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Review of Performance and Adaptable Of Demountable Exposition Centre towards Sustainability Development

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ABSTRACT
Buildings are often demolished due to a needed conversion, relocation or change of the architectural design, although the supporting structure remains completely undamaged and fully intact. This leads to huge quantities of waste which need to be discharged on mining tips. Thus, the building sector is generating a large amount of CO_2 emissions, resource consumption and waste production. Given the high resource-intensity and CO_2 emissions of the sector, new eco-construction approaches are needed. This work was undertaken to be pleased about the performance and adaptability of demountable elements in buildings whether on a short-term, mid-term and/ or long-term basis. The methodology of the research included case studies of two prominent structures under the rich context of performance and adaptable spaces in the exposition centre of Asia (Hong Kong) and in one of the largest megacities of Africa (Lagos) were examined. These traditional case studies research methods were also supported with inventive techniques like photography to help better explore existing conditions in and around the study sites. Findings of the case studies have shown that a design approach based on performance and adaptability of spaces relative to different activities for different times as well as evolving needs is possible and should be adopted, instead of allowing buildings become inefficient shells or waste products of a fast paced world. This work has shown that a design approach based on adaptability and multi-functionality of spaces relative to different activities for different times as well as evolving needs should be adopted rather than letting buildings become inefficient shells or waste products of a fast paced world.

Keywords: Performance, adaptability, demountable, exposition, and sustainability.

I. INTRODUCTION

In modern day business world, the importance of Exposition Centre need not be over-emphasized in view of the many uses such a centre can be put to (Aliyu, 2000). In current times an Exposition Centre is an unpredictable large scale gathering of nations exhibiting in most cases aggressively- their progress in science, technology and culture (Alol, 2007). It is essentially political with little commercial purpose, open to all sections of the economy (manufacturing and service industries) and participants exhibit their wares for the purpose of selling, getting supply orders or creating markets (Alol, 2007). Word Expositions have long been established as grand events for economic, scientific, technological and cultural exchanges, serving as important platforms for exchanging innovative ideas and showcasing future trends (Chao et al, 2001). The Expo centre is made up of multiple halls and a dedicated cutting edge News and International Broadcasting Center housing radio, television, internet and programme production studios, enabling tens of thousands of journalist from around the word to broadcast live (Hesketh, 2003). The peculiarity between the way space is perceived and defined is a significantly determined by the architectural experience. This peculiarity allows the limitations of space to be queried visually since space may be defined differently than it is perceived(Fulmer, 2006). Numerous authors have quoted adaptability (Pulakos, 2003) in relation to different phenomena at the individual, team, and organizational levels, often using many different names and definitions for this concept. For instance, (Hesketh, 2003) referred to adaptive performance, (Prof. Dr.-Ing., 2017) discussed

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role demountable and (Mone, 2003) wrote about the proficiency with which individuals self-manage their new learning experiences. Furthermore, adaptation has been discussed in relation to many different organizationally relevant variables (such as new people and teams, novel and ill-defined problems, different cultures, new technology, challenging physical conditions), encompassing a wide range of behaviours across a variety of different task demands. Demountable Exposition center need to be increasingly adaptable, versatile, and tolerant of uncertainty to function effectively in these changing and varied environments, yet adaptability, demountable, and sustainability are elusive concepts that have not been well defined in the psychological literature (Ford, 2005). In focus of reliability and innovation in designed Exposition Center, given that this would be an iconic building providing a long term infrastructure solution was an essential component to maintaining its status as an internationally renowned convention centre (Molex,2010). Advanced infrastructure solutions were chosen to support the Exposition Center and its image as one of most significant network infrastructure funds. As the most significant structure the Exposition Center will achieved these key performance indicators for standardisation, advanced technologies, practicality, changeability, compatibility, security, reliability and cost efficiencies (Molex,2010). It is a multi-unctional venue that also caters to a wide range of social and corporate events, creates blueprints for future cities and harmonious urban life styles, providing an extraordinary educational and entertainment platform for visitors from across the globe (Mone, 2003). Employing unique types of analyses and generating new innovative ideas in complex areas; new approaches, integrating seemingly unrelated information and developing creative solutions; entertaining wide-ranging possibilities, thinking outside the given parameters to see if there is a more effective approach (Holyoak, 2001). The expo aims to achieve the greatest participation in the history of world expo and estimates over 200 nations taking part.

