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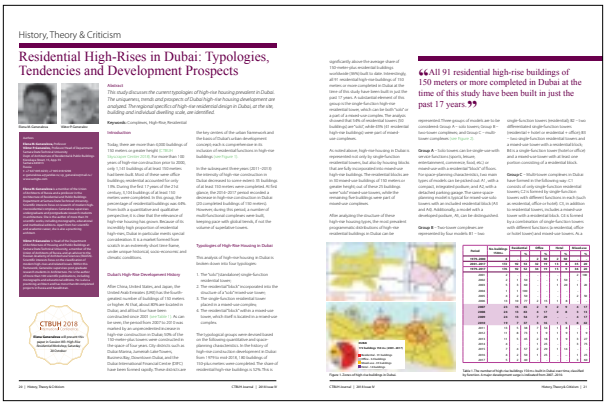

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> “Just as the private car will disappear as a form of urban transport, the formal and unadaptable monocentric monopolies will be consigned to history, admired by tourists, but dead as civic economic generators.”

William Murray, page 44

Global News

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Americas

New York continued to enthrall the tall world with project completions and milestones. The tallest tower in the Hudson Yards mega-development, the Kohn Pedersen Fox (KPF)-designed **30 Hudson Yards,** topped out at 387 meters, while permits were filed for a 43-story hotel building at **450 11th Avenue,** just a few blocks away. In Midtown, the Museum of Modern Art-adjacent **53W53 topped out,** while **550 Madison,** the former AT&T Building, became the youngest building ever to become a city landmark, temporarily halting controversial remodeling works that had already gutted part of its interior. The move should prevent its distinctive pink granite base from being stripped down to the structure and wrapped in glass. Meanwhile, downtown, **3 World Trade Center,** the supertall office building designed by Rogers, Stirk Harbour + Partners, officially opened for business, eight years after starting construction.

Miami's skyline was looking adventuresome, with the introduction of a Bjarke Ingels Group (BIG) design for the **Miami Produce Center** in the industrial district of Allapattah, an eight-building development outfitted with residential units, offices, retail, a hotel, a school, and a parking garage. The interconnected buildings, with their exposed floor plates, tilted walls, and angular views, are laid out like a horizontal game of Jenga – some reaching as high as 19 stories. Closer to downtown, the tulip-shaped **Sterling/Okan Tower** was to begin construction, its US$300 million price tag to be picked up entirely by Turkish businessman Bekir Okan. The 271-meter tower is to contain 153 residential condo units, 236 condo-hotel units, a 294-room full-service hotel and 8,361 square meters of office and meeting room space.

In **Toronto,** excitement ran high for two new proposals from Chicago firms. Adrian Smith + Gordon Gill Architecture offered **160 Front Street,** a 240-meter office building that is designed to achieve LEED Platinum and WELL Building Standard certifications. Construction is to begin in 2019, with completion set for 2022. Meanwhile, Studio Gang proposed **One Delisle,** a residential tower comprised of hexagonal prism shapes. Its stepping-back pattern is expected to help the building achieve good energy and thermal performance, meeting the City of Toronto's ambitious Tier 2 Green Standard target.

Good news continued to emanate from **Detroit,** once the poster-child of American urban decay. It was announced that **Chemical Bank,** a major regional institution, would move 500 employees into a new 20-story building in the city's downtown.

A small development spurt is underway in **Chicago**'s Hyde Park neighborhood near the University of Chicago, where the Studio Gang-designed residential tower **Solstice on the Park** has now completed. The recessed windows of its signature southern wall are slanted at precisely 72 degrees, the angle at which the sun's rays beat down on the day of the summer solstice. The arrangement, which shades the living space behind the angled windows, aims to ward off blinding light and the blistering heat that makes people turn on the air conditioner.

Big plans were afoot in **Los Angeles,** where it was announced that a supertall tower at **333 South Figueroa Street** had been proposed,

Solstice on The Park, Chicago. © Butler Adams

30 Hudson Yards, New York – recently topped out. © Related Oxford

Miami Produce Center, Miami. © Bjarke Ingels Group

Alvear Tower, Buenos Aires. © Nuevo Madero

Atrio Complex, Bogota. © EEIM (cc by-sa)

Government Civic Center, Tegucigalpa, Honduras. © SAPP

which at 338 meters would be just two meters higher than the city's current record-holder, the **Wilshire Grand.** The proposal would convert the existing 14-story, 1980s-era hotel tower on the site into 224 apartments, while adding the new 77-floor tower at the northeastern corner of the site, which would contain 242 condominiums and 599 hotel rooms.

Seattle was also giving new life to older projects. The city's famous **Space Needle,** constructed in 1962 for a World's Fair, received a one-of-a-kind rotating glass floor as part of its renovation. Visitors can now walk, stand, sit or stretch out on the new floor and look down on the Space Needle's architecture, the elevators and their counterweights.

Fate was not as kind to **Vancouver**'s 1973-built **Empire Landmark Hotel,** a 40-story edifice that also once held a revolving restaurant. The building is being replaced by the **Landmark on Robson,** which will be comprised of 237 market-rate condos and 57 social housing units in two high-rise towers of 28 and 30 stories, respectively, with retail and office space in a three-story podium.

In **Buenos Aires,** construction is underway on a 235-meter high-rise that could become Argentina's tallest, if not the third- or fourth-tallest building in South America, depending on the completion dates of contending buildings in Brazil and Colombia. The **Alvear Tower** will have 54 floors, as well as a rooftop common space. Some of the 180 units will have private pools.

One of those contending buildings may be **FORZA Tower,** in **Bogota,** designed by ODELL, which would include Class "A" office space, a five-star hotel, managed apartments and retail, rising to a height of 116 stories and 460 meters. Not far away, but considerably further ahead in terms of progress is the under-construction **Atrio Complex,** designed by Rogers Stirk Harbour + Partners, whose 201-meter north tower is already well underway. The south tower had not yet broken ground at press time, but it would rise to 268 meters.

Further north, a new mixed-use building, **DAO Panama,** consisting of commercial, office and residential space, will be developed in Bella Vista, a subdivision of a district in **Panama City.** Amenities in the 62-story, 320-apartment building are to include a green walking trail, gym, pool, poolside bar, a sauna, and a barbecue area.

In **Tegucigalpa,** the capital of Honduras, tall aspirations took on civic overtones, as citizens commemorated the construction of the **Government Civic Center** reaching halfway to its ultimate 24-story height. The massive complex will house 37 state institutions and some 3,600 parking spaces; 9,000 public employees will be transferred to the new buildings upon completion.

Asia and Oceania

The first Hotel Indigo in New Zealand is planned to open at **51 Albert Street, Auckland,** in 2021 after hospitality company Intercontinental Hotels Group (IHG) signed

THEY SAID

"I differentiate between risk and consequence. Sure, falling from this building is high-consequence, but, for me, it's low-risk."

Alex Honnold, on climbing the 213-meter Jersey City Urby without ropes or supports. From "Alex Honnold Climbs Halfway Up a New Jersey Skyscraper," The New Yorker, September 7, 2018.

A Permeable and Polycentric Urbanism

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James Von Klemperer is president and design principal at Kohn Pedersen Fox Associates, where he began as a young architect in 1983. His work ranges in scale from a house to a city, and he contributes closely to these efforts from conception to completion. In addition to focusing on his own projects, he leads the community of designers within the firm in exploring shared architectural agendas and goals. As president of the firm, he leads a staff of 550 people in six offices around the world. Von Klemperer received a Bachelor of Arts from Harvard University in 1979 and his Master of Architecture from Princeton University in 1983.

Elie Gamburg is a director at KPF. Since joining KPF in 2004, he has designed projects in the United States, Asia, Europe, and the Middle East, across a variety of programs, including academic, mixed-use, office, residential, retail, and many more. Gamburg is a graduate of Harvard's Graduate School of Design, where he was awarded the Kevin V. Kieran Prize for highest academic performance.

