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## **Vision for a Vertical Campus, Rethinking the Public Universities of Bangladesh.**

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### **Abstract**

Regarding the availability of land and the requirement for sustainable infrastructure, public universities of Bangladesh will confront formidable obstacles in the future. This paper proposes a vision for a vertical campus for the public universities of Bangladesh, concentrating on integrating interactive learning, spatial qualities like openness, visual connectivity and sustainable technologies in response to the land availability challenges of the country. The traditional approach to campus was questioned during the COVID-19 pandemic, forcing architects and planners worldwide to rethink the design approach to infrastructure. This paper will provide new thinking and ideas on how to rethink the traditional approach to campus design. The challenge is to provide a campus that is breathable and compact. The proposed campus layout uses a vertical approach to use spatial arrangements and house many educational facilities efficiently, environmental and economic sustainability by analysing the advantages and drawbacks of erecting a vertical campus in Bangladesh. The methodology for analysis includes a review of relevant literature and case studies of successful vertical campuses in other countries. The study will give us a new paradigm on the sustainable and breathable campus to resolve the problem of land availability. This paper presents a vision for a vertical campus that can meet the challenges facing public universities in Bangladesh while providing a modern, sustainable, and interactive learning environment for students, faculty, and staff.

*Keywords: vertical approach; land availability challenge; sustainability; interactive learning; educational institution*

### **1 Introduction**

Bangladesh is one of the South Asian nations undergoing significantly accelerated urbanisation. Urbanisation is currently 28% and is projected to reach 56% by 2050 (Hasan, 2022). In a country where land is limited to 1,47,570 square kilometres, architects and planners are incredibly concerned about how to accommodate the ever-growing population in the future. Urban planners, architects, and engineers around the globe are promoting vertical expansion for urban growth and development using vertical concepts such as public housing and educational facilities as a solution to reshaping architecture after the pandemic (Chayka, 2020). This paper urges the Public Universities of Bangladesh to develop vertically rather than horizontally, as our nation will face significant urbanisation expansion challenges. Most of our public universities have a horizontal campus configuration if we examine their architectural designs. All public universities in Bangladesh, including Dhaka University (600 acres), Jahangirnagar University (697 acres), Khulna University of Engineering & Technology (101 acres), Chittagong University (1754 acres), and Rajshahi University (753 acres), have a horizontal campus layout. A traditional horizontal campus layout consists of purpose-built structures connected by their quads and courtyards' open spaces. These connections are "out-of-class" spaces essential to the university setting that enriches the varsity experience. And if we look at how these universities run their programs, we'll see that their systems change by area and role. In this design, courtyards are crucial (Groesback, 2013).

The vertical campus plan differs from the horizontal one. The goal is to combine connective qualities that improve interactive learning on a horizontal campus while conforming to vertical building design constraints. Singapore, Japan, and the US have adopted new regulations prioritising vertical growth and towering structures above horizontal ones, even in educational institutions. The National University of Singapore (NUS) in Singapore and the Mode Gakuen Cocoon Tower in Tokyo are examples of vertical universities that maintain a high-quality environment. Vertical development is favoured over horizontal development when there is a

significant lack of available land. Bangladesh is also a small country. As a result of the high population density and accelerated urbanisation, land availability is already a problem in the vicinity of Dhaka city (Hasan, 2022). Thus, new public universities are constructed on unique habitats. Without a doubt, this enables the growth of new habitats in recent locations, but it also requires an enormous quantity of space. The majority of public universities have at least 100 acres of land.

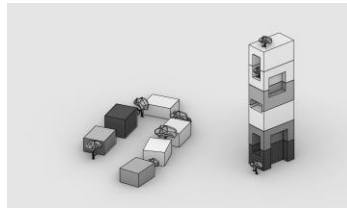


Figure 1. Visual Representation of a Horizontal campus layout (Left) VS Vertical campus layout (Right)  
(Produced by Author).