II. LITERATURE REVIEW

DESIGN FEATURES IN A BUILDING STRUCTURE

Design features are the distinguishing characteristics or different component parts together to form the houses, buildings and structures. A building includes the structure itself and the non-structural components attached to and supported by the structure. For a basic structure, the walls, floors and roofs make up these features and components. FEMA (2006)

WALLS

A wall is a vertical structural surface that defines an area; carries a load; provides security, shelter, or soundproofing; or, is decorative. In traditional masonry construction, they support the weight of floors and roofs but modern steel and reinforced concrete frames, as well as heavy timber and other skeletal structures, require exterior walls only for shelter and sometimes distribute with them on the ground floor to permit easier access. Masonry Institute of British Columbia (2015) Positioning of walls depend on type of support given floor and roofs. A wall directly above the beam is called load bearing wall. It is designed to carry the vertical load. In another way, if a wall doesn't have any walls, posts or other supports directly above it, it is more likely to be a load-bearing wall. Load bearing walls also carry their own weight. S. Mahendra, Re-Quarried (2011) This wall is typically over one another on each floor. Load bearing walls can be used as interior or exterior wall. This kind of wall will often be perpendicular to floor joists or ridge. Masonry Institute of British Columbia (2015)

FLOORS

Floor is regarded as the horizontal lower enclosing and supporting surface that extends horizontally throughout a structure. It forms the bottom of a room and divides space horizontally into stories. Floor systems form a horizontal partition at each level where they occur and transfer load to braced walls below that floor level or directly to the foundation when the lowest floor is supported on a foundation. S. Mahendra, Re-Quarried (2011)

ROOF

Roof is the covering of the top of a building, serving to protect against rain, snow, sunlight, wind and extremes of temperature. In many buildings, the roof is a major element that gives the building its characteristic profile. Roofs have been constructed in a variety of forms as dictated by technical, economic or aesthetic considerations. Architectural Heritage Protection (2004)

BUILDING PERFORMANCE

Building performance is a term often used in the Architecture, Engineering and Construction (AEC) sector, typically in association with issues

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like the energy efficiency of buildings, indoor environmental quality, thermal comfort or lighting. A. Rahim (2005) This is not unique to the AEC sector; the same goes for the use of 'performance' in other domains such as the automotive or computing industry. Performance in general is an importance concept in today's society which is strongly focused on efficiency and quality. The common understanding of building performance across these publications is that of a concept that allows to compare and contrast user needs with behaviour of a specific building, or, in other words, a concept that allows to quantify how well a building fulfils its functions as shown on figure 1. W. Gielingh (2005)

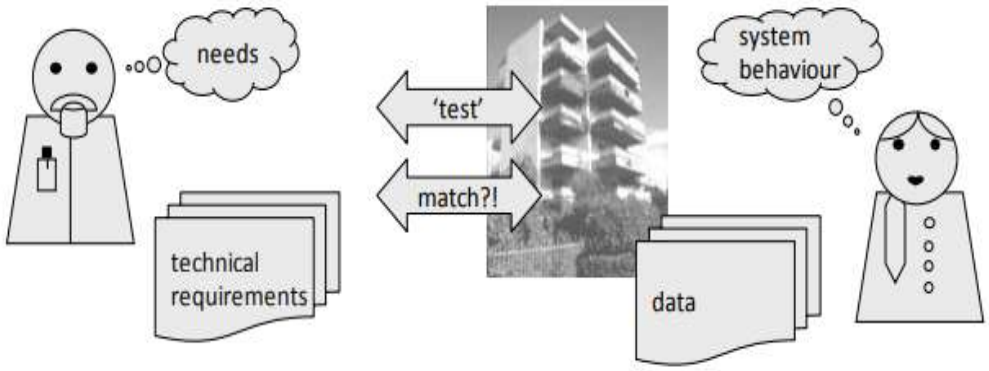

Figure 1: Building performance as the test of how stakeholder needs meet observed behavior

