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Distribution trend of high-rise buildings worldwide and factor exploration

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Abstract. This paper elaborates the development phenomenon of high-rise buildings nowadays. The development trend of super high-rise buildings worldwide is analyzed based on data from the Council on Tall Buildings and Urban Habitat, taking the top 100 high-rise buildings in different continents and with the time development and building type as the objects. Through analysis, the trend of flourishing of UAE super high-rise buildings and stable development of European and American high-rise buildings is obtained. The reasons for different development degrees of the regions are demonstrated from the aspects of social development, economy, culture and consciousness. This paper also presents unavoidable issues of super high-rise buildings and calls for rational treatment to these buildings.

1. Introduction

With the economic and social development, skyscrapers have sprung up like mushrooms after rain. High-rise buildings neither evolve from medieval European churches nor originate from ancient Asian wooden towers. Rather, they appear along with social development, population growth and land tension. In the European and American history, the development from the original Chicago School of Architecture to the Empire State Building in New York completed in 1931 is realized within only decades of years, indicating a qualitative leap of the human ability in building high-rise buildings.

Super high-rise buildings are the result of complex social activities. The attitudes to these buildings are worth pondering. The developed European and American countries are still building various super high-rise buildings, like the 541.3 m high One World Trade Center of New York. Besides, the development of the high-rise buildings is also embodied in lands outside Europe and America, such as the 632 m high Shanghai Tower in China and the 828 m high Burj Khalifa Tower in Dubai.

Generally, buildings higher than 100m are called super high-rise buildings. As the study objects of this paper are higher than 100 m, this study can be regarded as one oriented at super high-rise buildings. According to data issued by the Council on Tall Buildings and Urban Habitat in 2016, 76 buildings of the top 100 high-rise buildings finished worldwide are built in Asia. The global super high-rise building database displays the development track of super high-rise buildings worldwide today, including ranking of the newest super high-rise buildings and their change trends, etc. Based on data from the super high-rise building database, this paper depicts and analyzes the current distribution situation of super high-rise buildings worldwide nowadays through chart summaries, and further analyzes the reasons.



