

Issue

Brief

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The Merits and Demerits of Skyscrapers: Learnings for India

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Abstract

Skyscrapers are typically constructed to meet the housing needs arising from increased urbanisation, but they may also fulfil national ambitions to display economic might. This paper examines the advantages and disadvantages of building skyscrapers to establish key learnings for India.

A skyscraper is an unusually tall, multistoreyed building that is continuously inhabitable.¹ The height of the structure is the primary feature that defines a skyscraper. According to Louis Sullivan, a 19th-century American architect often referred to as the ‘father of skyscrapers’, such buildings must have “the force and power of altitude...[and] must be every inch a proud and soaring thing, rising in sheer exultation from bottom to top without a single dissenting line.”²

There is no clear definition for skyscrapers, nor is there a universally accepted benchmark of what constitutes such structures.³ Indeed, the qualifying height for a skyscraper has changed over time;⁴ for instance, in the 1880s, the term was used to describe the Home Insurance Building in Chicago, US,⁵ which had 10 storeys (or was about 30 metres in height).⁶

The Council on Tall Buildings and Urban Habitat (CTBUH), a US-based non-profit global organisation concerned with tall buildings and focused on sustainable vertical urbanism,⁷ has ascertained three characteristics to identify such structures.⁸

The first standard is height relative to context. A building may be considered tall if it is “distinctly taller than the urban norm” (higher than the other structures in the city). For instance, a 14-storey building will be considered tall in cities with smaller structures, but not in ‘high-rise cities’ such as Hong Kong or New York. The second measure is proportion, wherein a building may appear tall even if it is not particularly high because it is slender. At the same time, ‘big-footprint buildings’ that are high may not be classified as tall due to their large floor area. The third characteristic is the inclusion or use of technologies that can be attributed “as being a product of “tall”.” This would now mean steel-framed construction and the inclusion of electric safety elevators that enables the easy transportation of people to the higher storeys.

Notably, according to the CTBUH, the number of floors in a structure is not the only appropriate indicator for a tall building as the floor-to-floor height may differ among buildings and across functions (for instance, between residential and commercial buildings).⁹

For tall buildings to be classified as skyscrapers, it is typically understood that they must be self-supporting (not requiring tension cables or supports to remain upright), must rise to a height of at least 150 metres (492 feet), and the

habitable floor space must be at least 50 percent of the structure's total height.¹⁰ As the heights of buildings have increased over the years, newer classifications have emerged—for instance, supertall skyscrapers (structures over 300 metres in height) and mega-tall skyscrapers (600 metres and more).¹¹

Still, given the lack of a standard benchmark, country-wise classifications for high-rise buildings differ. For instance, India considers buildings that are 15 metres and more in height as high-rises, irrespective of their occupancy (according to the 2016 the National Building Code),¹² while China defines supertall buildings as structures with a minimum height of 100 metres (as per the 1995 Code of Fire Protection Design of Tall Civil Buildings).¹³ The term 'skyscraper' is evidently not yet commonly used in many Asian countries.

Skyscrapers may serve one or more specific urban need or function, such as commercial, residential, industrial, or institutional.¹⁴ A single-function skyscraper is one where 85 percent or more of its total height is dedicated to a single function,¹⁵ while a mixed-use structure will contain two or more functions, such as office space and residences.^a

This brief examines the factors that may drive the construction of skyscrapers, and the merits and demerits of building such structures.

a Support areas, such as car parks and mechanical plant spaces, do not constitute mixed-use functions.

The Rise of Skyscrapers

Two broad factors provided impetus to the construction of skyscrapers in the West—economic growth and urbanisation, and developments in construction technology. Economic growth in the US,¹⁶ the UK,¹⁷ and other western countries led to rapid urbanisation. Rising human densities in cities accentuated the demand on urban business and residential areas, which gave rise to the need to capture vertical space into structures as a solution. Building vertically also addressed issues like land limitations.

At the same time, innovations in construction technology enabled architects to abandon masonry techniques in favour of cast-iron and wrought-iron frameworks to support the weight of higher floors,¹⁸ which in turn was replaced by steel, a lighter and stronger material.¹⁹ The emergence of the safety elevator further encouraged vertical growth as it became convenient and safe for people to be transported to higher floors.²⁰ Over time, other issues like overheating, strong winds, and excessive light were resolved through the development of new cooling techniques, the use of glass for light, and innovative structural design to counter high winds.