OVERVIEW OF DEMOUNTABLE BUILDINGS

Demountable buildings are, in many ways, very similar to the traditional household flat packs that so many of us are used to. They are easy to transport, cheaper than non-demountable buildings and they are relatively quick to build as long you have a somewhat flat, level site. And of course, they have a range of flexible uses because they can be disassembled and reassembled in other locations to meet your day-to-day requirements. The Japanese, Metabolism reestablished links to traditional construction concepts such as prefabrication, modularity, circular growth and renewal. Kurokawa's Takara Beautillion (Figure 2.1) was assembled and disassembled in six days at the 1970 Osaka Expo and was composed of two elements - a framework of six-pointed crosses (steel tubes bent to a common radius) and mini showroom capsules that plugged into the framework (Koolhass and Obrist, 2011). The pavilion displayed the end joints of the framework which would allow additional framework units or capsules to be added when needed (Jencks, 1973). Another built example is the Yamanashi News Group office in Kofu designed by Kenzo Tange in 1961 which exhibits multiple approaches (Figure 2.2). The building contains three organizations that were distributed vertically based on functional needs with shared common facilities (Lin, 2010). Circulation and mechanical elements are grouped in 16 reinforced 5m diameter concrete cylindrical towers (communication cores) allowing for a spatially open plan office environment – the towers are finished at different heights to suggest future expansion (ibid). The building was eventually expanded in 1974 exactly as Tange envisioned (Koolhass and Obrist, 2011). Smithson (1964) argues against such a large centralized framework in that rather than promoting an open society it restricts with no capacity to opt out or work in a different way.

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Figure 2.1 Kurokawa's Takara Beautillion for the 1970 Osaka Expo (Takara Beautillion, 2012)

Figure 2.2 Tange's Yamanishi Press Office built in 1961 (Koolhass and Obrist, 2011)

An interesting evolution of the concept was Archigram's 'Control and Choice' by Cook, which utilised a small number of 'permanent' pylons that allowed for smaller, more flexible components to be plugged-in rather than volumetric spatial units (capsule) – wall, skin, services and roof can now be changed as individual conditions (Jenks, 1973).

ADAPTABILITY

Every building should be designed to have the ability to alter to changes or be changed to fit current situation. In architecture, change is inevitable therefore having a building with elements that allow for change to happen is the major concern so that while a building has a distinct purpose, it can operate as multipurpose L. Acharya (2013). The open building approach considered the most formalized approach for adaptable architecture. An example of adaptable building is the Schlaulager (Art Store) in Basel as seen in Figure 2.3(b) showing an open space which combines storage, exhibition spaces and art research institute. The storage concept ensures that works remain accessible unlike in a typical museum situation where art not on display is crated up and locked in a vault. Figure 2.3(a) shows the exterior view of the Art Store.

a

b

Figure 2.3; Adaptable Schlaulager (Art Store) in Basel (a)Exterior; (b)Interior, (Source L. Acharya (2013)

The concept of adaptability can be broken down into a number of simple strategies that are familiar to most designers:

(i) Flexibility, or enabling minor shifts in space planning;
(ii) Convertibility, or allowing for changes in use within the building; and
(iii) Expandability, (alternatively shrink ability) or facilitating additions to the quantity of space in a building.

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Adaptability is closely related to – but different from – two other design strategies that attempt to enhance long-term environmental performance:

(iv) Durability: selecting materials, assemblies and systems that require less maintenance, repair and replacement. Since durability extends the useful lifetime of materials and technology in a building, it is complimentary to adaptability.

(v) Design for Disassembly: making it easier to take products and assemblies apart so that their constituent elements can more easily be reused or recycled. Designing for disassembly can reduce the costs and environmental impact associated with adapting buildings to new uses.

Urban areas everywhere are experiencing problems related to poor use of buildings, and high flows of energy and materials through the building stock. Demolition rates are rising, and due to the artificially low costs of landfill disposal and incineration, much of the solid waste is not being recycled (Moffatt, 2001).

Kohler2 summarizes a number of trends found in the German building stock, which also speak to the increased relevance of adaptable stocks:

(i) New construction levels steadily decreasing;

(ii) Refurbishment activities surpassing new construction;

(iii) Large numbers of old buildings (warehouses, industry) sitting empty;

(iv) Growing numbers of new, highly-equipped office buildings, for lease (resulting from over production and corporate downsizing and outsourcing);

(iv) Flows of basic materials into the stock – for new construction and renovation – exceeding the solid waste flows by 4 to 10 times, (which indicates that the building sector is still a major consumer of natural resources).While these specific trends may not yet apply to all other countries, the conclusion is clear and universal: increasingly buildings need to be designed for long-term adaptability.

If adaptability is to be a useful design concept, it must be possible to properly distinguish those features of new buildings that will significantly increase their capacity for change (Moffatt, 2001).