CTBUH 2018
International Conference

James von Klemperer will present the Royal Atlantis via a keynote in the Opening Plenary: *Polycentric Developments in the Middle East*, Sunday 21 October.

Abstract

The Royal Atlantis innovates on typical high-rise hotel and residential design by introducing substantial areas of true open space into all areas of the tower – redefining the concept of urban indoor-outdoor living, vertically. The project's iconicity is a departure from typical form-driven, sculptural high-rises built in rapidly emerging global "alpha cities," as its striking profile results entirely from moves designed to create truly unique guest and resident experiences. Residents, hotel guests, and visitors are each given spaces that seamlessly blend interior and exterior, tempering Dubai's extreme climate and creating moments where it is possible to see the skyline of the city, while swimming underwater 10 to 40 stories in the sky.

Keywords: Climate, Construction, Connectivity, Context, Integrated Design, Structure

Design Strategy

The winning result of a design competition, which stated an explicit goal of creating the "most memorable building in the city" for Dubai's next phase of urban expansion (and in time for the 2020 Expo), the design of the Royal Atlantis rethinks the conventional concept of the "iconic" tower and its role in the skyline of rapidly growing cities. Rather than an exercise in sculptural form making, the scheme's unique appearance emerges by extending the idea of indoor-outdoor living – traditionally created through open-plan houses in warm, low-density urban contexts – vertically into the tower. The Royal Atlantis is a 600-meter-long, 178-meter-tall mega structure, operating as permeable screen, porous to people, light and air (see Figure 1).

The success of cities like Dubai in attracting residents and visitors mirrors that of a previous generation of warm-weather cities such as Los Angeles, Miami, Rio de Janeiro, and Mexico City. Each offered residents fleeing colder climes the promise of year-round outdoor living. The climate of these cities allowed Modernists to create residences that seamlessly connected open-plan interiors with intimately-scaled landscaping in unified compositions. In the work of architects like Oscar Niemeyer, Richard Neutra, Luis Barragan, and Paul Rudolph, the spaces of houses and gardens flowed into one another, to create a lifestyle very different from those of Northern cities.

This is primarily due to the area requirements for open spaces, which are substantially larger than those typically provided by tower balconies and terraces, and by the difficulties of integrating water and landscape into complex high-rise structures. Ironically, it is at the largest beachfront hotels and apartment buildings, so common in any coastal resort city, that people are most removed from the sun-soaked natural environments they have come to visit, locked inside large, efficiently-planned, double-loaded slabs.

Seeking to maximize indoor-outdoor space in a dense high-rise, the design splits the conventional slab tower typology into discrete two-to-four-story volumes, pulled apart to create roofed, yet open spaces called "sky courts" and open decks atop cantilevers called "sky terraces" (see Figure 2).

Both outdoor space-types seamlessly connect hotel and residential units to the exterior and create passively conditioned exterior environments that mediate the city's extreme climate, allowing for virtually year-round use. The stepped profile of the tower allows for substantially larger terraces for the units highest in the building, and creates a large deck at the tower's mid-point, where additional publicly-accessible pools, restaurants, and event spaces are located. The resulting screen-wall configuration curves in plan to provide optimal views to all units, while minimizing cross-views from one unit into another. The discrete blocks that are

Figure 1. The Royal Atlantis will stand on the Palm Jumeirah archipelago off the coast of Dubai.

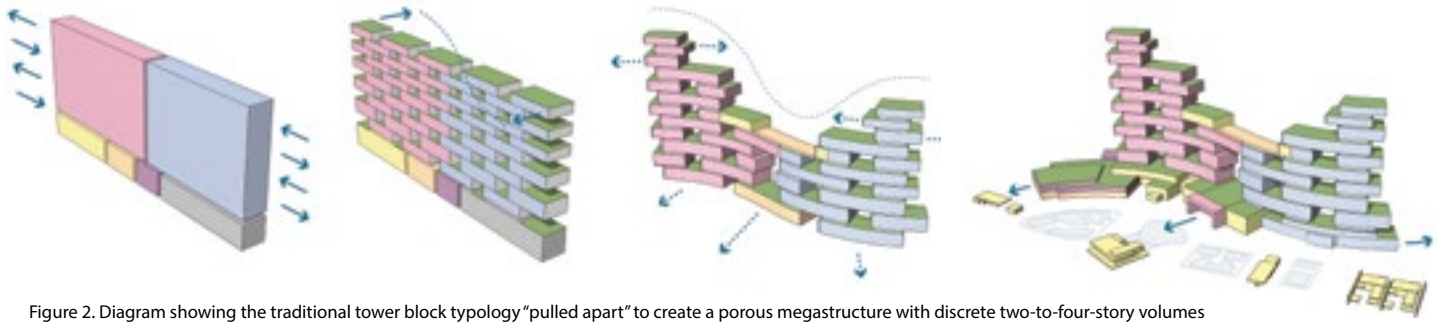

Figure 2. Diagram showing the traditional tower block typology "pulled apart" to create a porous megastructure with discrete two-to-four-story volumes and plenty of space for sky courts and terraces.

stacked to form the tower reprise themselves in the podium, allowing the lobbies, amenities, restaurants, and retail within to have terraces and extensive views (see Figure 3).

Context

The curvature and position of the project responds to the location of The Royal Atlantis on the outer ring of Palm Jumeirah, a man-made archipelago extending from the

> "The stepped profile of the tower allows for substantially larger terraces for the units highest in the building, and creates a large deck at the tower's mid-point, where additional publicly-accessible pools, restaurants, and event spaces are located."

The Tall, Polycentric City: Dubai and the Future of Vertical Urbanism

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CTBUH 2018
International Conference

Antony Wood will present some of this research in his keynote "Cities 2070: What is Truly 'Sustainable?'" in *Plenary 3: 50 Forward, 50 Back,* Monday 22 October.

Abstract

The development pattern of Dubai, host city of the 2018 CTBUH Middle East Conference core program, typifies the polycentric city phenomenon more than most cities. This paper analyzes the conditions and characteristics of Dubai's tall polycentrism. A longer version with more contextual analysis appears as the introduction to the Proceedings of the Conference, see store.ctbuh.org/2018-middle-east-proceedings.

Keywords: Polycentric, Urban Habitat, Urbanization, Density

Introduction

The concept of polycentric cities is not new. New York developed both its Downtown and Midtown in differing waves of development, and London was polycentric almost from its origin. However, even New York and London are seeing several new urban clusters shift the centers of gravity around the city whole, as other cities based on the core-CBD model – Hong Kong for example – shift density out beyond the established center. Numerous cities now have new skyscraper districts as part of these polycenters. The physical manifestation of this is often an undulating skyline, with density rising to a series of apexes across the city.

There is perhaps nowhere that demonstrates this concept better than our host city for the core of the 2018 conference, Dubai. Indeed, it could be argued that Dubai, a city that has largely risen in just three short decades, is a direct result of this decentralized urban approach, comprised as it is of evocative-sounding districts – Downtown Dubai; Business Bay; Dubai Marina; Festival City; Palm Jumeirah; and several others. New "centers" are still being added, including Midtown; Emirates Business Park; Meydan One; and Dubai Creek Harbour, anchored by the under-construction Dubai Creek Tower.

Equally as important as the centers themselves is the infrastructure that connects them. To enable the creation of new urban centers that match the socioeconomic intensity of longstanding metropolitan hubs, we must devise practical means of transportation that maximize geographical access and provide extensive city services, not just in the horizontal direction, but vertically. Such systems will progress the concept of transit-oriented development along a course of natural evolution, to polycentric city-building.

What is a "Tall, Polycentric" City?

This paper analyzes the phenomenon of Dubai's polycentrism in detail. It also attempts to isolate and identify the contemporary urban phenomenon of the "tall, polycentric" city, where the undulating skylines in question display certain common characteristics, recognized colloquially or formally by their populaces and governing authorities, respectively; which are reconciled with data from the CTBUH Skyscraper Center and other sources.

