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Vertical cities: A sought out future?

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Abstract:
At present, there is a total of one hundred and fifty million square kilometers of land available on the Earth's surface. This area of land is inhabited by approximately seven billion and eight hundred million people. These statistics indicate the world's population density, which measures approximately 59.27 per sq.km[1]. In other words, every square kilometer of land on Earth is occupied by an average of 59.27 humans, at any given point of time. Just 50 years ago, this value was 28.57 per sq.km[1]. In another 50 years, the world population density is predicted to be 76.77 per sq.km[1]. Although these numbers sound like complex jargon, what they mean is fairly simple. It means that while population increases exponentially over time, the surface of land on Earth will more or less remain constant. This is the context in which place-makers find themselves today. With more and more people migrating to cities every year[2], the discussion around Urban space shortage and efficient city-building is all the more relevant.
Over the years, architects, planners, designers, urban enthusiasts, scientists and academicians have dedicated their time and resources to this cause. Several projects have been attempted to overcome the shortage of Urban space, such as the creation of artificial islands, as in the case of Palm Islands in Dubai. Other projects that have been proposed include 'Above Below'(Matthew Fromboluti, 2010), a subterranean skyscraper in Arizona; and the 'The Gyre' (by the architectural firm Zigloo), a subaquatic "seascraper". However, no solution has been discussed, debated and promoted as the "Vertical City".

Keywords:
Population Density, Vertical Cities, Public Spaces, Global, Planning

Introduction

Ever since the advent of the skyscraper in American cities such as Chicago and New York in the late 19th and 20th centuries, there has been no looking back. Cities worldwide have looked skywards for a solution to problems of overcrowding, congestion, land shortage and overpopulation. It seems to be less complicated and more economical to build skyscrapers than to create new cities through the reclamation of land and water.

In its essence, 'Vertical City' refers to an entire human ecosystem that is contained in one or more massive skyscrapers. One of the early ambitious Vertical City proposals was that of the 'Contemporary City' of three million Inhabitants by the famous Swiss-French architect, Le Corbusier in 1922. It was designed to accommodate six times the population of Central Paris at the time. The central part of the site was reserved for twenty-four skyscrapers, each measuring an area of about 190m x 190m, and a height of over 200m. These buildings were to function as hotels and business centers, and were surrounded by residential districts that would provide accommodation for the people who worked in the skyscrapers. The entire built-up area of the 'Contemporary City' accounted for just 15% of the site area, and the rest of it was designated for gardens and open spaces. A three dimensional rendering of this proposal has been depicted below.

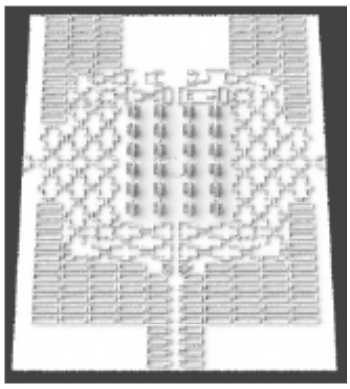

Fig 1: 3D rendering of Contemporary City (Source: "La Ville Radieuse" by Le Corbusier once again a case study, Marylene Montavon et al.)

Corbusier envisioned this city as a 'living machine' which organized the business district, the residential district, the transportation core and the high street shopping area in a Cartesian manner, as demonstrated in Fig 2. However, this project was never realized, due to the lack of financial support from the business sector at the time.

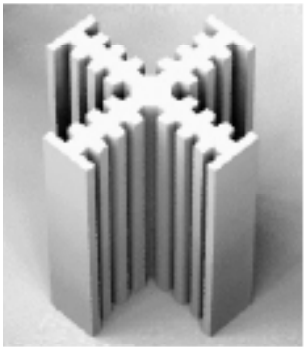

Fig2: 3D rendering of skyscraper (Source: "La Ville Radieuse" by Le Corbusier once again a case study, Marylene Montavon et al.)