2. Distribution trend of high-rise buildings worldwide

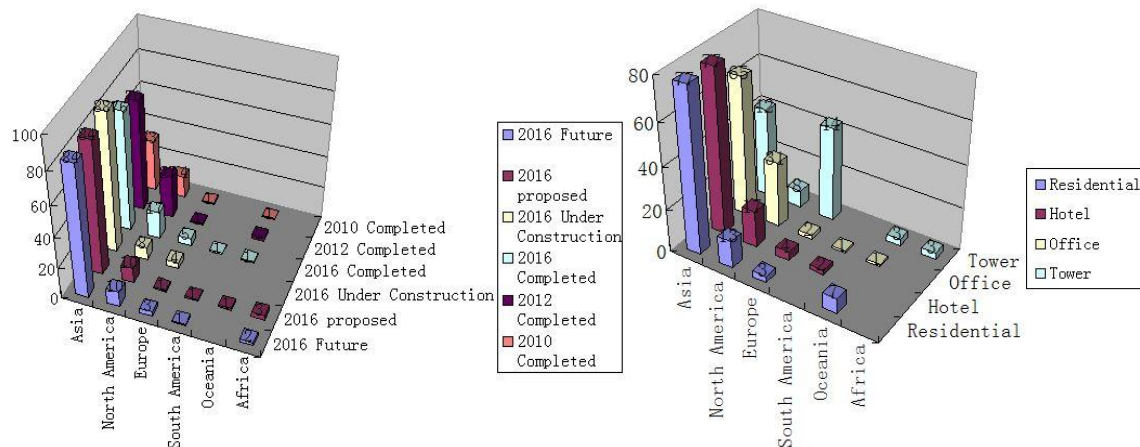


Figure 1. Buildings rank - by year

Figure 2. Buildings rank - by type

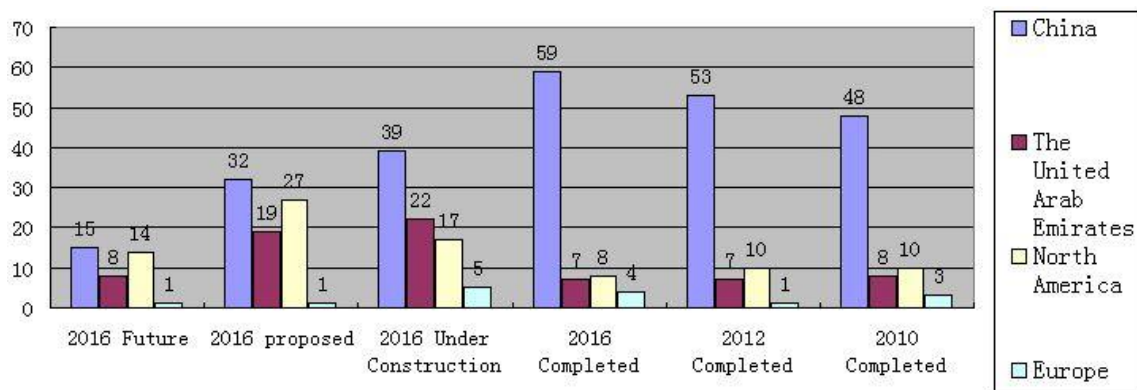


Figure 3. Quantitative comparison of tall buildings

2.1. Distribution of top 100 super high-rise buildings in the continents

As shown in figure 1-3, in terms of the absolute quantity of super high-rise buildings completed by 2010 or predicted super high-rise buildings to be built after 2016, Asia takes up the most majority. While comparatively Europe and America, the origins of high-rise buildings have less high-rise buildings, with the number reaching a single digit in Europe. South America, Oceania and Africa have even less, hardly any one in particular.

The changes in the building quantity of high-rise buildings in the continents are as follows. The quantity in Asia rose to an absolute advantage quickly and then keeps a stable development, with the fastest growth years being 2010-2012. The building quantity in North America was reduced quickly after 2012, and then was kept with a stable proportion. The development track of high-rise buildings in Europe is similar to that of North America, with the quantity tending to keep at the stable level after reaching a certain number in 2016. The ranking of South America and Africa grew from zero, while the ranking of Oceania grew to zero.

2.2. Distribution of top 100 various types of super high-rise buildings in the continents

In terms of super high-rise residential buildings, hotels and office buildings, and even towers, Asia again takes the quantitative superiority. There are a certain number of super high-rise office buildings in North America, while other types of buildings are conventional. Among the top 100 various types of super high-rise buildings, European towers occupy the most. South America does a better

performance in hotels and office buildings, while Oceania has an advantage in terms of residential buildings. Africa has only three towers ranked at the top 100 super high-rise buildings.

China outnumbered in the number of super high-rise buildings, while the United Arab Emirates is catching up. The proportion of four countries and regions all kept rising from 2010 to 2016, but after 2016, the proportion of China dropped, that of the United Arab Emirates kept unchanged in absolute number, that of the United States maintained stable after dropping to some level, and that of Europe maintained stable after rising to some level. In fact, the absolute number of the four systems will drop in the future because there are more super high-rise buildings in the third world countries.

2.3. Development centre will shift to Asia Pacific region with focus on China

Asia Pacific region's terrain has its own features. General speaking, Asian and Pacific countries' strategic locations are main cities along natural coastline and ports, which are subject to limitations by ocean, volcano and rugged terrain in natural conditions" [1]. As shown in figure 4-5, Asia Pacific countries are experiencing a rapid urbanization process. Asia Pacific region has huge population pressure. World's population density focuses on Asia Pacific and Europe.

Regions across China differ: Beijing's super high-rise buildings are the least because of protection of Beijing's style and features; the 2010 World Expo stimulated Shanghai's construction and super high-rise buildings should play its role as a symbol of city; super high-rise buildings are widely seen in the Pearl River Delta because the region pursues pragmatic culture and focuses on economic benefits.