BENEFIT OF ADAPTABILITY TO ENVIRONMENTAL PERFORMANCE

Unless a building is capable of responding to changing circumstances it is vulnerable to becoming poorly utilized, prematurely obsolete and unable to accommodate new, more efficient technologies. The combined impact of such failures may be to increase resource use within the building sector by 20 to 30%. Depending upon the additional investment required to achieve adaptable designs and materials, it should be possible to significantly improve the environmental performance of the world's buildings in at least three ways, as outlined below (Larsson, 1999).

i. More efficient use of space
ii. Increased Longevity
iii. Improved Operating Performance

KEY PRINCIPLES OF ADAPTABILITY

The first step in evaluating the adaptability of a building is simply to determine whether or not a conscious effort has been made to address Key Principles of adaptability such as: . **Independence:** Integrate systems (or layers) within a building in ways that allow parts to be removed or upgraded without affecting the performance of connected systems.

Upgradeability: Choose systems and components that anticipate and can accommodate potential increased performance requirements.

Lifetime compatibility: Do not encapsulate, or strongly interconnect short lifetime components with those having longer lifetimes. It also may be advantageous to maximize durability of materials in locations where long lifetimes are required, like structural elements and the cladding. Durable claddings and foundations can greatly facilitate adaptability, often tipping the scale in favour of conversion over demolition.

Recordkeeping: Ensure that information on the building components and systems is available and explicit for future use. It will assist effective decision making with regard to conversion options and prevent costly probing exercises.

MOBILITY

Mobility of buildings represent the physical movement of a building that changes places within a time range L. Acharya (2013). Flexibility in the design of buildings, using mobile design is related with the possibility of designing temporary accommodations in critical and emergency situations such as in war and conflict areas or in relation to natural disasters. Mobility of buildings gives rise to efficient use of materials and resources making it important for flexibility. The Halley VI Antarctica Research Station that served as a home and work station for 50 scientists, designed by London-based Hugh Broughton Architects is an example of a mobile structure C. Andrei (2002).

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TRANSFORMABILITY

Transformability in buildings enables a building to change its shape, space and appearance by the physical modification to its basic components, outer shell or internal surfaces. The transformation operation can be done manually by disassembling and assembling of different building components, or by mechanical means using a button to control the movement of parts and change of form of a building. An example is the M-House made by Architect Jantzen which consists of a series of rectangular panels that are attached in hinges which allows the panels to fold to perform various functions and this structure could be assembled and disassembled L. Acharya (2013).

DEMOUNTABLE OF BUILDING ELEMENT FEATURES

The demountable of the building components that form a structure is the basic factor that determines how flexible a structure can be. The breaking down of these components that can be disassembled non-destructively from the product as a unit is referred to as elements and each element can be attached or detached, adapted, moved, and swapped easily for upgrading, renovate, recycling, or reuse. The function-based modular design offers flexibility and allows maximum space utilization and functions to satisfy the needs of different groups of users.

BASIC ELEMENTS OF BUILDING COMPONENT FEATURES

There are two ways to achieve adaptable and sustainability in multiuse spaces; first is by using furniture and secondly by the building construction such as transportable walls and floors. The fact that movable walls yield space multifunctional, modular design also leads to multipurpose spaces and can be realized by building elements such as walls, furniture, ceilings, doors or windows E. Farjami, A. L. Mohammadzadeh, & A. Taran (N.D).

MOVEABLE AND MOBILE WALLS

It is obvious that walls are a necessity in forming multifunctional structure spaces E. Farjami, A. L. Mohammadzadeh, & A. Taran (N.D). Comfort's moveable walls have been designed to give economical but long-lasting use in the division of spaces where dynamicity is required. Movable walls are specified where functional space demarcation is an essential element within the partition project. Due to their multifunctional, cost effectiveness and waste minimisation they allow large rooms to be conveniently sub-divided to maximise space utilisation. Compared to traditional wall construction, installation of these elements is faster and eliminate the cost and mess of cutting and fitting carpet and ceilings around fixed walls. They offer maximum change and reusability to accommodate frequent and quick transfer of structure without loss of materials, damage or modification to panels or to adjoining structures such as ceilings, fixed walls and floors. Movable elements and some mobile partitions are non-progressive allowing the removal of individual panels from any location without disturbing adjoining units.

MOVEABLE AND RETRACTABLE SEATING

Change in the function of a space is one of the like changes that can take place in a space E. S. Slaughter (N.D). When static seats are used, it limits the type of function that the space can be used for, thereby making the space less multiuse, but when movable seats are introduced, the space can be rearranged to allow several functions. The most movable seats that offers multi-functional spaces in performing spaces like in exposition centres are the retractable seats. Moveable and retractable seating platforms are used in a range of facilities including event centres where there is a requirement for seating areas and floor space to be racked. The types include: fixed, recessed, mobile and travelling seating.

