Maximizing Day-Lighting in an Aquatic Centre (Natatorium) at Akwa Ibom State

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Abstract- ***This research identifies the importance of an Aquatic Centre as a strategy for providing an environment for water sport and recreation at Ibeno, Akwa Ibom. The center provides a venue for a variety of activities which include water sport competitions for schools and international sport events along with other leisure activities. It is important to design a facility that provide users with a positive experience when visiting its environment. It is a center for all age group and visitors from different parts of the world, thereby boosting the economic aspect of the state and local community. An Aquatic Centre is a facility that require large amounts of water and energy to operate as it involves various types and sizes of indoor and outdoor swimming pools and equipment that help in the smooth running of the facility. The aim of this research is to maximize day-lighting in the facility which helps lower the energy demands of the facility and also helps to illuminate spaces through the use of transparent materials that gives visual control, thereby bringing natural light and help to connect indoor and outdoor spaces which enhances users experience in the facility. The research methodology employed was qualitative analysis, entailing the gathering of information from both primary and secondary sources. As a result, the research successfully integrated day-lighting systems into the design of an Aquatic Center to enhance users experience in the facility which will help boost the social and economic status of the community and state.***

Indexed Terms: Aquatic Centre, Day-lighting, Facility, Water Sports.

I. INTRODUCTION

Swimming is a recreational activity that is a very important contributor in the provision of health and well-being benefits to Nigerians and the local community. Recreational activities provide people with an escape from the pressures and tensions of daily life, leading to improved levels of physical and mental health, thereby building up strong social networks and relationships. According to (Chikagbum et al., 2015) Recreation is a form of play or amusement, refreshment of the body and mind.

An Aquatic Centre is a community or public venue that provides at least an indoor pool along with three different types of other amenities (gymnasium, cafe, sauna/spa etc.) for recreation and competitive purposes. It is a significant civic asset to the community. According to (Duverge, 2019) Aquatic Centre's can include indoor and outdoor recreational pools, lap swimming pools, diving pools, hydrotherapy pools, family and toddler pools, gymnasiums, sauna and spas, childcare facilities and cafes. All these aforementioned activities help to complement the facility thereby boosting the economic aspect of the local community and benefiting both students, locals and visitors.

A well-designed Aquatic facility that maximizes day-lighting can attract lots of tourists both local and internationally for social and sporting activities, leisure and sightseeing. Daylighting is defined as the controlled admission of natural light and direct sunlight and diffusion of skylight into a building to reduce electric lighting and saving energy (Di & Dell, 2015). It also helps to connect indoor and outdoor spaces visually through the use of transparent materials. It gives visual control which breaks down hierarchical barriers and nurtures a culture of transparency which promotes a sense of belonging, sense of place while in the facility and openness.

Along with its health and recreation benefits, this research helps in providing architectural solutions that help reduce high energy demands through day-light in recreational facilities while also providing a facility that encourages swimming competitions among schools and other sporting events which will

help generate revenue for Akwa Ibom state and the country.

II. TYPES OF AQUATIC SPORTS

1) Free diving: This is a type of underwater diving that relies heavily on breath holding rather than the use of breathing apparatus until resurfacing from the water. There is competitive and non-competitive freediving. Competitive Free diving involves lengthy holding of breaths, breathing techniques, deep dives, strength and endurance.

Plate 1: Freediving; Source: Daan Verhoeven, 2023

2) Water Polo: This is a team sport played in a swimming pool with a minimum depth of 2 meters by two teams of seven players and a ball resembling a soccer ball. It originated in the 1870s in Great Britain and is regulated by the International Amateur Swimming Federation 1908. The major aim of the sports is to score a goal by throwing the ball into the oppositions net with your hands. It is a competitive sporting activity but can also be an active recreational activity.

Plate 2: Water Polo; Source: npr.org by Marcel Ter Bals, 2021

3) Competitive Swimming: This type of water sport involves the use of different swimming strokes combined with strength, speed and endurance to perform and race against other competitors on different lanes. This activity requires the use of arms, legs, head and other body parts simultaneously along with breath control technique. It is performed in a 25 or 50-meter pool done for competitive and recreational purposes.

Plate 3: Competitive Swimming;
Source: summersolutionsswim.com, 2017

4) Synchronized Diving: This is a diving sport which involves two divers performing a dive with the same technique from the same level board on either a 3, 5,7 or 10-meter platform with the aim being to be in sync throughout. It is governed by FINA and made its debut at the 2000 Olympic games at Sydney. It is a competitive sport.

Plate 4: Synchronized Diving; Source: watersportswhiz.com by Sam Obrien, 2024

5) Underwater Hockey: Also known as UHS or Octopush, it is a limited-contact sport in which two teams consisting of 6 players compete with a stick to maneuver a puck across the bottom of the swimming pool into the oppositions goal. The Hockey pool measures a minimum of 12 x 21 meter. It is played worldwide with the Confederation Mondiale des Activites Subaquatiques (CMAS).