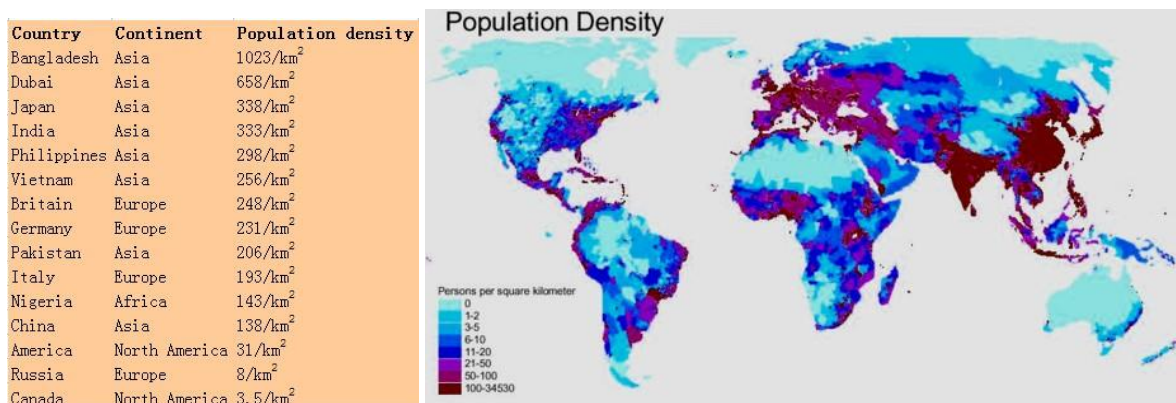


Figure 4. Population density in some countries **Figure 5.** Sketch map of world population density

3. Analysis of reasons for distribution trend of super high-rise buildings.

3.1. Reasons for prosperity of super high-rise buildings in China

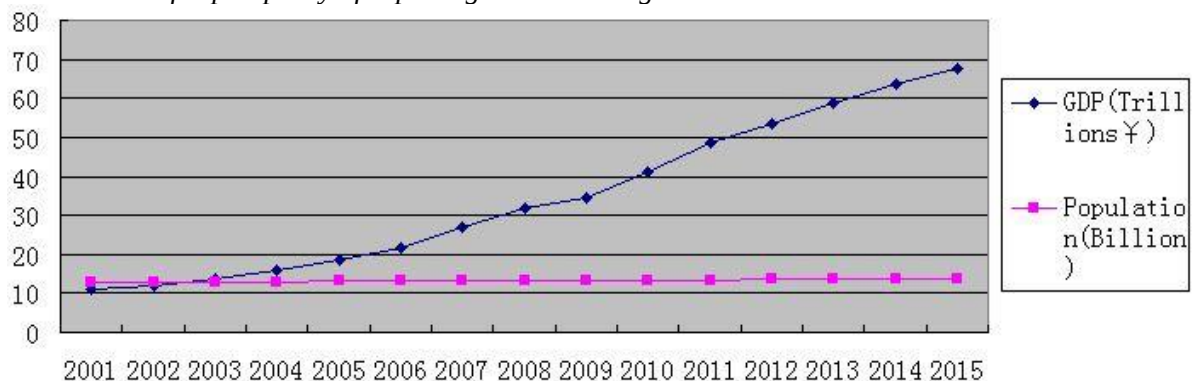


Figure 6. GDP and population in China in recent years

3.1.1. Long-standing national awareness. It is well known that building socialism has always been a development route recommended by the nation. High-density and massive construction for making more people have space to live has always been an ideal objective for construction. Unlike decentralism in many European and American countries, the awareness turns many resources into small big cities, resulting in more buildings in cities and increasing urban-rural gap. Urban-rural gap leaves fewer choices to people and people must go to urban city if they want to survive and seek development. If high-density dwelling districts are not established in downtown, people must commute for hours to work in cities, which is not supported by the nation and the government.

3.1.2. Economic needs and land productivity. As shown in figure 6, China's economy has seen rapid development over the past few decades, but its GDP heavily depended on land tax. Land tax depends on property. Government gains profit from property, while property earns a profit from people. The same land parcel with a higher plot ratio means more GDP will be created. Land productivity can boost growth of house prices. High house prices can also result in problems such as basic salary, social insurance and pension cost. The chain reaction that affects and harms mutually has driven economic development. Using the same land parcel to build more houses means that more money will be gained. China's economy and super high-rise buildings have seen rapid development over the past more than ten years.

3.1.3. Policy stimulus---the 4 trillion plan. In order to deal with economy crisis, Chinese Government had launched 10 measures to further expand domestic demands and promote a stable and rapid growth of economy on November 2008, among which the expenditure on government-subsidized housing, rural infrastructure and major infrastructure projects has exceeded half of the sum total, amounting 2270 billion Yuan. The central enterprises which got money had no alternative choice but to register the real estate enterprises. The input of high-rise building is greatly larger than that of multi-story building, but high-rise building is still supposed to be more "profitable" in consideration of the high land cost [2]. While the land development has directly led to the fast increase of land price which has made more and more high-rise buildings the choice of social construction so as to adapt to the expensive land price. The density of high-rise building is closely connected to the cost of land [3].