MOVEABLE AND RETRACTABLE ROOFS

This is a roofing system designed to roll back on tracks so that the interior of the facility is open to the outdoors. The development of these roof structures originated from ancient times when Romans covered their buildings intended for mass events (amphitheatre, theatre, and circus) with foldable awnings M. Andrej (2015). Retractable roof structures are a type of roof structure, which can be completely or partly moved or folded in a short period of time so that the building can be used with an open or closed roof K. Ishii (2000). Retractable roofs are used in residences, restaurants and bars, swim centres, and other facilities wishing to provide an open-air experience at the push of a button. They vary in shape, material and movement and could be categorised based on frequency of opening and closing, structural design, type of movement, size of movable roof elements, and type of moving system.

OVERVIEW OF EXPOSITION CENTRES

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Exposition centre means one or more related structures, including fixtures and equipment, owned, operated or leased by a district and used primarily for conventions, expositions, trade shows, musical or dramatic events or other events involving educational, cultural or commercial activities, and not primarily for recreational or sporting activities.

TYPES OF EXPOSITION CENTRES

Permanent

A permanent exposition centre is one which is attached to the ground for a foreseeable future. It is usually planned and designed to remain in a particular location. They are usually constructed on site, or the components could be prefabricated and assembled on site. An example of the permanent exposition structures in Abuja the Federal Capital Territory of Nigeria, J.T. Useni International Trade Fair, shown in Figure 2.4. It is one of the premier event and wedding venues in the city located in kilometre 8, Airport Road, Abuja.

Figure 2.4; Permanent structure of J.T. Useni International Trade Fair, Abuja (Source . www.abujaicc.com/aicc.htm 2005)

Temporary

A temporary event centre is one which is not attached to a permanent foundation. It is usually used where there is uncertainty concerning future space requirements or expansion plans. They are usually locatable therefore can be dismantled and removed when they are no longer needed at a convenient time. A temporary event centre is also sustainable because materials are reusable and recyclable and energy usage and cost are kept to a minimum. Figure 2.5 shows a temporary event structure in Kaduna, Kaduna State International Trade Fair Press Centre, Kaduna which is also among the premier event venues.

Figure 2.5; Temporary structure of Kaduna State International Trade Fair Press, Kaduna. (Source [18])

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III. METHODOLOGY

To appraise the characteristics of performance and adaptability of demountable exposition centres over time and space, the methodology of the research included case studies, surveys, key informant interviews and reviews of associated materials were very useful in determining the specific scenarios that aided the attainment of a functional yet aesthetically-pleasant matrix. These traditional design research methods have also been supplemented with innovative techniques like photography to help better explore existing conditions in and around the study sites. Other relevant secondary data from newspapers and journals, reputable internet sources, conventional statistics from government regulatory organs and archives, as well as naturalistic observations by the author also played a prominent role in the success of the work.

CASE STUDY

One of the oldest traditions in architecture is the use of the understood and proven precedents which are partly repeated and partly modified in the making of architecture. It should be noted that the things that will exist can be understood from what has already existed (Kashkooli and Altan, 2010). For this work, two notable facilities under the rich context of adaptable, multi-functional spaces in the event capital of Asia and in one of the largest megacities of Africa have been examined. The locations were chosen due to their current development index, ever increasing population and potentials for expansion of existing public infrastructure (Davison et al., 2006). It is these cases that should enable the researcher to critically analyze their relevant guiding principles and therefore serve to highlight the paradigms of adaptability, demountable, and sustainability.

CASE STUDY 1: HONG KONG CONVENTION AND EXHIBITION CENTRE BACKGROUND INFORMATION

Client: Hong Kong Trade Development Council (HTDC) and the Hong Kong Special Administrative Region Government.

Venue Address: 1 Expo Drive, Wanchai, Hong Kong, China (Hong Kong S.A.R.) – 85254.

Area: Around 70,000 square metres of exhibition space at 1st Opening.

Framed by Hong Kong's skyline, the Hong Kong Convention and Exhibition Centre (HKCEC) is a magnificent, multi-use venue located in the heart of Hong Kong on its famous Victoria Harbour (Figure 4.1).