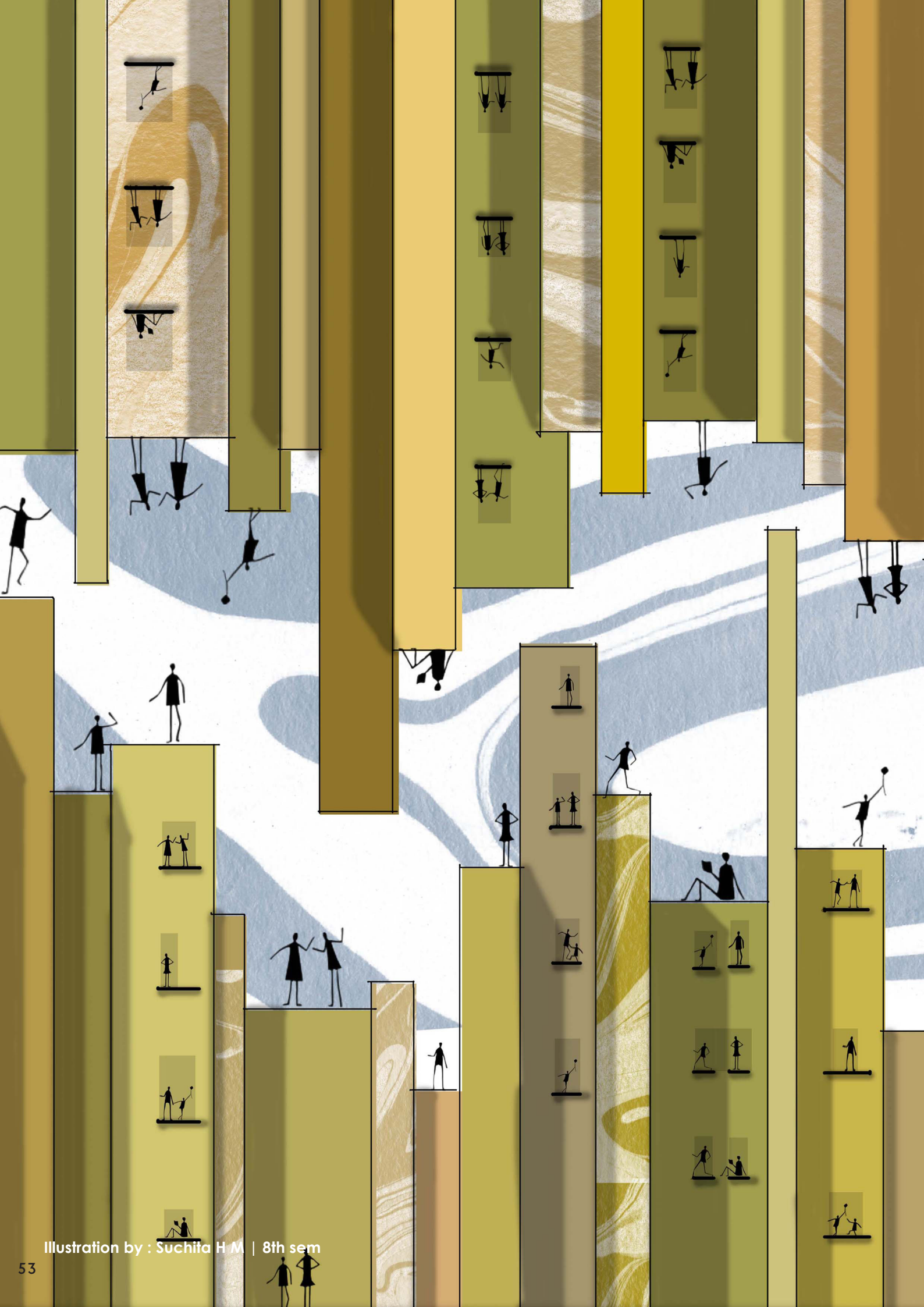

Illustration by : Suchita H M | 8th sem

This proposal was followed by several futuristic hypothetical studies that integrated technology with Vertical City, such as 'A Walking City', 'Living Pod', 'Plug-In City' and 'Instant City' by Archigram in the 1960's. These projects were not considered practical and economical enough to implement. However, some successful and ongoing attempts at Vertical Cities in recent years include the city of Hong Kong, The Raffles City in Singapore, and The Line in Saudi Arabia.

The Indian Context: Mumbai City

As of 2022, the population density of India is 431.11 people per square kilometer[1]. The city of Mumbai, in particular, has a density of 19,652 people per sq.km[3]. This makes Mumbai one of the most densely populated cities not just in India, but in the world. There are 237 buildings taller than a 100 meters in Mumbai, which puts the city on the league of having a vast number of skyscrapers; comparable to Shanghai and New York, which have 327 and 855 such buildings respectively.
In the paper titled 'Urban Layouts, Densities and the Quality of Urban Life' by Shirish B Patel et.al 2007, the authors observe that although Mumbai is often compared to New York by politicians, the context of the two and their requirements of floor space per capita cannot be compared.

The paper comments on urban planning in Mumbai, and the tools employed by the government of Maharashtra in the planning of the city. The article mainly focuses on three tools, namely; Buildable Plot Ratio (BPR), Floor space index (FSI), Public ground area (PGA), and Built up area (BUA).