Plate 5: Underwater Hockey; Source: sportalsub.net, 2023

III. DAY-LIGHTING SYSTEMS

According to (Sangeeta, 2020), Daylighting is the practice of bring natural light inside the building to provide a better indoor light environment. If properly controlled and distributed, the daily insolation in buildings presents numerous advantages, especially with regard to visual comfort, health, productivity, and energy consumption (Krasic, 2013). All daylighting planning and strategies make use of the luminance from the sun, the sky and building (Di & Dell, 2015). This means that the daylighting strategy applied can either make the skyline into the space visible or can totally block the sky, therefore appropriate daylighting systems should be adopted to ensure that daylighting is sufficient for its intended purpose. In selecting a proper daylighting system, the Architect considers factors such as; the role of the chosen system (redirection, blockage, diffusion), the function of the fenestration (visual control and connectivity, lighting up spaces). The ways in which these systems can be applied, their design features, types, and functions are reviewed below;

1) Clerestory Windows: A clerestory is a series of fenestration or glass window at a top of a high section wall usually at or near the roof line (Sangeeta, 2020). Daylight enters from a certain height into the allocated space it was designed for thereby preventing glare from affecting users of the facility. This method also allows brighter and deeper daylight penetration into the space with less variation in the illuminance as compared to other systems with daylight entering from higher point reaching vertical surfaces without any obstruction thereby preventing unwanted shadows (Williams & Enwin, 2023).

Plate 6: View of Clerestory Window,
Source: Canadianarchitect.com (2023)

2) Skylight: The use of skylights is frequent in modern architecture since they allow access to natural light in rooms, providing homogeneous lighting over the horizontal plane (Acosta et al., 2012). Skylight is a source of natural light and can admit more than three times as much light as a vertical window of the same size, distributing it evenly, saving energy and improving your visual comfort levels (Sangeeta, 2020). In conclusion it is a daylighting system which helps transmit daylight and serves as a means of saving energy in various facilities.

Plate 7: Fixed Unit Skylight Window,
Source: keyliteroofwindows.com (2023)

3) Light Shelves: These can be seen as passive architectural shading devices that can either be used to reflect or redirect light from the sun into the building. It is effective for natatoriums with issues of glare as its prevents daylight from going further which often results to glare issues for divers and swimmers while using the pools in the facility. The choice of materials varies and may include, glass, plastic, timber, aluminum composite panels, acoustic panels etc.

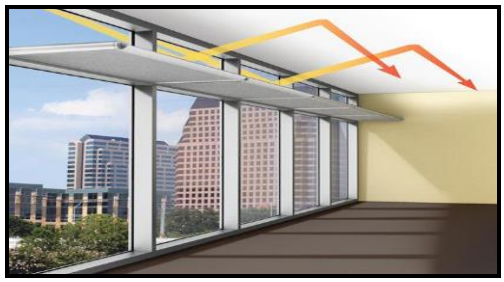

Plate 8: View of light shelves
Source: Designbuildings.co.uk (2023)

4) Prismatic Panels: Prismatic panels are planar components including a flat surface and a prismatic patterned side composed of transparent materials such as polymers which are usually consolidated within window panes for low maintenance (Amir et al., 2021). The prismatic panel was exploited to provide daylight inside the room, where the incident light

striking the prismatic panel is reflected into the ceiling, then the ceiling act as a diffuse light to illuminate the room and therefore aims to improve daylight distribution inside the room and reduce the glare (Eltaweel et al., 2020).

Plate 9: Prismatic Panels
Source: maizey.co.za (2024)

5) Louvres and Blinds: These are daylight systems that are used external and internally for solar shading in building of different types to redirect light and prevent glare in the facility. The angle of the slats determines its intended purpose. At a horizontal angle, diffused skylight and direct sunlight enter which increases window glare, when tilted upwards the skylight is made visible and the amount of glare increases, when tilted downward it provides a shade from the sunlight and skylight and reduces glare issues. According to (Amir et al., 2021) the system may block the visual field, deflect and/or transfer solar radiation directly or diffusely to the interiors, although the overall performance of the system can vary significantly depending on several settings; sun position, system positon, slat's tilt, slat's reflectivity and transparency, system operation and slats configuration (flat or curved).

Plate 10: Horizontal and Vertical Louvres & Blinds
Source: haluminium.com (2024)

IV. RESEARCH METHODOLOGY

Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes (Muhammad & Kabir, 2018).

This thesis was developed through the use of multiple research methods. It was essential to first create a data framework so that the appropriate Aquatic Centre could be designed to maximize day-light and enable visual control between spaces. A preliminary review of the literature was done to give a general overview and understanding of the concepts of day-lighting systems as these enhance user's experience within the facility through well-lit spaces and providing an energy efficient design.

This research employed a number of techniques, such as; qualitative and descriptive research methods dealing with data from primary sources from personal observations and secondary sources which include information obtained from textbooks, journals, internet and other published in relation to recreation, Aquatic activities and facilities, daylighting strategies.

V. FINDINGS

The introduction of an Aquatic Centre that facilitates both Indoor competitive water sports and recreational activities at Ibeno Local Government Area in Akwa ibom, automatically creates awareness to a type of recreational facility that can hardly be found in any part of the country thereby attracting people from different parts of the country to experience this type of facility. This in turn boosts the economic aspects of the local community and state by generating revenues through tourism, welfare facilities such as hotels, eateries, shopping malls and supermarkets in close proximity to the facility.

It also creates new job opportunities for locals in the community while creating a facility that gives people access to swimming activities regardless of the weather condition. The educational sector of the state and country will also benefit from this facility because there will be a template for future designs of Aquatic Centres in other parts of the country that maximizes daylighting which in turn enhances users experience and reduce energy demands.

CONCLUSION

Recreation is one of the essential catalysts for accelerating and enhancing the economic and social aspects of the community. Most recreational facilities consist of swimming pools that are affected by climatic conditions because of their heavy reliance on outdoor activities and poor design of indoor spaces to engage the users. This leads to poor social and economic output which affects the economic aspect of the community and state. Therefore, a well-designed Aquatic Centre that maximizes daylighting through various use of daylighting systems is needed in the state.

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