A definition of "tall, polycentric" city is first needed to limit study areas to the locations with the highest development intensity and velocity of vertical development, and to distinguish "polycentrism" from mere "sprawl." For the purposes of this research, then:

A "tall, polycentric" city has three or more "clusters" of tall buildings that are clearly separated, visually and geographically. A "cluster" is a group of buildings that is significantly taller than the surrounding urban fabric, and is visually and geographically distinct, with at least five buildings (completed

or topped out) of at least 100 or 150 meters, depending on the local height context.

The determination of a local context that is used to define individual tall building clusters is both a numerical and observational operation. In general, if a city's 100 tallest buildings have an average height of 200 meters or greater, the default determination is that 150 meters should be the minimum height threshold for consideration of a group of tall buildings as a "cluster." Likewise, cities whose 100 tallest buildings average less than 200 meters in height are generally assigned a 100-meter minimum height threshold for consideration of clusters.

> "A 'tall, polycentric' city has three or more 'clusters' of tall buildings that are clearly separated, visually and geographically. A 'cluster' is a group of buildings that is significantly taller than the surrounding urban fabric, and is visually and geographically distinct, with at least five buildings (completed or topped out) of at least 100 or 150 meters, depending on the local height context."

Dubai is somewhat unique, in the sense that the boundaries of high-rise clusters in Dubai are much easier to delineate than in other cities, because the terrain is mostly flat, and there is a great deal of horizontal separation between clusters. Its 100 tallest buildings also have an average height of 265.4 meters, which would place the cutoff for cluster consideration at 150 meters and higher, from an objective standpoint. But from the perspective of visual coherence, the interpretation is different. Other cities with a particularly high average building height (such as New York and Hong Kong) tend to have a "carpet" of tall buildings, from which a few pinnacles rise. However, due to its distinctly separate tall building clusters, Dubai is assigned 100-meter minimum threshold, which ensures inclusion of a greater number of buildings within a visually discernible cluster.

Dubai's Polycentrism – An Overview

Dubai (see Table 1 and Figure 1) can be thought of as a linear array of tall building clusters, stretching some 35 kilometers from the International Airport to the southern end of Dubai Marina, along Sheikh Zayed Road, a broad thoroughfare that in some places is wide enough to form the boundary between clusters; in others, it's the main street. In many cases, the clusters are easily identifiable, not just on the skyline physically, but also because they are name-branded comprehensive developments by single developers that are practically small cities. From north to south, these clusters are: Deira, Al Satwa & Dubai International Financial Centre (DIFC), Downtown Dubai & Business Bay, Barsha Heights, Dubai Marina, and Jumeirah Lakes.

Dubai's development pattern is fairly unique, and its speed and scale are even more so. Its development pace reflects a conscious strategy to build on the city's foundation as a trading port, while also becoming a financial and tourism hub. The dredging of Dubai Creek in the 1950s, the construction of the Dubai International Airport in 1960, unification of the seven emirates into the United Arab Emirates in 1972, and the opening of the Port of Jebel Ali in 1979 are

Metropolitan area	Name of cluster	Number of 100 m+ buildings in cluster	Combined height of 100 m+ buildings in cluster (m)	Average building height in cluster (m)	Tallest building within cluster (completed or topped out)	Height (m)	Completion year	Function
Dubai (United Arab Emirates) • *Population:* ***4,625,000*** • *Average height of 100 tallest buildings:* ***265.9 m*** • *Minimum height threshold of clusters:* ***100 m*** • *Number of clusters:* ***6***	Downtown Dubai & Business Bay	88	17,434.99	198	Burj Khalifa	828	2010	office/ residential/hotel
	Dubai Marina	87	15,854.30	182	Marina 101	425	2017	residential/hotel
	Jumeirah Lakes	61	9,599.66	157	Almas Tower	360	2008	office
	Al Satwa & DIFC	55	10,968.28	199	Gevora Hotel	356	2017	hotel
	Barsha Heights	9	16,28.55	181	Business Central Towers	265	2008	office
	Deira	9	985.82	110	Deira Tower	135	1980	government
	6 Clusters	**309**	**56,471.60**					

Note: A different color is used for each cluster as per cluster location map.

= Highest value in column = Lowest value in column

Table 1. Dubai's tall building clusters, containing at least five buildings of 100 meters or greater height.

Riyadh: The Metamorphosis of a City From Centerless to Polycentric

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Fernando Pérez started his career at Frank Gehry's studio before joining IDOM in 1993 as leader of the external cladding package design for the Guggenheim Museum in Bilbao. He then became project director of IDOM, designing alongside architects such as Frank Gehry and Zaha Hadid. Perez taught urban design at the University of Navarra (1995–2000) and technical studies at the Architectural Association (London, 2002–2012). He was director of IDOM's permanent studio in the UK (2001–2013). In December 2013, he relocated to Riyadh to lead the design of 20 Riyadh Metro stations.

CTBUH 2018
International Conference

Fernando Perez will present this paper in Session 3F: *The Polycentric, Mobile City,* Sunday 21 October

Abstract

Riyadh, the capital of Saudi Arabia, is a city of six million people, dominated by the automobile and laid out in a pattern of centerless, continuous sprawl. However, the city is undergoing a rather miraculous process of transformation, of a kind that is perhaps only possible in Saudi Arabia. A fully developed transport network, comprising 176 kilometers of metro rail and 1,200 kilometers of bus lines, is being laid out over the uniform carpet. This additional layer should manage to break the uniformity of the current city. The unprecedented urban experiment will be a reality in less than two years. Will it help to convert Riyadh in a more sustainable, more livable and more humane city?

Keywords: Infrastructure, Transportation, Urban Planning, Urban Sprawl

Introduction

Riyadh, the capital of the Kingdom of Saudi Arabia, appears like a mirage in the middle of the vast desert. Situated in the center of the Arabian Peninsula, it currently covers an area of 2,200 square kilometers and provides shelter to more than six million inhabitants. Its growth during the last 70 years has been staggering. Back in the 1950s, Riyadh was a modest city of 110,000 inhabitants. Since then, the population has multiplied 62 times. This extremely accelerated growth helps to underscore not only Riyadh's current morphology, but also explains many of the urban shortcomings that surprise those who visit the city for the first time.

During this period, fueled by the oil boom, the accelerated growth of the city repeatedly exceeded forecasts. The city boundaries envisaged in successive master plans were surpassed decades in advance.

> "Riyadh currently lacks virtually any form of mass public transport, leading to perpetually congested streets and an urban culture completely reliant on the use of the private vehicle."

Remarkably, however, these planning instruments succeeded in providing the city with a clear urban structure. The scenario could have been very different, with rapid development occurring in a haphazard and chaotic manner. Instead, the supergrid first envisaged by Constantinos Doxiadis in the late 1960s (Doxiadis 1968) has proved to be an efficient and resilient instrument to provide urban order and organization to the city (Al-Hathloul 2017).

Seen from the air, the apparently infinite square grid disappearing into the dusty desert horizon is nothing short of poetic. (see Figure 1). Back on the ground, however, it becomes apparent that the original master plan and subsequent evolutions failed to set the conditions required to provide an environment that could be defined as "humane." Perhaps the main failing has been the exclusive reliance on the private car as a means of transport. Excessively wide roads – many of them true urban freeways – became hostile environments for pedestrians, particularly during the intense heat of the long summer months. The lack of properly paved streets and public spaces, together with the omnipresence of private vehicles, are constant reminders of a certain disrespectful attitude towards the city, failing to understand it as a human habitat (see Figure 2).

The extreme dominance of the private car is made more apparent by the almost complete

Figure 1. An aerial night shot demonstrates the regularity of the Riyadh street grid.

Figure 2. A typical Riyadh street view reveals the dominance of cars over the built environment.

absence of public transport, an astounding fact in a metropolis of more than six million people. With the exception of a limited number of old and unregulated minibuses, the only way to navigate Riyadh is by car, whether in a private vehicle or taxi. This greatly hinders the mobility of a considerable percentage of the population – particularly women – while clogging up the city with a relentless flow of vehicles.