The types of spaces that have been considered for the study have been listed below.
a) Private space, which includes home, family, and shared private space with neighbours.
b) Public space refers to those spaces which are shared by the wider public; people who aren't necessarily related. These may include open spaces, built spaces, pedestrian and bicycle spaces etc.
c) Arterial transport spaces refer to the transport arteries of the city, railway tracks and stations, expressways and arterial roads and bus ways.

The article proceeds to draw parallels between cities such as Mumbai, Delhi, Manhattan and Shanghai. For instance, the Built-Up Area (BUA) for residential and commercial buildings in Mumbai is within the range of 7.5sqm per resident per job. The lowest value is about 5sqm per resident per job. The BUA for slums is about 1sqm/capita on an average while in Manhattan it is 63.7sqm/capita, nearly 9 times the average of Mumbai.

Public spaces include spaces for common amenities, recreation and foot paths, roads and public parking. These spaces are together called PGA. The international norm for community spaces is 4 acres per 1000 population, that is, 16sqm of PGA per person. The PGA in other cities like Shanghai and Manhattan is much greater than that in Mumbai. It is observed that when politicians envision Mumbai on the same terms as Shanghai, they do not consider the amount of public areas that are available in the latter. Instead, they suggest an increase in FSI, which will reduce PGA and make the outdoor living environment much worse than its present condition.

The authors also reflect on the densities of the locality, both gross and global. For example, if a building of 1 hectare of buildable plot accommodates 2000 people at 5sqm/person, they would require a built up area of 10,000sqm. This gives an FSI of 1, which can be achieved in a G+2 height building, provided that 1/3rd of the land is occupied. If this is compared with the standard density of 65sqm/person as required in Manhattan, we would require 1,33,000sqm BUA. This would imply a building of 40 floors and a higher FSI. Thus, a higher PGA per capita requires a reduction in BPR. As density increases, the BPR will further reduce, and more FSI will be required to accommodate the population. At this rate, the future of Mumbai as a Vertical City is a huge possibility in the near future.

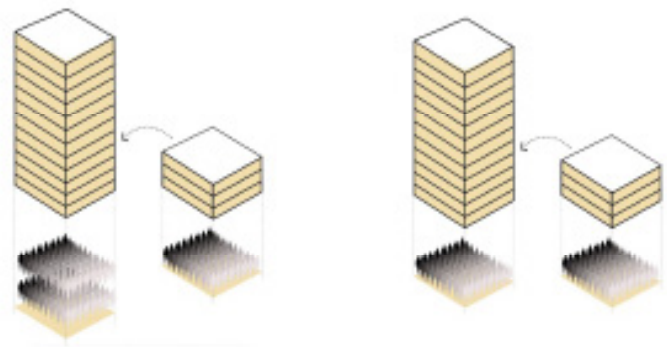

Fig3: The relationship between vertical growth and density of population

The two instances represented in Fig.3 represent the relationship between vertical growth and density in the context of Mumbai. The first instance depicts an ideal situation, wherein vertical growth must lead to a decrease in density and an increase in space per person. However, in reality, vertical growth is leading to an increased density and a decrease in space per person, due to the negligence of PGA and gross density.

Conclusion

One of the aspects of Vertical City that is slowly gaining traction is that of vertical farming or vertical gardening. Fig 4 represents two instances that help explain the relationship between the height of the building and the availability of green open space. It is observed that the low rise building with high density in the first instance seems to make more allowance for green space than the high-rise building with high density in the second instance. This contradicts the idea of vertical gardening as a solution to the increasing density and decreasing land parcels in cities.

Thus, the implementation of 'Vertical City' as a concept continues to be a complex process today. This is mainly because of the multitude of contextual and regulatory parameters that are to be considered in its design, some of which have been mentioned above. It also requires enormous financial and political support from the public as well as private agencies. In conclusion, the goal of the 'Vertical City' must not only be to minimize our intervention in the natural environment, but also to provide a healthy living environment for city dwellers.

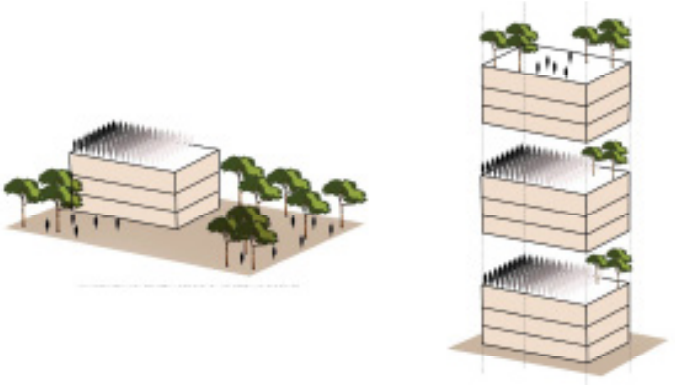

Fig4: The relationship between the height of the building and availability of green space

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