A tall-building model for university programs should balance the university's functionally-driven curriculum and the model's efficiencies. Recently, the Government has been pushing the idea of verticality on many campuses, such as Hajee Mohammad Danesh Science & Technology University (87 acres) and Khulna University of Engineering & Technology (101 acres). An adaptability strategy must be considered for university buildings to retain their value for the duration of the institution's existence. Program Stacking, Planning, Vertical Transportation and Circulation, Structural Strategies, MEP Strategies, Fire Safety Strategies, Sustainability, Openness, Connection, and Interactive Learning are crucial factors to consider (Groesback, 2013). The advantages of a vertical campus over a horizontal configuration include the efficient utilisation of land area, the accommodation of a large number of students in a smaller footprint, the connection of traditional courtyards via connecting atriums, and the accommodation of large numbers of students in residential facilities, among others. The aesthetic experience of a vertical campus is very distinct from that of a horizontal campus. According to a recent study, aesthetic experience is directly linked to the perception of locations (Bostancı and Girginkaya Akdağ, 2020).

Moreover, a vertical campus is justified by the land availability challenge and future infrastructure expansion. The vertical campus is optional for a city or country with abundant land. However, it is still essential as it is the only valid and logical factor for future campus extensions (Groesback, 2013). The main objectives of this paper are: to develop a vision: This paper aims to establish a thorough and specific vision for a vertical campus in Bangladesh. This demands an innovative and sustainable educational environment that solves land shortages and supports sustainable design. The purpose is to provide design techniques and guiding principles that optimise the utilisation of limited land while satisfying the educational institutions and stakeholders' needs. This study incorporates sustainable design into the vertical campus idea. It employs passive solar design, energy efficiency, waste management, and eco-friendly materials. The objective is to reduce the ecological footprint of the vertical campus and encourage sustainable living and learning.

The primary objectives of the research paper are to develop a vision for a sustainable vertical campus that addresses land scarcity, promotes sustainability, enhances the learning environment, and provides recommendations for implementation.

## 2 Methodology

The paper will adopt the exploratory method for research on vertical campuses and rethinking public universities. This paper will use existing case studies and point out various factors favouring vertical campuses focusing on those who reside in urban areas and encounter similar land shortage issues. Examine the impact on the learning experience of their design strategies, spatial configurations, and sustainable features. This research aims to develop a vision for a vertical campus in Bangladesh that addresses land scarcity issues and promotes sustainability. The objective is to propose design strategies and principles that optimise space usage, enhance the learning environment, and reduce the ecological imprint. After analysing the case studies, we will develop a concept for a vertical campus that can be implemented in Bangladesh. The conceptual analysis will shed some light on implementing vertical campuses by rethinking our public universities and tackling land availability and future expansion challenges.

## 3 Existing Cases

The examples we will discuss are The University Center for the New School in New York, The Wabash Building for Roosevelt University in Chicago, The National University of Singapore, and the South-East University of

Bangladesh for exploring the idea of a vertical campus. The findings for these existing cases will help us determine the factors for an ideal breathable vertical campus for our public universities.



Figure 2. The New School University Center (ArchDaily, 2014).



Figure 3. The Roosevelt University (ArchDaily, 2010).



Figure 4. The National University of Singapore, Singapore (Divisare, n.d.).



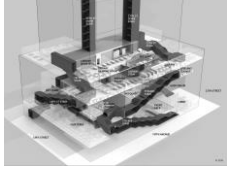




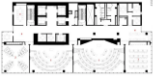

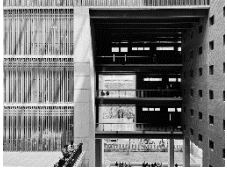
Figure 5. South-East University, Bangladesh (ArchiDiaries, n.d.).

#### 4 Overview & Findings

After analysing the four case studies, we can discuss the strategies that make up these vertical campuses. These are the Program Stacking, Structure, MEP Strategies, Sustainability, Circulation and Connectivity, and Fire Safety. Some of these will shortly be discussed in the following table:

Table 1. Reviewing and comparing different Vertical Campuses

Sl no.		The New School University Center	The Roosevelt University	The National University of Singapore	South-East University, Bangladesh
1.	Location	New York	Chicago, USA	Singapore	Dhaka, Bangladesh
2.	Architect/ Firm	SOM	VOA Associates	Serie+Multiply Architects	CubeInside Design Limited
3.	Concept	Campus within a building	Solving Land scarcity	Zero-energy building	A breathable campus.
4.	Total Area (sq. ft)	3,75,000 sq. ft	4,15,000 sq. ft	91,430 sq. ft	60,000 sq. ft
5.	Total Floors no.	16	32	6	10
6.	Built-in (year)	2014	2012	2019	2022
7.	Type	Vertical	Vertical	Vertical	Vertical
8.	Program Stacking	Lower Tower: Academic and gathering spaces Upper Tower: Dormitory	Lower Tower: Academic and gathering spaces Upper Tower: Dormitory	Lower Tower: Amenities and Academic Upper Tower: Academic	Lower Tower: Amenities and Academic Upper Tower: Academic
9.	Functions				
10.	Circulation	Vertically, Horizontally, and Obliquely.	Vertical (Compact Core) Four large high-speed elevators.	Long Single-Flight stairs connect the long corridors.	Symmetrical vertical central circulation system incorporating horizontal connectivity and the central void.

		 <p>Figure 6. Vertical Circulation of The New School University Center (ArchDaily, 2014).</p>	 <p>Figure 7. Section of Roosevelt University (world-architects, 2012)</p>	 <p>Figure 8. Connection and Circulation of the National University of Singapore (ArchDaily, 2019).</p>	 <p>Figure 9. Central Void (ArchiDiaries, n.d.)</p>
11.	Connectivity	<p>Connected through sky quads, stairs to connect diagonally</p>  <p>Figure 10. Connectivity (ArchDaily, 2014)</p>	<p>Elevators and stairs</p>  <p>Figure 11. Location of the core area (world-architects, 2012)</p>	<p>Glass facades create a visual connection</p>  <p>Figure 12. Visual connection (ArchDaily, 2019).</p>	<p>Multiple voids complement the courtyard.</p>  <p>Figure 13. Voids Connection (ArchiDiaries, n.d.)</p>
12.	Structure	<p>Steel frame and concrete core Split core</p>	<p>Steel frame and concrete core Off-centre core</p>	<p>Steel frame and concrete core Split core</p>	<p>Steel frame and concrete core Split core</p>
13.	MEP Strategies	<ul style="list-style-type: none"> <li>• Green Roof to reduce heat island effect</li> <li>• LEDs</li> <li>• Occupancy Sensor</li> <li>• 265-KW cogeneration plant</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanical Floor is located mid-tower.</li> <li>• Has four pipe systems and VAV systems (Groesback, 2013).</li> </ul>	<ul style="list-style-type: none"> <li>• Hybrid tempered ventilation system</li> <li>• LEDs</li> <li>• Occupancy sensor</li> <li>• Solar roof (500 MWH/yr)</li> </ul>	<ul style="list-style-type: none"> <li>• Corridors are naturally ventilated</li> <li>• Energy consumption is reduced using passive technique</li> </ul>
14.	Sustainability	<ul style="list-style-type: none"> <li>• LEED gold certification</li> <li>• Saves 31% more energy</li> <li>• Shingled cladding glass reduces heat absorption by up to 20% (ArchDaily, 2014)</li> </ul>	<ul style="list-style-type: none"> <li>• Cladding glass reduces heat absorption</li> <li>• LEED silver certification</li> </ul>	<ul style="list-style-type: none"> <li>• 1200 Solar roof panels, LEDs, 50% less energy using ventilation system technology (NZEB, n.d.).</li> </ul>	<ul style="list-style-type: none"> <li>• Light flows into the void naturally</li> <li>• Central void reverberates with the sun's movement</li> <li>• Designed for passive cooling corridors.</li> </ul>

## 5 Rethinking Public Universities to Go Vertical

The public universities of Bangladesh are breathable horizontal campus layouts, but it is high time to rethink the design and go vertical. Reviewing campus layouts is necessary to tackle and use the spaces effectively in a future pandemic outbreak. We must be ready to tackle the land scarcity problem and another pandemic attack. Suppose a vertical campus can accommodate an equal number of students in a small land area providing quality education and an environment for education. In that case, this innovation should be implemented in public universities to yield more students in education and research. A mixed layout approach can be considered where horizontal spaces are incorporated with vertical stacking of programs.