3.1.4. Mass culture and faith loss. The order of "collectivism" in Chinese culture. The high-rise buildings have gradually been accepted as a model as well as a representation of wealth and urban identity. The truth is as Mr. The mind of rivalry has made the urban building a new standard for success. Besides the public acquiescence and acceptance are also the prerequisites for the prosperity of high-rise buildings.

3.2. The Reason for the flourishing of super-high-rise buildings in United Arab Emirates

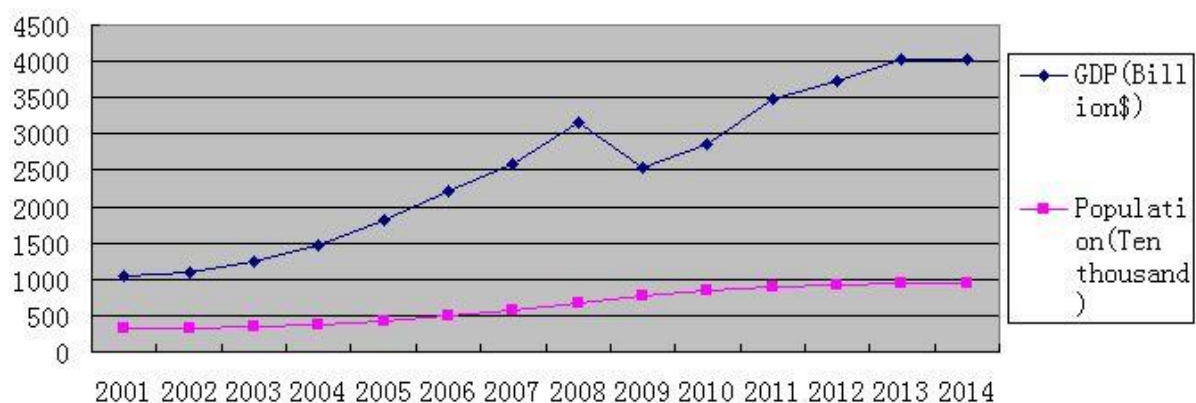


Figure 7. United Arab Emirates GDP and population in recent years

3.2.1. The ideology of “To be Number One”. Dubai has the greatest passion for “being the first” and people there believe that it is they who should break their own records. The chief of Dubai once said that in this world no one can remember who is the number two, Dubai must be the number one.” The mind of “to be number one” has been inspired and activated when the ex-Dubai leader visited the Empire State Building in United States. Influenced by the 2008 financial crisis, Dubai’s once rapid economic growth rate has slowed down in recent years. Facing the competition between developing countries in super-high-rise building construction, the European and American countries call it “meaningless number competition games”. It seems that the Middle Eastern countries are determined to compete and compare in many respects with China. As shown in figure 7, The GDP growth rate of the United Arab Emirates are faster than that of population growth, which is similar to China, thus this is also one common reason for the rise of super-high-rise buildings.

3.2.2. The reverse thinking of urban transformation. It is a misunderstanding that the gather of United Arab Emirates’ super-high-rise building is the result of the push of oil economy. The function of oil economy has been exaggerated since the oil revenue is only 2% of Dubai GDP. The Dubai 2020 World Expo has strengthened its determination to present its World Number one image. By building a fabulous city image, they hope that they can impress the world people so as to promote its development of tourism, commerce and other sectors. Given the fact that the development of resources economy won’t go further, one long-term mind for Dubai’s development is to successfully realize its transformation before oil depletion. Against the background that counter-urbanization are ubiquitous in the major world cities and old capitalist countries, the leader of the United Arab Emirates is going to build a world-class metropolis.