This somehow inhumane impression is reinforced by the overwhelming uniformity of a streetscape largely deprived of beauty. The main roads are lined with an endless repetition of rubber-stamped, double-height commercial units that protect the low-density villas behind them. This depressingly homogeneous urban fabric is randomly punctuated by a few landmark buildings or shopping malls devoid of any character. Not one of these streets has been able to generate sufficient density to attract other activities and become something that citizens can recognize as a city center, or a properly designed environment where urban life, both indoors and outdoors, can thrive (see Figure 3).

As a result, most areas in Riyadh lack "urban gravity." Cars fill the roads and highways uniformly: all day, everywhere, and in all directions. The usual tidal flows from the center to the periphery, so common in other big capitals, do not exist here. A case in point is the King Abdullah Financial District, a large master-planned high-rise community that has been stalled for three years. Devoid of activity, it is a symbol of Riyadh's aversion to anything centralized.

However, amid this bleak scenario, there are exceptions that disprove those who argue that the main reason for the dominance of the private car and the absence of street life is Riyadh's harsh climate. In fact, for at least seven months of the year, weather conditions are perfectly conducive to street life. A visit to one of the successful public spaces, such as the National Library plaza in the Olaya district would confirm this (see Figure 4). Therefore, rather than the climate, the issue seems to be the fact that not enough of these properly designed urban spaces exist.

Local authorities have not been oblivious to these problems. In fact, extraordinary endeavors are being undertaken on an unprecedented scale by both the Riyadh Municipality and the Arriyadh Development Authority (ADA) to respond to the city's apparently unstoppable tendency to grow in an endless, uniform manner without a recognizable center. Before discovering the initiatives that are currently being implemented, it is worth examining the milestones of the urban evolution of Riyadh over the last 70 years.

Riyadh's Urban Evolution

Riyadh's history can be traced back several centuries and is inextricably linked to Wadi Hanifah, a 120 kilometer-long oasis crossing the arid Nedj plateau that provided water and resources to the communities along its length (Atkins 2012). The city was established in the Yamāmah region on the ruins of the old city of Hajr, which long served as a center for the trading caravans that traversed the Arabian Peninsula. By the end of the 18th century Riyadh was part of the First Saudi State, with the capital located in nearby Dir'iyah, destroyed in 1818 by the Turks (Kim 1998). In 1902 Abdulaziz Al-Saud seized Riyadh, until then a modest town, and began a campaign to consolidate modern Saudi Arabia, with Riyadh as capital city.

By the 1930s, the now-King Abdulaziz built his palace and administrative complex in the city, starting a process of transformation. The chosen location, two kilometers north of the existing walled city, marked the direction of

Figure 3. Riyadh's homogeneous urban fabric as seen from the air.

Figure 4. King Fahad National Library Plaza, Riyadh. © ADA

Residential High-Rises in Dubai: Typologies, Tendencies and Development Prospects

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Viktor P. Generalov is Head of the Department of Architecture of Housing and Public Buildings at Samara State Technical University, a member of the Union of Architects of Russia, and an advisor to the Russian Academy of Architectural Sciences (RAASN). Scientific interests focus on the classification of modern high-rises and related issues. Within this framework, Generalov supervises post-graduate research students in Architecture. He is the author of more than 100 scientific publications, including monographs and educational editions. He is also a practicing architect and has more than 80 completed projects in Russia and Kazakhstan.

CTBUH 2018
International Conference

Elena Generalova will present this paper in Session W3: *High-Rise Residential Workshop,* Saturday 20 October

Abstract

This study discusses the current typologies of high-rise housing prevalent in Dubai. The uniqueness, trends and prospects of Dubai tall, residential development are analyzed. The regional specifics of the typology in Dubai, at the site, building and individual dwelling scale, are identified.

Keywords: Complexes, High-Rise, Residential

Introduction

Today, there are more than 4,000 buildings of 150 meters or greater height (CTBUH Skyscraper Center 2018). For more than 100 years of high-rise construction prior to 2000, only 1,141 buildings of at least 150 meters had been built. Most of these were office buildings; residential accounted for only 13%. During the first 17 years of the 21st century, 3,104 buildings of at least 150 meters were completed. In this group, the percentage of residential buildings was 44%. From both a quantitative and qualitative perspective, it is clear that the relevance of high-rise housing has grown. Because of its incredibly high proportion of residential high-rises, Dubai in particular merits special consideration. It is a market formed from scratch in an extremely short time frame, under unique historical, socio-economic and climatic conditions.

Dubai's High-Rise Development History

After China, United States, and Japan, the United Arab Emirates (UAE) has the fourth-greatest number of buildings of 150 meters or higher. At that, about 80% are located in Dubai, and all but four have been constructed since 2001 (see Table 1). As can be seen, the period from 2007 to 2010 was marked by an unprecedented increase in high-rise construction in Dubai; 50% of the 150-meter-plus towers were constructed in the space of four years. City districts such as Dubai Marina, Jumeirah Lake Towers, Business Bay, Downtown Dubai, and the Dubai International Financial Centre (DIFC) have been formed rapidly. These districts are the key centers of the urban framework and the basis of Dubai's urban development concept; each is comprehensive in its inclusion of residential functions in high-rise buildings (see Figure 1).

In the subsequent three years (2011–2013) the intensity of high-rise construction in Dubai decreased to some extent: 35 buildings of at least 150 meters were completed. At first glance, the 2014–2017 period recorded a decrease in high-rise construction in Dubai (20 completed buildings of 150 meters). However, during this period, a number of multi-functional complexes were built, keeping pace with global trends, if not the volume of superlative towers.

Typologies of High-Rise Housing in Dubai

This analysis of high-rise housing in Dubai is broken down into four typologies:

1. The "solo" (standalone) single-function residential tower;
2. The residential "block" incorporated into the structure of a "solo" mixed-use tower;
3. The single-function residential tower placed in a mixed-use complex;
4. The residential "block" within a mixed-use tower, which itself is located in a mixed-use complex.

The typological groups were devised based on the following quantitative and space-planning characteristics. In the history of high-rise construction development in Dubai from 1979 to mid-2018, 180 buildings of 150-plus meters were completed. The share of residential high-rise buildings is 52%. This is

significantly above the average share of 150-meter-plus residential buildings worldwide (36%) built to date. Interestingly, all 91 residential high-rise buildings of 150 meters or more completed in Dubai at the time of this study have been built in just the past 17 years. A substantial element of this group is the single-function high-rise residential tower, which can be both "solo" or a part of a mixed-use complex. The analysis showed that 54% of residential towers (50 buildings) are "solo", while 45% (41 residential high-rise buildings) were part of mixed-use complexes.

As noted above, high-rise housing in Dubai is represented not only by single-function residential towers, but also by housing blocks that are fully incorporated into mixed-use high-rise buildings. The residential blocks are in 30 mixed-use buildings of 150 meters or greater height; out of these 25 buildings were "solo" mixed-use towers, while the remaining five buildings were part of mixed-use complexes.

After analyzing the structure of these high-rise housing types, the most prevalent programmatic distributions of high-rise residential buildings in Dubai can be represented. Three groups of models are to be considered: Group A – solo towers; Group B – two-tower complexes; and Group C – multi-tower complexes (see Figure 2).

> "All 91 residential high-rise buildings of 150 meters or more completed in Dubai at the time of this study have been built in just the past 17 years."

Group A – Solo towers can be single-use with service functions (sports, leisure, entertainment, commerce, food, etc.) or mixed-use with a residential "block" of floors. For space-planning characteristics, two main types of models can be picked out: A1, with a compact, integrated podium; and A2, with a detached parking garage. The same space-planning model is typical for mixed-use solo towers with an included residential block (A3 and A4). Additionally, a model with a developed podium, A5, can be distinguished.

Group B – Two-tower complexes are represented by four models: B1 – two single-function towers (residential); B2 – two differentiated single-function towers (residential + hotel or residential + office); B3 – two single-function residential towers and a mixed-use tower with a residential block; B4 is a single-function tower (hotel or office) and a mixed-use tower with at least one portion consisting of a residential block.