### 5.1 Concept of a Vertical Campus in Bangladesh

Based on the case studies and the findings, we can propose a concept of a vertical campus that can be implemented for the public universities in our country for maximum land use and sustainability and interactive quality education.

Based on a report of interviews with graduates from public universities and private universities, it is seen that both parties enjoy the greenery and connection with nature, and the way they perceive the green space is an escape from the robotic curriculum, and it keeps them fresh. Students from private universities miss out on this opportunity, and students from public universities have plenty. A sense of place uplifts the mood and creates harmony in the mind (Abrams, 2017). Research shows that green environments reduce stress. More connectivity and natural spaces are a significant challenge for vertical approach campuses in Bangladesh. Previous case studies and further research may help campus designers integrate connectivity, accessibility, and green spaces into high-rise buildings while emphasising sustainability for the building and its surroundings.

Vertical stacking plans may reduce the size of built areas, freeing more room for green spaces. Implementing an intelligent program layout and providing appropriate vertical height may save public institution building space. Most educational institutions were halted during the pandemic, and many spaces were idle. These spaces were ineffective in every way, and in a country where land shortage is inevitable, we must rethink our spaces to be

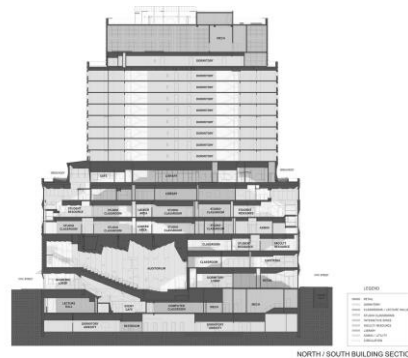


Figure 14. Section of University Center in New York (ArchDaily, 2014).

more multifunctional and efficient in thinking about the future. Implementing the lower floors of buildings for academic functions, such as multifunctional classrooms, cafés, libraries, and auditoriums, and the top segment should focus on creative issues, including architecture, URP, educational administrations and offices. If vertical stacking is employed to fit dormitories in a skyscraper, residential facilities will be on the top floors. The construction must have many openings and visual links to the natural world. This will help students and teachers feel at home. Hallways, patios, and classrooms need optical links.

Sustainable technologies, including solar panels, photovoltaic glass, kinetic facades, rainwater harvesting, grey and black water treatment, and stormwater runoff, are essential for building energy efficiency. This would effectively reduce the power costs, and the institutions will be more sustainable. Power-saving sensors are suggested. Due to their criticality, tall structures must prioritise fire safety (Kodur, Kumar and Rafi, 2019). The structure should be standard steel and concrete, and the building should be prioritised by natural sunlight and ventilation as much as possible. MEP strategies should be planned according to user needs and the site.

## 6 Conclusion

The rising demand for education makes land use optimisation crucial in our society. This study is novel in that it seeks to conceptualise a vertical campus as a potential solution to the land scarcity problem and the future expansion of public institutions in Bangladesh. A vertical campus's challenges will be implementing and adapting to our context. Sustainable design ideas, including passive solar design, energy efficiency, waste management, and eco-friendly materials, are used in the proposed idea to reduce its environmental effect and

promote sustainability. In architectural design, the concept of a vertical campus has been suggested previously. However, Bangladesh must prioritise research to execute the idea entirely.

Public institutions in Bangladesh should combine vertical and horizontal components to maximise land usage and generate a strong sense of place. Vertical campuses provide several advantages. These amenities boost campus productivity, space efficiency, and communication. Vertical campuses encourage academic cooperation and multidisciplinary interactions due to their small structures. This may also employ sustainable infrastructure and green building concepts, helping the environment and improving learning conditions. This needs careful architectural design, infrastructure planning, accessibility, sustainability, and community participation. Successful international and Asian case studies may help implementers overcome hurdles. To succeed, vertical campuses must collaborate with students, faculty, staff, and communities. This study suggests exploring the concept further to examine ideal space arrangements. Vertical campuses in Bangladesh are a paradigm-shifting way to overcome geographical constraints, improve operational efficiency, and create environmentally friendly educational environments. This is an opportunity to make significant changes in public institutions, giving kids the tools they need to succeed academically and personally. This idea might improve higher education in Bangladesh by reevaluating educational institution design.

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