Figure 4.1: Site Photo (Source: http://www.hkcec.com)

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Figure 4.2: Entrance to the structure (Source: http://www.hkcec.com)

Figure 4.3: HKCEC December 2009 Expansion Milestone (Source: http://www.hkcec.com)

4.1.2 Design Analysis

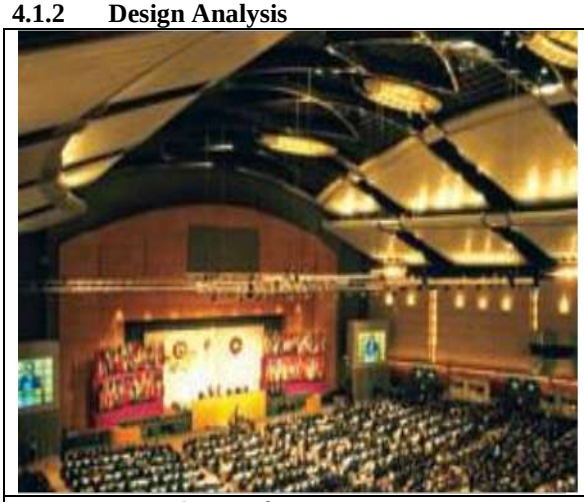

Figure 4.4: Photo of Centre Interiors (Source: http://www.hkcec.com)

Figure 4.5: Centre Interiors (Source: http://www.hkcec.com)

From accommodating over 25 of the world's most expensive cars for the Top Gear Live show, to dazzling an audience of over 8,000 people at rock band Air Supply's Never Ending Love Concert, the HKCEC has the capacity to provide a solid foundation for any event chiefly because all the HKCEC venues are adaptable, providing multiple set-up choices with draping systems and operable partitions to cater for both large-scale and intimate events (Geraedts, 2008).For instance, Hall 5BC can be adapted for concerts, accommodating 8,000 people with the option of a retractable telescopic seating system for 3,200 people (Figure 4.4). Recently, the developers of Hong Kong Convention and Exhibition Centre have uniquely provided more than 91,500 square meters (sq. m) of rentable space right in the heart of one of the world's most exciting cities, in 6 Exhibition Halls totaling 66,000 sq. m; 2 Multi-Purpose Halls (for conventions or banquets) totaling 5,700 sq. m; 2 Theatres (with seating for 336 and 637) totaling 800 sq. m; 52 Meeting Rooms of 6,000 sq. m total floor area; as well as other multi-functional rental space measuring 13,000 sq. m (Figure 4.6).

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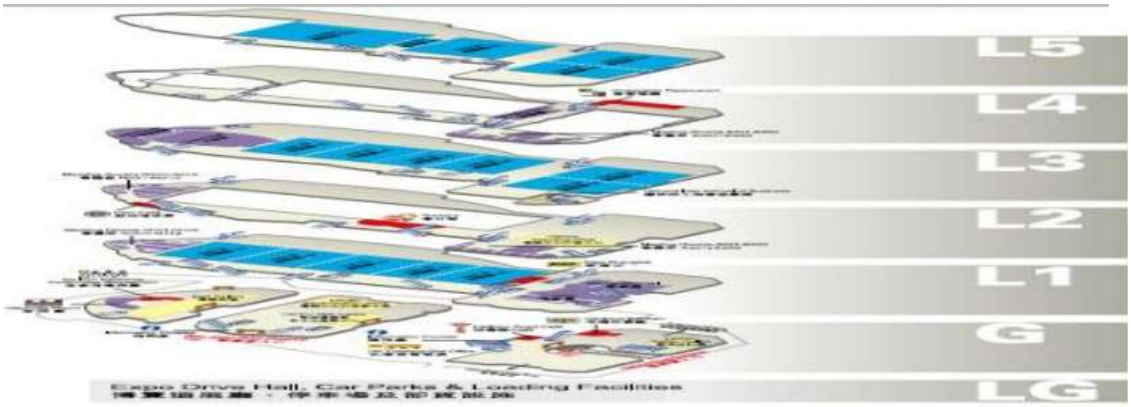

Figure 4.6: HKCEC Elevation Plan (Source: http://www.hkcec.com)

CASE STUDY 2: THE CIVIC CENTRE, LAGOS

Figure 4.7: Vantage View (Source: Author's Field Study, 2022)

BACKGROUND INFORMATION

Location: Ozumba Mbadiwe Avenue,Opposite 1004, Victoria Island, Eti-osa, Lagos, Nigeria
Area:A 2,190m2 site
Architects:M/s James Cubitt Architects.
Other consultants:Ove Arup Partners Nigeria (Civil & Structural Engineers), Miu – Beta Engineers (Mechanical & Electrical Engineers), Austin Onaro & Associates (Quantity Surveyors)

The Civic Centre is located in Victoria Island, the highbrow commercial nerve of Lagos (Figures 4.7 and 4.8). It is one of the largest and most important convention centers that graces the emerging megacity's landscape, and is still serving as venue for many national and international events in the past and offers state of art event hosting services.