Group C – Multi-tower complexes in Dubai have formed in the following way: C1 consists of only single-function residential towers; C2 is formed by single-function towers with different functions in each (such as residential, office or hotel). C3, in addition to residential towers, includes a mixed-use tower with a residential block. C4 is formed by a combination of single-function towers with different functions (a residential, office or hotel tower) and mixed-use towers. As a

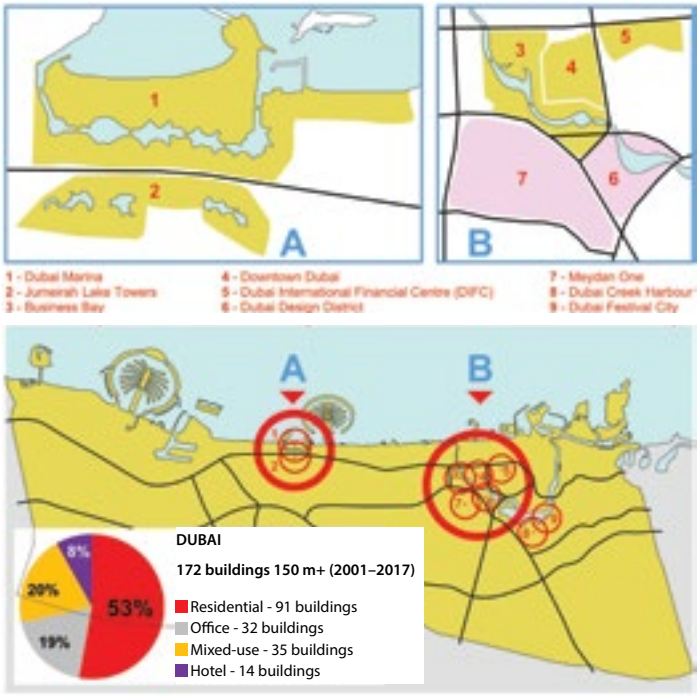


Figure 1. Zones of high-rise buildings in Dubai.

Period	No. buildings 150m+	Residential		Office		Hotel		Mixed-use	
			%		%		%		%
1979–2000	**4**	**-**	**-**	**2**	**50**	**2**	**50**	**-**	**-**
2001–2017	**172**	**92**	**53**	**32**	**19**	**13**	**8**	**35**	**20**
1979–2017	**176**	**92**	**52**	**34**	**19**	**15**	**9**	**36**	**20**
2001	2	-	-	-	-	-		2	100
2002	2	1	50	-	-	1	50	-	
2003	5	3	60	-	-	1	20	1	20
2004	1	1	100	-	-	-	-	-	
2005	4	2	50	-	-	-	-	2	50
2006	13	10	77	2	15	1	8	-	-
2007	**23**	**15**	**65**	**2**	**9**	**2**	**9**	**4**	**17**
2008	**24**	**13**	**63**	**4**	**17**	**2**	**8**	**3**	**13**
2009	**24**	**13**	**54**	**7**	**29**	**-**	**-**	**4**	**17**
2010	**19**	**7**	**37**	**3**	**16**	**1**	**5**	**8**	**42**
2011	13	5	38	7	54	1	8	-	-
2012	11	8	73	1	9	1	9	1	9
2013	11	5	45	2	18	1	9	3	27
2014	4	-	-	1	25	-	-	3	75
2015	7	4	57	2	29	1	14	-	-
2016	4	2	50	1	25	-	--	1	25
2017	5	2	40	-	-	-	-	3	60

Table 1. The number of high-rise buildings 150 m+ built in Dubai over time, classified by function. A major development surge is indicated from 2007–2010.

Polycentric Cities: The Future of Vertical Urbanism

Abstract

As we approach the new normality of cities housing 10 million or more inhabitants, those best positioned for the future are evolving along polycentric, multi-nodal lines, with several central business districts, ideally all offering something slightly different to the urban inhabitant. When focused around transit nodes and well-planned infrastructure, embracing high density, public space and civic functions, this amalgamation of "several cities within a city" perhaps offers the best opportunity for a sustainable future for the many millions of people who will move into cities over the coming decades. The 2018 CTBUH Conference debates the merits and challenges of this multi-nodal approach to urbanism, and to understand and envision how tall buildings, density, infrastructure and people fit into this vital mix, as well as other critical issues facing the tall building industry. The following pages contain highlights of the program.

Keywords: Urban Planning, Urban Design, Vertical Urbanism, Urban Infrastructure

Developing Polycentric Cities in the Middle East

Opening Plenary: Polycentric Developments in the Middle East
Sunday 21 October

Mounib Hammoud, CEO, *Jeddah Economic Company*

Reflecting on more than 30 years of personal experience in land and real estate development throughout the Middle East, this presentation relays the drivers behind the region's move toward polycentric urban development, through then exploration of several case studies. Stops along the way include the reconstruction of Beirut's city center around nine unique activity areas, a project comprising 191 hectares, including 73 hectares reclaimed from the sea. With marinas, open views to sea and mountains, and a planned city park, the Beirut Waterfront District is envisioned as an integrated and sustainable urban environment. The Beirut project incorporates a triple-A office tower of the highest international standards, with a large podium, as a contemporary interpretation of the porous urbanism that creates the unique character of the Middle Eastern souk with its sheltered passageways.

The story embraces Al Zorah, the premier mixed-use and hospitality destination in Ajman, UAE, comprised of five distinct neighborhoods, where some 60% of the land area is devoted to open space. Next, it takes us to Jeddah, Saudi Arabia, where the Golden Tower is rising as a new landmark on the city's famed Corniche. With a sense of space and openness, maximized through expansive views of the sea and local urban scenes, the tower caters to a modern luxurious lifestyle while remaining rooted in the local culture through its attention to privacy. The story continues with detailed insights about developing fully-fledged, culturally and environmentally balanced communities.

> "We need to rethink the skyscraper, not as a hermetic, isolated landmark, but as a building that responds to the specificities of its urban and social context."
>
> – Ole Scheeren, *Principal, Buro Ole Scheeren*

The Future of Tall Building Technology

Plenary 3: 50 Forward, 50 Back
Monday 22 October

William Baker, Partner, *Skidmore, Owings & Merrill*

Since their earliest form, tall buildings have stood as technological marvels, reflecting the latest advancements in materials, methodologies, and tools. The Home Insurance Building (William Le Baron Jenney, 1884) was guided by new innovations in structures and vertical transportation to reach unprecedented 10-story heights to become the world's first skyscraper. These two technologies continue to be the leading drivers of tall buildings today, though the continuous interest in constructing taller and taller buildings in various climates and locations throughout the world has led to the ongoing development of new technologies, specialties, and social considerations that have the potential to transform the buildings of the future.

Increasingly sophisticated optimization tools, software, physical testing capabilities, and building materials are advancing and refining design processes and practices. Evolving methods for assessing the sustainability and performance of a tall building; its impact and integration with the local urban context; and the role it has in the quality of its occupants' lives, work together to inform a building's

design. In addition to operational energy concerns and high-performance design, the role of embodied carbon is beginning to attract the critical level of attention that it deserves.

The Skyscraper as Social Organism

Plenary 3: 50 Forward, 50 Back
Monday 22 October

Ole Scheeren, Principal, *Buro Ole Scheeren*

As hyper-growth increasingly calls for high-density living and working, we need to rethink the skyscraper, not as a hermetic, isolated landmark, but as a building that responds to the specificities of its urban and social context. Rather than reinforcing stratification and hierarchical systems, the skyscraper needs to go beyond vertical dominance and explore spatial qualities that allow for greater social interaction and cohesion. This presentation examines eight overarching topics relevant to tall buildings and the future of our cities:

ORGANISM – How can we understand the skyscraper as an organic life-form (not simply built matter) and explore organizational structures of functional, yet socially interconnected, entities? SCALE – How can we reconnect the scale of the skyscraper to that of the human being? CONTEXT – How can the skyscraper go beyond being a self-referential singularity and re-establish context and cohesion as a system of urban inclusivity? HORIZONTALITY – How can a skyscraper (sometimes) no longer be a skyscrape and can how it can become a construct of spatial and social connectivity? VERTICALITY – How can a skyscraper create a space of three-dimensional engagement within (or against) its vertical predetermination? RE-USE – How can existing substance be re-imagined to breathe new life into old cities? FANTASY – How can a skyscraper become a space of exploration and memory, and engage our fantasy and imagination? CLOUD – How can we turn the skyscraper into a collaborative world of physical (and digital) connectivity and social exchange?

