Building tall in the Arabian Gulf: Perception | performance | place-making

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ABSTRACT: Skyscrapers are arguably impressive, excessive, essential and ubiquitous in the intense landscapes of contemporary global cities. As a typology these towers are unparalleled in their costs, demands, parameters and presence. Perhaps more so than any region on the planet, the realities, including both remarkable challenges and outstanding opportunities, of building tall is illustrated and demonstrated in the emerging urban centres of the Arabian Gulf . Despite the massive impacts of this building type, and especially on the burgeoning cities in the Gulf States, research concerning place-making, social perceptions, and sustainable performance (i.e., systemic views) is undeniably lacking. The cities in this region have changed dramatically – transforming overnight from traditional human-scaled settlements, built by local materials and local expertise, into the modern oil-driven technology-propelled metropolitan hubs of today. Over the past two decades the Arab Gulf area has witnessed unprecedented urban growth, especially in vertical constructions which have flourished in Emirates cities such as Dubai and Abu Dhabi, and more recently in neighbouring Doha (Qatar), Kuwait City (Kuwait), and Riyadh & Jeddah (Saudi Arabia). In relatively spectacular bursts of development these cities have seen their skylines erupt, their streets defined and their buildings soar. Such transformation has multiple impacts on the city, including the shaping of a metropolitan image, influences on inhabitant perceptions and traction towards a more sustainable tomorrow. To gain a better understanding of the impacts of tall buildings in Arabian Gulf Cities, the researchers consider urban growth in three pivotal Gulf cities (Dubai, Kuwait City and Doha) from the early 1970s until present times. The present paper, a reporting of ongoing research in this stimulating field, encompasses two main parts: the first part outlines and explores master plans for each city, with aim to delineate policy and strategies for tall buildings, while the second part reviews work on several building case studies from each city, with a goal to critically examine aspects pertaining to perception, performance and place-making. The paper surveys at a general level the phenomenon of building tall, then moves beyond the general to tackle the specific, unique and compelling context, culture and circumstances of designing and delivering towers in the Arabian Gulf. A key outcome is an innovative framework for building tall in Gulf cities – a timely and necessary contribution that promises to help designers + developers and policymakers + politicians, to reconsider a more viable, responsible and successful path for these soaring, momentous, intensive and iconic skyscrapers. Considering the intense pressures for our buildings to reach higher, and the serious implications of housing greater numbers of occupants in our towers, there remains a pressing need to realize better understanding, more effective methods, and more sustainable outcomes.

KEYWORDS: Architecture, Tall Building, Framework, Performance, Place-Making

INTRODUCTION

"The skyscraper, by being much taller than the average construction, began to assume (whether or not it was wanted) a public role, that of primary contributor to the silhouette and image of the city of which it was a part." Cesar Pelli

Architectural design is a complex and challenging yet remarkable activity. Architecture holds exceptional promise to impart satisfaction, wellness and meaning to users while concurrently contributing in significant ways to the identity, fabric and quality of cities. In our modern world the intricacies of realizing a building prove staggering, including complicated dimensions such as aesthetics, economics, legal concerns, cultural aspects and social factors. Increasingly our built environment is deemed to be too static and too intractable. There are, nonetheless and in response, pioneering efforts to challenge the status quo and introduce demonstrable change. Rigid approaches, fragmentation and separation are being replaced with more dynamic methods, integration and holism. Within this ethos bright directions such as open building, systems thinking and integrated design offer extraordinary mindsets + methods to create more appropriate, agile and potent architecture. Coupled into the equation are spectacularly shifting features of the design milieu including heightened pluralism, ecosystem assault, financial uncertainty and a rapidly globalizing planet. Within such a realm architects, engineers,

developers and others in the design & construction industry attempt to navigate turbulent waters, innovate process, advance product and improve the quality of spaces, places, buildings and cities.

Few building typologies are as demanding, daunting and complex as the contemporary highrise. Tall buildings operate at multiple levels of meaning and interpretation, from the site to the skyline. Exceptional technological aspects permit these forms to soar to unimaginable heights, supported by innovative structural and mechanical systems and inspired by scenography and iconic aspirations. Such projects dominate their communities, tax local resources, contribute to place, and hold the possibility to define identity. Skyscrapers from the historic Chicago Tribune Tower and the Empire State Building to the newly emerged Burj Al Arab and One World Trade Center play pivotal roles in providing personality to their cities. With the unbridled development in many cities around the globe, architects, developers and politicians are asking hard questions about such towers. Given the stature, presence and permanence of these mighty giants, it seems especially urgent for us to gain greater clarity, understanding and certainty around the implications, obstacles and opportunities of building tall. While performance stands front and center in such considerations, the definitions, parameters and metrics of performance in skyscrapers is shifting, developing, controversial yet critical.

1.0 CONCEPTUAL FRAMEWORKS

"In Architecture as well as in all other Operative Arts, the end is to build well.
Well building hath three conditions: Commodity, Firmness and Delight."
On Marcus Vitruvius Pollio's de Architectura
Sir Henry Wotton The Elements of Architecture (1624)

A conceptual framework is a vehicle for managing complexity, approaching problems, and directing processes towards desired outcomes. In an era where challenges arrive at unprecedented levels (e.g., scale, scope, frequency, etc.) there are increasing needs to be equipped with the means to move forward despite daunting complications, unfathomable dimensions, and a high degree of uncertainty. A part of the problem is due to endemic fragmentation that is common in contemporary societies, including nations and cities. The authors argue that more integrated and interdisciplinary approaches are needed when tackling environmental design challenges. This argument extends from the level of regional planning down to the design of individual buildings, including, for the purposes of the present paper, skyscrapers. A *Holistic Framework for Design and Planning* was first introduced by Sinclair in 2009. This novel approach focuses on four action areas that are seen as having flexibility, interoperability and capacity for adaptation: Agility, Fitness, Diversity, and Delight. Sinclair's framework has both robustness and resiliency, encouraging modification and customization depending on context, culture and circumstance.