IV. DESIGN ANALYSIS

The building is a commercial development providing shops, meeting rooms, a large multi-purpose Grand Banquet Hall, a Panoramic View Hall and the Floating Restaurant overlooking the lagoon. In addition, the site also provides a private boat club. The Civic Centre offers breath-taking hospitality and service complete with incomparable value for money. This is aside from the fact that the large multipurpose Grand Banquet Hall was designed without columns to make it conducive for events. As such, the floor slab over the hall was suspended from a large steel truss flying over the roof (Figure 4.9). It must be noted also that the inverted ziggurat form of the building, according to the architects, is dictated by the limited site area.

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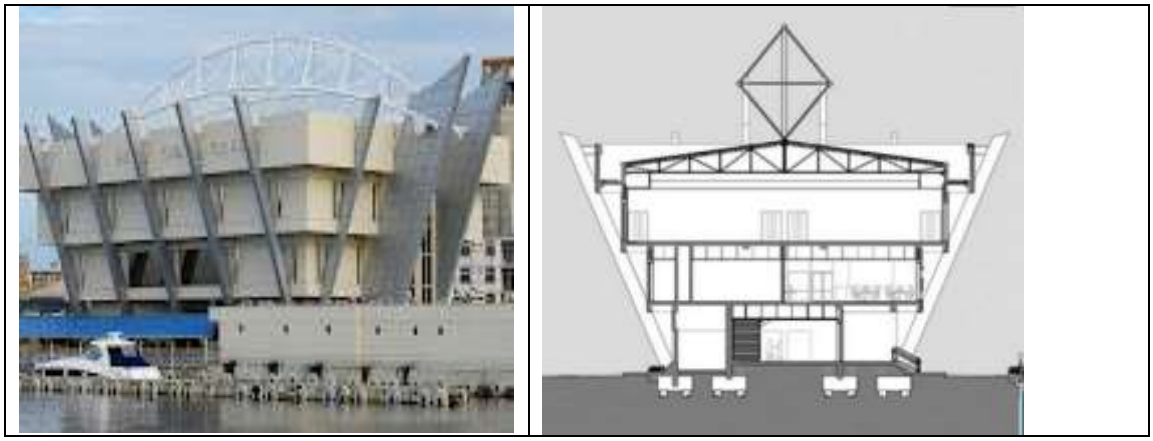

Figure 4.9: Civic Centre Photo and Section, courtesy James Cubitt Architects
(Source: Author's Field Study, 2014)

The large multi-purpose hall as highlighted above is ideal for large corporate or grand social functions, seating 600 in banquet and at least 1,000 conference or cocktail guests coupled with its spectacular views; it can also be re-configured to serve as a venue for the delivery of highly focused presentations, trainings, seminars or meetings to midsize and small audiences (Figure 4.10).

Figure 4.10: Typical Adaptable, Multi-functional Use Scenarios for the Main Hall (Source: Author's Field Study, 2022)

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V. FINDINGS

Brand (1994), Kronenburg (2000), Fernandez (2003) and Mauthoor (2010) assert that the adaptability and multi-functionality of a space is a result of highly calculated use scenarios, effectively organized program arrangements, and building systems to support each changeable spatial property; that they both "only exist within determinism, (and are) not resulted from randomness" (Kim, 2008). It is these set parameters that enabled the critical appraisal of the two case studies in terms of performance in use, aesthetics and viability of concept. In the Hong Kong Convention and Exhibition Centre case, for instance, the complex is orchestrated in such a way that parallel sessions can be held on 4th Floor and 6th Floor Meeting Rooms in addition to the fact that all facilities are purpose-built, adaptable and multiuse including 66,000 square metres of exhibition space, 20,000 square metres of multi-functional venues and 5,500 square metres of event support space (Figure 5.1). The complex was the proud recipient of the Grand Award in the non-residential category of Quality Building Award 2010 for its second expansion and a remarkable part of the judging criteria was serviceability and performance outcome. Put more succinctly, the original scheme has been so 'adaptable' that it has undergone three successful expansions "with further opportunities for long term infrastructural improvements" (HKCEC, 2011).

Figure 5.2: Aerial View of the Civic Centre, Lagos (Source: Author's Field Study, 2022)

In the same vein, findings from the Lagos Civic Centre studies showed the facility as an artistic venue for the performance of several multi-level functions like shopping activities and bazaars, art exhibitions, conferences, wedding receptions, and such other social events. Its strategic layout in location and form also gives it credence as an iconic, well-loved and well-used building of the future in the city of Lagos (Figure 5.2). Moreover, its exceptionally column-free main hall enables varied configurations of seating for any event and confers on it the status of a "vastly adaptable space" (Gosling, et. al., 2008). Part of the fringe benefits for the management is the highly priced on-site car parking spaces for all users.