Dubai Creek Tower, Dubai

Santiago Calatrava

The Dubai Creek Tower's monumental design is influenced by the natural forms of the lily and evokes the shape of a minaret, a distinctive architectural feature in Islamic culture. It is on track to become one of the tallest man-made structures on earth. The tower combines modern, sustainable design with the rich culture and heritage of the United Arab Emirates (UAE). The tower's numerous observation decks are part of an elongated, oval-shaped "bud" at the top of the tower. The slender stem serves as the spine of the structure, and the cables linking the building to the ground are reminiscent of the delicate ribbing of the lily's leaves. At the same time, they represent the UAE's welcome to the world. This project is inspired by the goal of making this space a meeting point for citizens, not only from Dubai and the UAE, but from around the world. It is a symbol of belief in progress.

Completion Date: 2021 (expected)
Height: 1,300 m (estimated)
Function: Observation Tower

Dubai Creek Tower, Dubai. © Emaar Properties

CTBUH 2018
International Conference

Santiago Calatrava, Principal of Santiago Calatrava LLC will present Dubai Creek Tower in *Session 1: Opening Plenary,* Sunday 21 October.

Polycentric vs. Monocentric: The Future of Vertical Urbanism?

Plenary 2 Panel Discussion
Monday 22 October

Americas: James Parakh, Urban Design Manager, *City of Toronto Planning Dept.*

Asia: Dr. Cheong Koon Hean, CEO, *Housing & Development Board, Singapore*

Australia: Helen Lochhead, Dean, Faculty of Built Environment, *UNSW Sydney*

Europe: Peter Murray, Chairman, *New London Architecture Centre*

Middle East: Mohammad Kaiser Azad, Head of Community Management, *Emaar Properties, Dubai*

At this significant point in the history of urban development, cities are at a crossroads. They are facing questions of how to optimally organize resources, infrastructure and population, and account for the potential of greatly disruptive technological and climatic change. Among these questions is whether the monocentric or polycentric model is preferable, and under what conditions?

This panel discussion considers the merits of both the polycentric and monocentric approaches to urban development, with views from both sides of the equation from renowned urbanists representing each global region. International in nature, the panel gives a view on how cities should be developed, amidst a world that is rapidly urbanizing.

The Middle East: 30+ Years of Building Tall

The Middle East region is hosting its first CTBUH International Conference since 2008. In that year, there were 119 completed buildings of 150 meters or greater height. Ten years later, there are now 387 such buildings either completed or topped out (with expected 2018 completion), meaning an average of nearly 27 were constructed each year in the region during that decade. As this study will show, however, the growth is not evenly distributed nor especially correlated to overall population, or to density. The dynamics, and the reasons for high-rise construction in the region, are as diverse as the nations that comprise it.

148,257,284
36.8% of pop
0 buildings **0.0%** of total

Rest of Middle East
Egypt
Oman
Syria
Yemen

64,012,926
15.9% of pop.
16 buildings **4.1%** of total

Asiatic Turkey
Izmir (6)
Ankara (8)
Mersin (1)
Konya (1)

Lebanon
Beirut (2)

5,369,872
1.3% of pop.
2 buildings **0.5%** of total

Israel
Tel Aviv (13)
Ramat Gan (3)
Bat Yam (1)
Bnei Brak (1)
Givatayim (1)

19 buildings **4.9%** of total

8,628,600
2.1% of pop.

9,531,712
2.4% of pop.
1 building **0.3%** of total

Jordan
Amman (1)

36,933,700
9.2% of pop.
1 building **0.3%** of total

Iraq
Sulaymaniyah (1)

79,926,270
19.8% of pop
1 building **0.3%** of total

Iran
Tehran (1)

16 buildings **4.1%** of total

4,437,590
1.1% of pop.

Kuwait
Kuwait City (16)

14 buildings **3.6%** of total
1,423,726 **0.4%** of pop.

Bahrain
Manama (14)

32,949,700
8.2% of pop.
37 buildings **9.5%** of total

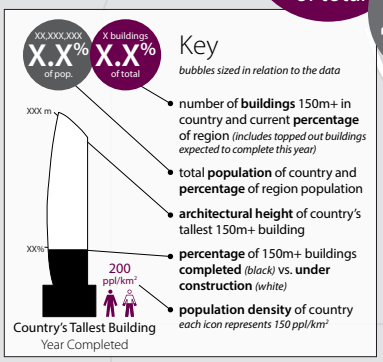
Saudi Arabia
Riyadh (22)
Mecca (7)
Jeddah (6)
Damman (1)
Al Khobar (1)

35 buildings **9.0%** of total
2,404,776 **0.6%** of pop.

Qatar
Doha (35)

245 buildings
63.3% of total
9,121,167
2.3% of pop.

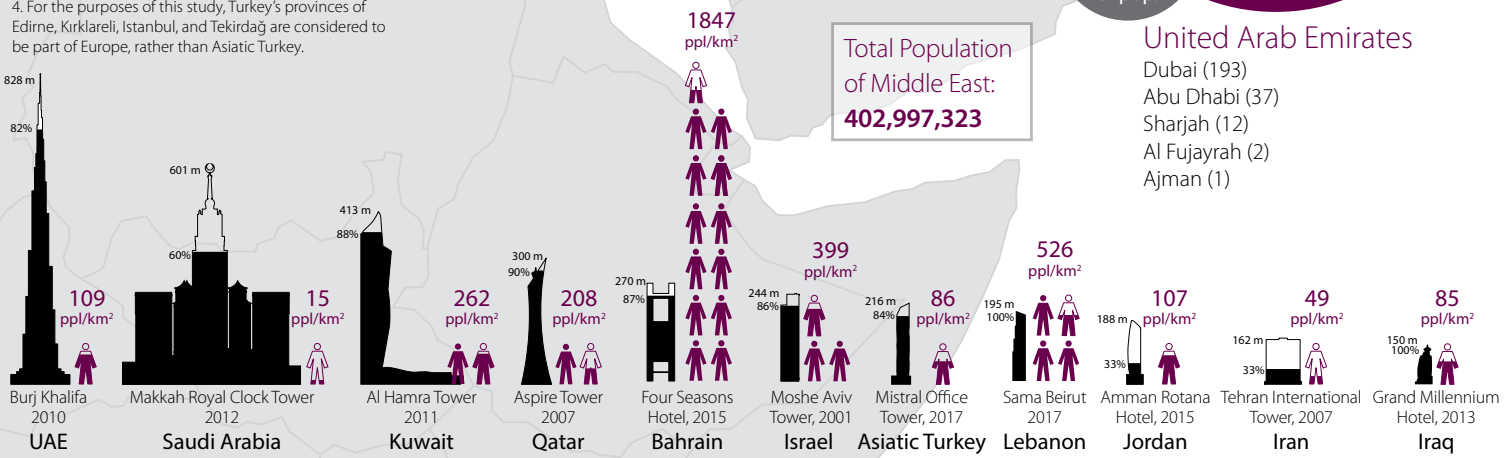
United Arab Emirates
Dubai (193)
Abu Dhabi (37)
Sharjah (12)
Al Fujayrah (2)
Ajman (1)



Footnotes:

1. The focus on buildings over 150 meters is driven by the need to ensure accuracy of data, rather than suggesting that this is the threshold for a tall building.
2. All population and land area data is taken from citypopulation.de
3. All tall building data is taken from the CTBUH Skyscraper Center as of 1 September, 2018.
4. For the purposes of this study, Turkey's provinces of Edirne, Kırklareli, Istanbul, and Tekirdağ are considered to be part of Europe, rather than Asiatic Turkey.