The US was a pioneer in the construction of skyscrapers, with several cities building tall structures. By the beginning of the 20th century, New York City had little scope for horizontal growth, and technological advancements in construction methodologies led to a surge in the development of high-rise buildings.²¹ However, the rush to build such structures in the US diminished in the latter part of the 20th century, and in the first two decades of the 21st century, only six commercial towers over 300 metres were constructed.²²

Still, the construction of skyscrapers globally increased by 402 percent between 2000 and 2018,²³ on the back of a boom in Asia. In 2021, the continent had 80 percent of the world's skyscrapers, with China home to 3,500 of Asia's 7,500 skyscrapers.²⁴

However, many skyscrapers are now being built as a display of a country's might and abilities. For instance, China's rapid economic growth, frenetic urbanisation, and desire to showcase its technical ability in erecting tall buildings propelled it to construct many skyscrapers. In the last three decades, China has built more skyscrapers than the US constructed in the entire 20th century.²⁵

Another example is the United Arab Emirates (UAE), home to the Burj Khalifa, the world's tallest building (828 metres).²⁶ The Burj was primarily built as a showcase of the UAE's financial might²⁷—indeed, the top 244 metres of the building (29 percent of the structure's total height) are not usable and were only built to make the Burj the tallest structure globally.²⁸

Global Experiences

Even as countries around the world have built tall residential and commercial structures over the past few decades, there has been some hesitance in such construction in recent years, particularly in China. The country's experience with the 632-metre Shanghai Tower²⁹ can in part be credited for this reluctance.³⁰ The tower, built between 2008 and 2015, faced numerous challenges on completion.³¹ First, there were delays in obtaining occupancy permits and a no-objection certificate from the fire department (mainly because, at that time, China did not have fire safety standards for buildings exceeding a height of 600 metres³²). By mid-2017, only 60 percent of the office spaces had been leased, primarily due to the high rents and the building's design (the twisted glass façade was ideal to offset wind loads but meant large areas of space were unusable space), forcing many businesses to look for cheaper alternatives.³³ In 2020, major water leakages between the ninth and sixtieth floors of the tower resulted in the destruction of large quantities of office equipment and electronics.³⁴

At the same time, the subsidence^b of the Shanghai area became evident, with many experts attributing this to the construction of numerous high-rises and the massive extraction of groundwater.³⁵

An April 2020 decree by China's central government halted the "blind planning and construction of super high-rise skyscrapers" to "further strengthen the urban and architectural features".³⁶ The construction of structures over 500 metres was forbidden and those over 250 metres were restricted unless absolutely necessary.³⁷ While the ban was partly fuelled by an oversupply of office space in Chinese cities due to the number of skyscrapers constructed, it was also triggered by quality and safety concerns.³⁸

^b Land subsidence is a gradual settling or sudden sinking of the Earth's surface on account of underground material movement.

The Rise of Skyscrapers

Notably, even as countries around the world have built and learnt lessons from their experiences with skyscrapers, Europe has so far avoided any such boom. Over 60 percent of the region's skyscrapers are located in just five cities—London (UK), Paris (France), Frankfurt (Germany), Moscow (Russia), and Istanbul (Türkiye).³⁹ Among the reasons advanced for this reluctance to build high is that the skyscraper trend came about much after many European cities had largely been built,⁴⁰ and many European countries did not want to build tall structures and erode their way of life.⁴¹ Additionally, the experiences of Belgium's Brussels—which saw many historic structures razed and replaced by modern high-rise buildings in a disorderly manner, in what has been termed as 'Brusselization'⁴²—have served as a warning to other European cities.

Although some observers expect Europe to see a period of skyscraper development,⁴³ an ageing populace and low or negative population growth in most countries in the region coupled with economic slowdown means there is no real demand for such tall buildings (either to satisfy a space shortage or as a display of economic might).

“Two broad factors provided impetus to the construction of skyscrapers in the West—economic growth and urbanisation, and developments in construction technology.”

The Pros and Cons: Lessons for India

Although many Indian cities have very high human densities, there are only a few skyscrapers in the country.⁴⁴ Most of India's tall buildings are in Mumbai, but all are below 300 metres in height, primarily due to the low floor space index (FSI) in Indian cities.⁴⁵ FSI prescribes how much can be built on a plot of land; it is the ratio of the total floor area of a building on a plot of land to the size of the plot. A low FSI results in a low volume of construction on a plot of land, thereby limiting the profitability of any project.⁴⁶ FSIs in India are among the lowest globally—for instance, Hong Kong's FSI is 12, Manhattan's 15, and Singapore's can go up to 25,⁴⁷ but Mumbai's FSI has only recently been raised to between 2.5 and 5.⁴⁸

Other challenges in constructing tall buildings in India are that they are not economically viable for most of the population, and due to the infrastructure burden they place on the state (for instance, to provide for electricity supply).⁴⁹ Additionally, many Indian cities, including Delhi and Ahmedabad, are located in seismically active regions.⁵⁰ Building earthquake-resilient skyscrapers will increase the costs and make them even less affordable, even for the high-income groups.

Still, there are many advantages and disadvantages to constructing skyscrapers in India.