VI. CONCLUSION

Taking into cognizance the wide variety of activities that take place in "buildings of the future" relative to space, it becomes obvious that many other existing public facilities operate in segregated, disjointedly patterned ensembles resulting in wastages of available spaces and idle investments whenever such predetermined activity is not held. This work has shown that a design approach based on adaptability and multi-functionality of spaces relative to different activities for different times as well as evolving needs should be adopted rather than letting buildings become inefficient shells or waste

products of a fast paced world. It is these qualities that will engender them to stand out as robust, thus allowing for the adaptations of flexible configuration of occupancy because of their use for different forms of interaction between respondents of different sizes and mix, whether on a short-term, mid-term and/ or long-term basis.

RECOMMENDATION

After carrying out all necessary research on adaptability, demountable exposition center, it is recommended Architect professionals should be more enlightened in the aspects of demountable, adaptability, and sustainability when designing exposition center.

REFERENCES

[1]. Rahim, Performativity: beyond efficiency and optimization in architecture, in: B. Kolarevic and A. Malkawi (Eds.), Performative Architecture: Beyond Instrumentality, Spon Press, New York, 2005, pp. 177-192.
[2]. Architectural Heritage Protection, Guidelines for Planning Authorities: Guidance on Part IV of the Planning and Development ACT 2000, 2004.
[3]. Kolarevic, B., A. Malkawi (Eds.), Performative Architecture: Beyond Instrumentality, Spon Press, New York, 2005.
[4]. Andrei, Mobiles: The Art of Portable Architecture. Princeton Architectural Press, New York, 2002.
[5]. Farjami, A. L. Mohammadzadeh, & A. Taran, Flexibility in Modular Furniture Systems in Open Offices, Famagusta, North Cyprus. World Academy of Science, Engineering and Technology, International Journal of Social, Management, Economics and Business Engineering 8(5), 1229- 1232.
[6]. S. Slaughter, Design strategies to increase building flexibility. Building Research & Information, 29(3), 208-217, 2001
[7]. Szigeti and G. Davis, Using the ASTM/ANSI standards for whole building functionality and serviceability for major asset and portfolio decisions, CIB W070 Glob.Symp., Glasgow, UK, 2002, 507-521.
[8]. FEMA 232, Home Builder's Guide to Earthquake Resistant Design and Construction. National Institute of Building Services, Washington DC, 2006.
[9]. Augenbroe, The role of simulation in performance based building, in: J. Hensen and R. Lamberts (Eds.), Building Performance Simulation for Design and Operation, Spon Press, Abingdon, 2011, pp. 15-36.
[10]. J. Gero, Design prototypes: a knowledge representation schema for design, AI Magazine, 11 (1990) 26-36.
[11]. K. Ishii, Structural Design of Retractable Roof Structures. International Association of Shell and Spatial Structures, WIT Press, Southampton, UK, 2000.
[12]. L. Acharya, Flexible Architecture for Dynamic Societies, Reflection on a Journey from the 20th Century into the Future, Faculty of Humanities, Social Sciences and Education, University of Tromso, 2013.
[13]. M. Andrej, Typology of Retractable Roof Structures in Stadiums and Sports Halls, University of Ljubljana, 2015. Retrieved from http://www.iu-cg.org/paper/2015/cg03.html.
[14]. M. Hensel, Performance-oriented Architecture: Rethinking Architectural Design and the Built Environment, Wiley, Chichester, 2013.
[15]. Masonry Institute of British Columbia (MIBC), Masonry Technical Manual, 3636 4th Avenue East Vancouver, 2015.
[16]. P. de Wilde, Building Performance Analysis, Wiley, Oxford, 2018.
[17]. Q. A. Oday, A. S. Omar, & S. A. Hussien, Impact of Flexibility Principle on the Efficiency of Interior Design. International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 5(3), 195-212, 2014
[18]. R. Kronenburg, Flexible: Architecture that respond to change. Lauren King, London, 2007.
[19]. S. Mahendra, Re-Quarried: Reclaimed in an urban framework, LAP Lambert Academic Publishing, 2011.
[20]. W. Gielingh, Improving the Performance of Construction by the Acquisition, Organization and Use of Knowledge, PhD thesis, TU Delft, the Netherlands, 2005.