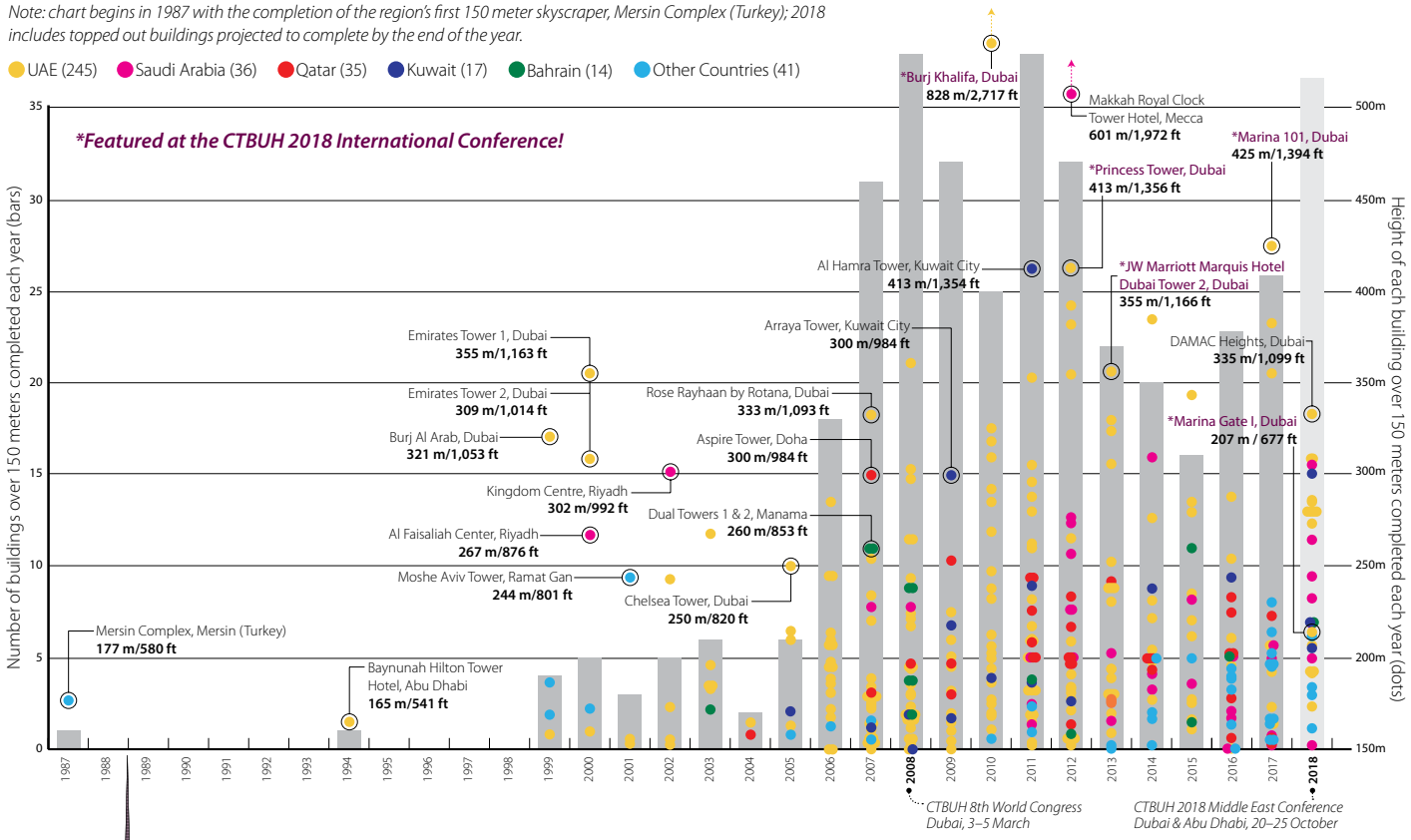
Total Population of Middle East: **402,997,323**



Timeline of Skyscraper Completion in the Middle East

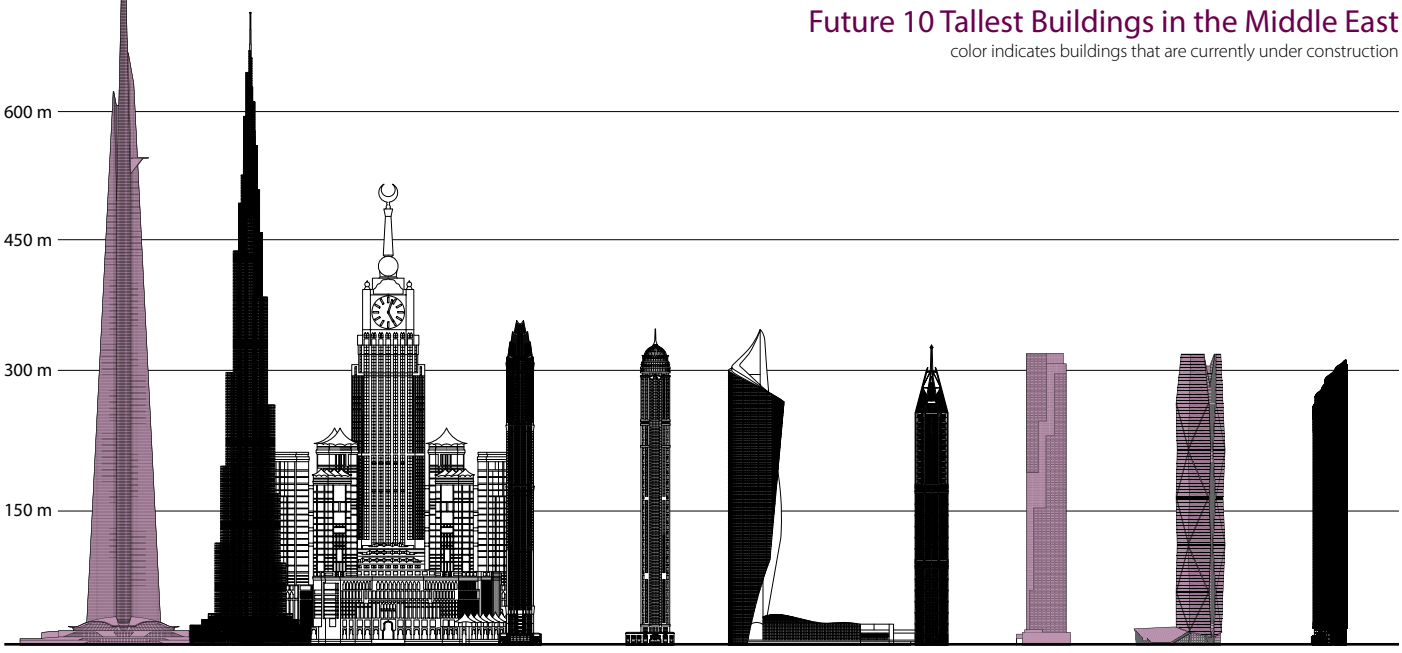
Dots represent individual building height and location. Bars represent the number of completed buildings each year.

Note: chart begins in 1987 with the completion of the region's first 150 meter skyscraper, Mersin Complex (Turkey); 2018 includes topped out buildings projected to complete by the end of the year.



Future 10 Tallest Buildings in the Middle East

color indicates buildings that are currently under construction



Jeddah Tower
Jeddah, 2021
1000+ m

Burj Khalifa
Dubai, 2010
828 m

Makkah Royal Clock Tower
Mecca, 2012
601 m

Marina 101
Dubai, 2017
425 m

Princess Tower
Dubai, 2012
413 m

Al Hamra Tower
Kuwait City, 2011
413 m

23 Marina
Dubai, 2012
392 m

La Maison by HDS
Dubai, 2021
387 m

Capital Market Authority Tower
Riyadh, 2019
385 m

Burj Mohammed Bin Rashid
Abu Dhabi, 2014
381 m

Of all Middle East countries, the United Arab Emirates (UAE) has 63.3% of the total: 245 buildings 150 meters and taller.