3.3. Analysis of the reasons for the relative decadence of high-rise buildings in Europe and America

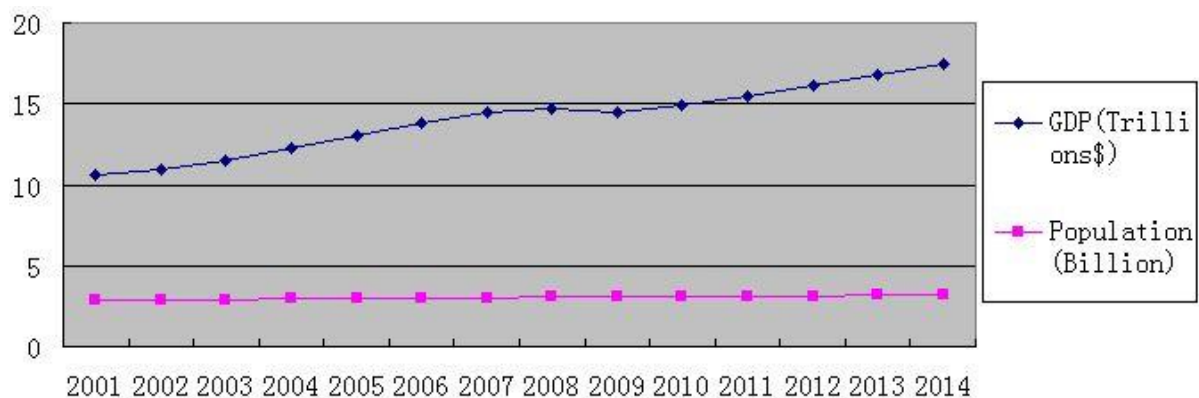


Figure 8. U.S. GDP and population in recent years

3.3.1. Rational choice of anti-urbanization. Why high-rise buildings in Europe and America witnessed a relatively significant decline compared to those in other regions of the world? Beginning in 1970s, within twenty or thirty years after the WWII, Americans downplayed for big cities. The middle class often lived in multi-storey apartments or villas at suburbs. In Europe and America, people tend to pursue a better environment and a free life. As shown in figure 8, GDP growth in the United States is relatively slow; the growth rate of its population is not conspicuous. So, the development of super high-rise in America is quite different from that in China and the United Arab Emirates (UAE).

4. A rational view of super high-rise buildings

4.1. Unavoidable flaws in high-rise buildings

Nowadays, super high-rise buildings in China and the United Arab Emirates are developing rapidly. Super high-rise building is a mirror of one country's economic strength and technological progress. But nowadays, high-rise buildings are keeping increasing. They are getting higher and more densely distributed. This might not be a good phenomenon. Super high-rise buildings cannot deviate from human scale and their behaviour. Limited by materials, technology and economy, super high-rise buildings should have their most appropriate height and scale.

At present, 300-meter is regarded as the minimum reasonable height. Elevation change from lower to higher workplaces may increase worker heart rate and physical workload, while decreasing visual sensitivity [4]. Tall buildings spoil traditional urban pattern and pleasant scale. The compacted high-rise buildings makes people lose themselves, the recreational apartment with a courtyard has virtually become a memory. High-rise buildings have hindered communication among people, and the sight of happy neighbors getting along well with each other will never return. The high-rise buildings have impeded people's access to the nature, and people tend to be lazy as they rarely go out of their houses.

4.2. Moderately restraining high-rise buildings

The prosperity of the high-rise buildings is an unavoidable stage for cities, but it is actually a detour of rational development after urbanization. The over-growth of the super high-rise buildings is negative. It can be thought that it is better accepted in societies being insufficient in democracy and freedom to make choice. The government takes the lead and the people follow, and then the whole city will be crazy for high-rise buildings.

The strategy is realized by two methods: control and release. Control population is the radical method to increase the land area per capita. Narrowing the gap between rural and urban areas helps to improve the housing quality in rural areas. Modern municipal facilities should be applied in multi-storey buildings in an appropriate way. The government should release housing construction authority, and allow more people to build their own houses. If the economic gap between the urban and rural areas is narrowed, and the suburban environment can be improved, urban pressure will be relieved. The upsurge of super high-rise buildings can return to a rational level.

5. Conclusion

Distribution of super high-rise buildings in the world, and their development background and reasons were analyzed based on the data from the Council on Tall Buildings and Urban Habitat. Super high-rise building in the world is witnessing its rises and falls: once its cradle regains its reason in Europe and America, the Asia Pacific region is booming its "super high-rise building". The social and economic base, institutional policies, cultural customs, and even the individual preferences of leaders can influence the form of the country's architecture. The ultimate aim of architecture is to offer healthy and cozy habitats. Thus, super high-rise buildings shall meet the new standards and needs, conforming to "integration, cluster and ecologicalization" [5]. So economy should not be the only focus in architecture. We should take a comprehensive views in design buildings and treat super high-rise buildings rationally.

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