The principal argument in favour of skyscrapers is that they use limited land area but provide more living, working, business, and recreational space. As urban population densities rise and land becomes scarcer, it is best to maximise the use of land by building tall to address housing shortages and business space constraints by taking advantage of technological and architectural advancements. This is a better alternative than cities expanding horizontally, eating into agricultural space to reach all city infrastructure.⁵¹ This is especially true for countries where arable land is scarce and so must be protected from being diverted to other uses. As India rapidly urbanises, its cities will be under intense pressure to provide for the incoming population. It would, therefore, be advisable to build tall rather than compromise food sustainability by consuming rural agricultural land. At the same time, India can also consider promoting technology solutions—such as rooftop farming techniques—to offset any loss of arable land.⁵²

The Pros and Cons: Lessons for India

Skyscrapers have also proved to be tourist attractions. Visitors to the Burj Khalifa, for instance, have eclipsed those to Buckingham Palace in the UK and Disneyland.⁵³ The 15 most popular tourist attractions worldwide include several other tall structures such as the Empire State Building and Freedom Tower in New York City, CN Tower in Toronto (Canada), and the Eiffel Tower in Paris (France).⁵⁴

Skyscrapers that are devoted to business and commercial activities are more suitable as having many activities near each other allows for a larger volume of transactions, thereby supporting greater city productivity, makes city transport more efficient, and reduces the carbon footprint.⁵⁵ A clustering of tall buildings will also encourage transit-oriented development. Cities can build their transportation network to service these buildings with the aim of largely eliminating the use of personalised vehicles. At the same time, increased usage of mass transit options will raise the fare box collections of the transportation network. A further positive of skyscrapers is that their limited footprint on a plot means there will be plenty of land area open for green and public spaces, thereby improving city openness.

At the same time, skyscrapers also have several drawbacks. They impact liveability in cities by separating people from the streets and limiting their spontaneous social interactions, which are crucial to the vigour of a city and for the creation of social capital.⁵⁶ This has the opposite effect of public spaces. At the same time, many modern tall buildings include amenities such as parks, swimming pools, gymnasiums, and meeting spaces where residents can interact and socialise.⁵⁷

The taller the building, the more expensive the construction. As such, the tallest buildings tend to be luxury units, often for the elite.⁵⁸ Skyscrapers do not add to the stock of affordable housing or affordable business space, which are in short supply in Indian cities. Tall buildings inflate the price of adjacent land, thus making affordable housing less achievable⁵⁹ and increasing inequality. Since many cities in India are in high seismic zones, any new construction of skyscrapers will need to be resilient to earthquakes. Although the 2005 National Building Code has incorporated the requirements of an earthquake-resilient structure, their observance is estimated to increase construction and overall costs by about 17 percent,^{60,61} making skyscrapers even more elitist.

The Pros and Cons: Lessons for India

Although some skyscrapers are tourist attractions with several resultant benefits, only a limited number of tall structures draw tourists.⁶² Some tourism experts have described skyscrapers as creating unpleasant contexts for urban tourism⁶³ by contributing to poor leisure, an aspect at the core of recreational and cultural experiences.

High-rises can also negatively impact the setting appeal of listed heritage buildings and conservation areas.⁶⁴ For instance, the construction of a skyscraper (with its unique height and design characteristics) in a heritage area, where the uniformity of height and architectural design among numerous structures creates a certain visual aesthetic, will destroy the appeal of the precinct.

Additionally, skyscrapers, like other buildings, require significant maintenance, including continuous power supply (so elevators can function), waste management, and regular water supply.⁶⁵ Importantly, skyscrapers are not entirely environmentally friendly. These huge structures of glass and steel are hard to heat or cool.⁶⁶ For instance, electricity use per square metre of floor area was nearly two-and-a-half times greater in high-rise office buildings than in low-rises, while about 40 percent more gas was used for heating tall buildings, resulting in double the carbon emissions.⁶⁷ While the figures for heating may be lower in India, given the marginal heating requirement in most cities in the country, the cooling requirements are far larger. However, developers are adopting many innovations for a lower energy footprint.⁶⁸ For instance, in Singapore, several skyscrapers are enveloped by vegetation.⁶⁹ Similarly, the Bahrain World Trade Centre with 250 floors has installed three air turbines for generating green energy for its 250 storeys.⁷⁰ Another development is the emergence of wooden skyscrapers,⁷¹ a concept that is yet to be fully explored. India can adopt similar innovations for its tall buildings.

Some claim that a high-rise built environment promotes more sustainable urbanisation, but this is not an entirely accurate picture if all emissions from the beginning to the end of the construction are computed.⁷²

Notably, skyscrapers can also be targets for digital war or acts of terrorism, as was seen during the September 2001 terror attacks that brought down the twin towers in New York City. Targeting skyscrapers in such attacks serves the purposes of causing heavy destruction to human and material.

The National Commission on Urbanisation (NCU, set up in 1986 to assess the process of urbanisation and facilitate the formulation of related policy) favoured decentralised urbanisation to equitably distribute the fruits of economic growth in India.⁷³ It identified 329 cities as potential centres “capable of generating economic growth”⁷⁴ in a bid to relieve few cities from being burdened with unmanageable densities. However, rapid urbanisation in a few cities meant India had to consider building tall to provide space for its people and businesses.

Still, given the imperatives of climate change and city sustainability, there remains a strong case for limiting human density in cities to a manageable level, as the NCU had recommended. Further, skyscrapers have many disadvantages, including their vulnerability in the event of modern-day conflicts and, as such, are not advisable for India. India must prioritise other issues—such as urban planning, urban governance, urban environment, and urban equity—that need both time and resources. As such, there is little justification for the high-cost construction of skyscrapers. ORF

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