825%

From 2008 to 2018, **Saudi Arabia** had the largest percentage increase in 150-meter-plus buildings, from 4 to 37.

Three of the 10 future tallest buildings in the Middle East, and four of the 10 current tallest, are in Dubai Marina, mere blocks from each other.

Towering Aspirations in Dubai and Beyond

His Excellency Mohamed Ali Alabbar

Interviewee

His Excellency Mohamed Ali Alabbar, Chairman
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His Excellency Mohamed Ali Alabbar is a global entrepreneur with active interests in real estate, retail, luxury hospitality and now e-commerce, technology, logistics and the food industry, Mohamed Alabbar is the Founder and Chairman of Emaar Properties, the leading developer of iconic assets such as Burj Khalifa. Holding a graduate degree in Finance and Business Administration from Seattle University, Alabbar also holds an Honorary Doctorate from the same university.

CTBUH 2018
International Conference

His Excellency Mohamed Ali Alabbar will deliver the Opening Address to the Conference and Dubai Creek Tower will be featured in the Opening Plenary on the morning of Sunday 21 October.

In 2008, CTBUH held its Eighth World Congress in Dubai, at which time the world's tallest building, the Burj Khalifa, was still under construction. His Excellency Mohamed Ali Alabbar, Chairman of Emaar Properties, took the stage to address the conference. Ten years later, CTBUH now returns to Dubai for its International Conference on the theme "Polycentric Cities." CTBUH Editor Daniel Safarik interviews Mr. Alabbar on the occasion of this anniversary.

It has been 10 years since CTBUH held its last conference in Dubai. In this time, the Burj Khalifa has been constructed, and the number of buildings over 150 meters has grown, from 83 to 180 today, with 52 under construction. In your experience, what do you think are the main causes of this high-rise building spree?

Developers have their own individual perspectives on why they invest in high-rises – but for us, the reasoning is clear: our iconic towers add significant value to the destination, add to the nation's skyline, and serve as economic catalysts, supporting diverse sectors, including tourism, retail, and hospitality.

When we developed Burj Khalifa, we had a clearly articulated vision of not just delivering an icon that underlines the ambitions and spirit of global collaboration that defines Dubai, but also to maximize the value of the land by creating a truly "vertical city." Burj Khalifa is at the heart of Downtown Dubai, our 202-hectare megadevelopment, and it adds incremental value to the destination.

Today, we are developing Dubai Creek Tower in Dubai Creek Harbour, a six-square kilometer waterfront destination (see Figure 1). Dubai Creek Tower has an entirely different concept and objective compared to Burj Khalifa. Designed by neo-futuristic Swiss-Spanish architect Santiago Calatrava, the tower will be a global icon and add to the skyline of the nation. It will feature multiple cutting-edge observation decks with 360-degree views of Dubai Creek Harbour and the metropolis beyond.

How would you describe the development strategy the Dubai Creek Tower and its surrounding development, Dubai Creek Harbour, as compared to that of Burj Khalifa and Downtown Dubai?

The development strategy for Burj Khalifa was to serve as an anchor point for Downtown Dubai. In fact, we had initially conceived Burj Khalifa as a 90-story structure, and we were inspired by His Highness Sheikh Mohammed bin Rashid Al Maktoum, UAE Vice President and Prime Minister and Ruler of Dubai, to push our boundaries. Our goal was not to be in a race to build the tallest – but to demonstrate to the world the can-do attitude of the UAE and to highlight the global collaborations that the city of over 200 nationalities promotes.

Figure 1. Dubai Creek Tower will anchor the Dubai Creek Harbour development. © Emaar Properties

For Dubai Creek Harbour too, we have a very holistic approach to the development. Dubai Creek Tower anchors the project, no doubt, but it has several spectacular features, such as the recently announced Dubai Square (see Figure 2) – the retail and lifestyle destination of the future – and the vibrant Creek Marina, among others. What we deliver is the destination with several spectacular features, and the iconic high-rises serve as economic catalysts.

In 2008, in your address to the CTBUH Conference before the Burj Khalifa was finished, you acknowledged that "someone would try to build something taller," but added that they would also need to match the quality of design and respect for the human spirit that went into the Burj Khalifa. It is possible that the "someone" may turn out to be you? Why is it important to build what may become the world's tallest structure for the second time, and what do you think you will have to do to outdo your earlier achievement – besides simply being taller?

We are not in a race to build higher and taller. We have a clear vision and concept for our mega-developments to which the iconic high-rises add significant value. With Burj Khalifa, we have pushed the boundaries of architecture, construction and engineering, and it will continue to serve as a reference point for any high-rise of the future. We are similarly challenging ourselves with Dubai Creek Tower, which will be a notch higher than Burj Khalifa.

Across the world, there are monuments that come to represent cities and their aspirations. In Dubai, we have Burj Khalifa – a powerful testament to the city's industriousness. Dubai Creek Tower is an incomparable architectural feat that will symbolize our city's positivity and energy. A US$1 billion investment, it will welcome visitors from around the world and contribute to the tourism, retail and hospitality sectors, adding incremental value to the economy.

Figure 2. Dubai Square is a massive shopping mall at the core of Dubai Creek Harbour.© Emaar Properties

Dubai Creek Tower has been designed by Santiago Calatrava. What led you to select Calatrava, and can you describe the selection process?

The design for Dubai Creek Tower was selected after an intense competitive pitch. Calatrava's design was perfectly aligned to the vision we had – a compelling structure that will enhance the value of the megadevelopment.

He is a master architect with spectacular projects such as the World Trade Center Transportation Hub in New York, Calgary Peace Bridge, the Olympic Sports Complex in Athens, and the Turning Torso Tower in Malmö, among others. Calatrava's design is not just futuristic – it is rooted in our history and culture and is a strong statement on our ambitions.

The tower derives design inspiration from the lily and the minarets that are part of Islamic culture. With its spectacular design and magnificent illumination, it will create a brand-new skyline for our nation.

Further, at the foot of Dubai Creek Tower is an exciting experiential destination - Dubai Creek Plaza, a clock-shaped haven of landscaping, palm trees and water features sprawling across half a kilometer of land – the length of ten Olympic-sized swimming pools (see Figure 3). It is connected to Dubai Square through a cutting-edge underground extension.

What's different about the economic, cultural, and construction technology conditions for developing/building the Burj Khalifa + Downtown Dubai development, versus the Dubai Creek Tower/Dubai Creek Harbour development today?

The most significant game changer is the change in the lifestyle aspirations of a new generation of tech-savvy youth. They demand a connected, networked, social destination that calls for a comprehensive review of how we design and build our cities. While Downtown Dubai has served as an economic catalyst for Dubai, with Dubai Creek Harbour and Dubai Creek Tower, we

"The lifestyle aspirations of a new generation of tech-savvy youth demand a connected, networked, social destination that calls for a comprehensive review of how we design and build our cities."

About the Council

The Council on Tall Buildings and Urban Habitat (CTBUH) is the world's leading resource for professionals focused on the inception, design, construction, and operation of tall buildings and future cities. Founded in 1969 and headquartered at Chicago's historic Monroe Building, the CTBUH is a not-for-profit organization with an Asia Headquaters office at Tongji University, Shanghai, a Research Office at Iuav University, Venice, Italy, and an Academic Office at the Illinois Institute of Technology, Chicago. CTBUH facilitates the exchange of the latest knowledge available on tall buildings around the world through publications, research, events, working groups, web resources, and its extensive network of international representatives. The Council's research department is spearheading the investigation of the next generation of tall buildings by aiding original research on sustainability and key development issues. The Council's free database on tall buildings, The Skyscraper Center, is updated daily with detailed information, images, data, and news. The CTBUH also developed the international standards for measuring tall building height and is recognized as the arbiter for bestowing such designations as "The World's Tallest Building."

Council on Tall Buildings and Urban Habitat

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