 600m (0)	Excellent
	✓				

3.3.2 Flexibility of Building Servicing

This research examines the flexibility of building servicing variables. Table 4.2 reveals that the center's services are poorly rated, with embedded services on the floor. However, external service ducts provide easy accessibility for usage and maintenance changes. The head room for communal spaces, allowing for flexible routing services, is between 3000-3500mm and fair, according to the rating factor. Overall, the study aims to assess the flexibility of building servicing.

Table 8: Level of Flexibility of building servicing of Tafawa Balewa University student center, Bauchi

Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

Source: Author (2023)

Changes to building services	Below one building layer (3)	Above one building layer (2)	Between two building layers (1)	Embedded in the floor (0)	Fair
				✓	
Ease of access to service ducts	Located external to building with complete access (3)	Located in a ground floor plant room with easy external access (2)	Located in a plant room on the roof or within an accessible patio (1)	Embedded in a sub-basement of the building (0)	Excellent
	✓				
Higher ceilings for service route	>4000 mm (3)	3500-4000 mm (2)	3000-3500 mm (1)	< 3000mm (0)	Good
			✓		

3.3.3 Flexibility of Building Façade and Structure

The flexibility of building façade and structure is an important variable in adaptable structure as it allows for expansion and contraction depending on the need and space type. The structural wall of the façade is a non-load façade with bearing obstacles which is good according to the rating factor as it will allow for changes to be made easily to both internal layout and external elements. The structural design of the center as seen in plate 10 is a single-storey building which according to the level of conformity to adaptability and flexibility principle is poor, as vertical expansion of floor area of the center is not made possible.

Table 9: Level of Flexibility of building façade and structure of Tafawa Balewa University student center, Bauchi

Level of conformity Excellent=3, Good=2, Fair=1, Poor=0

Changes to the buildings' façade and structure	Non-bearing facade, no bearing obstacles (3)	Non-bearing facade, bearing obstacles (2)	Bearing facade, no bearing obstacles (1)	Bearing facade with bearing obstacles (0)	Good
		✓			
Structural design to support future expansion	4 or more storeys (3)	3 storeys (2)	2 storey (1)	1 storey (0)	Poor
				✓	

Source: Author (2023)

3.4 Comparative Analysis of Three Case Studies

Table 10: comparative evaluation of three case studies

Variables	Case Study	Score	Level of Conformity (%)	
Flexibility of internal space distribution	Case study 1	8 (8/24 x 100)	33.3%	
	Case study 2	6 (6/24 x 100)	25%	(20/72×100)
	Case study 3	6 (6/24 x 100)	25%	27.8%
	Total	20		
Flexibility of building servicing	Case study 1	6 (6/18x100)	33.33%	
	Case study 2	5 (5/18x100)	27.78%	(15/54×100)
	Case study 3	4 (4/18x100)	22.22%	27.8%
	Total	15		
Flexibility of building façade and structure	Case study 1	2 (2/12x100)	16.67%	
	Case study 2	3 (3/12x100)	25%	(7/36×100)
	Case study 3	2 (2/12x100)	16.67%	19.44%.
	Total	7		

4.0 CONCLUSION

This study aimed to assess the flexibility of student recreation centers in federal universities based on three main variables: internal space distribution, building servicing, and building façade and structure. The results revealed that the internal spaces were not flexible due to the rigid construction method, with the predominant use of permanent sandcrete walls. The spatial layout did not allow for expansion or conversion of spaces. The overall level of flexibility of internal space was found to be 27.8%, indicating that students' recreational centers in federal universities are not adaptable to evolving spatial needs.

For a building to be adaptable, the building services should support future changes to technical equipment and provide easy access in terms of location and configuration. This suggests that services concealed within the structural elements of the building are not flexible and effective for changes. The nature of the building's façade structure is an important factor in determining its adaptability. Non-load bearing façade structures allow for easy changes to both internal and external layouts. Incorporating redundant load-bearing capacity will support potential future changes in the building's façade and uses. Structural designs with vertical strength to support additional storeys will allow for future expansion of the floor area. The overall flexibility percentage for the building façade was 19.44%, indicating that the centers are not responsive to the constant changes that occur in contemporary societies. This is consistent with Acharya's (2013) finding that modern architecture must embrace and respond to the constant change, transfer, exchange, relocation, and adaptation that are characteristic of contemporary societies.

In conclusion, this study finds that local centers primarily focus on business domains for students' buying and selling activities. In contrast, local case studies focus on indoor recreational activities and business spaces, which do not align with the objectives of students' recreational spaces. The study proposes a design that prioritizes students' social, recreational, and leisure needs while incorporating business domains as a secondary focus. The research also examines buildings that have successfully integrated adaptable features to establish international standards for adaptable buildings. The study aims to validate the applicability of the research variables in other buildings.

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