Figure 1: Holistic Integrated Framework for Design + Planning (Sinclair 2009)

The present paper looks at the master planning of several key cities in the Gulf Region then pursues case studies of individual iconic high rises in these same centres. In many ways this work is analytical in character. Subsequently Sinclair's Holistic Framework is revisited in specific consideration of the skyscraper typology. Modifications to and extensions from this base framework are undertaken in an effort to customize and synthesize its value to the specific cultural, contextual and circumstantial conditions raised in the present paper. This work, in both its analytical and synthetic dimensions, is speculative and propositional. Given the absence of substantive research in this emerging field, the present efforts are geared to provoke vital questions rather than proffering concrete answers.

2.0 MASTER PLANNING

The emergence of the cities of the Gulf Region has been rapid, striking and largely without precedent. From fishing outposts and small villages to burgeoning cities and impressive metropolitan conurbations, the rise of the major urban centres of the Middle East have proven remarkable and at times spectacular. In many instances funded by resource wealth and keen to reach high, skyscrapers have sprung from the desert in forms and fantasies diverse and dramatic. As is true with most rapidly developing centres, master planning is invoked in an effort to capture vision, guide growth and help shape identity. Cities in the Gulf Region are no exception, with master planning commonplace and often iterative in nature. Under the pressures of such hurried progress such plans need frequent confirmation, adjustment and at times abandonment and redirection. The researchers have explored master planning in three primary cities in the area, in part to better understand the context of this part of the planet and in part to set the stage for case studies of individual skyscrapers from these cities/districts.

2.1. Dubai, United Arab Emirates

Dubai as a potent model influences many cities around the world, leading some scholars to coin the term 'Dubaization' to express a new form of urbanization that relies extensively on capital markets. It also invokes processes of dividing a city into a collection of service hubs, sometimes referred to as cities (e.g., Education City, Medical City, etc.) inside a city. Moreover there is a pervasive myth that Dubai was raised up from a tabula rasa – from the vast emptiness of the desert. Yasser Elsheshtawy (2009) has endeavored to dispel this misconception in his book about Dubai's urbanization, delineating advancements from its humble beginning until the spectacular arrival of a world-class city. The present authors note that the city has hidden spaces which have largely been ignored by media and scholars alike – a region of Dubai representing the lower socio-economic strata or laboring class, which is dominated mainly by Asian migrant workers.

The history of inhabitation of the city began around 1833 AD when a subgroup from the Bni Yas clan (Almkhtom the current ruler of Dubai) traveled from Abu Dhabi to settle in an area between Abu Dhabi and Alsharjah. The population at that seminal time was approximately 800 (Ramos & Rowe 2013).

Dubai back then comprised a small land area, which was constituted with a collection of small mud huts, (Elsheshtawy 2009). In 1870 Dubai was declared by Britain as its principal port for the Empire's merchants in the Trucial States (i.e., the group of Sheikdoms they were under the British control from 1820 until 1971)(Ramos & Rowe 2013). The newly emerged emirah had two main resources, namely fishing and pearl hunting. Together these two economic factors played a crucial role in the growth of the area, continuing until the middle of the 20th century when the Japanese invented the cultured pearl.

General speaking, Dubai in the first half of the 20th century enjoyed the same architectural character of the Arabian peninsula cities -- mainly comprising narrow alleyways, mud buildings with courtyards, and the emblematic wind catchers (*Barjel*). The city moved to a new phase of modern development when Sheikh Rashid bin Saeed Al Maktoum commissioned British architect John R. Harris to conceive the first master plan, which outlined main roads, zoned the city and shaped its infrastructure. In 1971, following the discovery of oil in 1966, Harris executed a second phase of the master plan, extending his vision for the new Dubai by establishing a ring road system, two bridges across Dubai Creek and connecting the outer housing area with the inner city (Ramos & Rowep 2013; Elsheshtawy 2004). The criticism of these two plans is they failed to tackle the rapid and admittedly unparalleled growth of Dubai. It is worth emphasizing that the creator of the Dubai plan was also the architect behind the first tall building in the region, the Dubai World Trade Centre. Sheikh Rashid had again hired Harris to design this important building, which was the tallest building in Arab world from 1979 until 1999 when the Burj Al Arab was completed (Elsheshtawy 2004).

2.1. Doha, Qatar

The history of Doha goes back to the first half of 19th century, and particularly in 1846 when the Al Maddhid tribe moved from the central Arabian peninsula (i.e., Najad), to settle in what was then known as Al Bidda on the Qatar peninsula. Economic resources during this period was again limited to fishing and pearl hunting. Demographics of the city comprised of the Al Maddhid tribe, traders, Persians, Bedouin people on the periphery of the city, and African workers (Salama 2013).

The population during the opening decade of the 20th century grew to 12,000 inhabitants (Adham 2008). Modern urbanization happened after the first exporting of oil, which was discovered in 1973. While the arrival of oil impacted all of the Gulf cities, there were especially dramatic impacts on the urban morphology of the Doha. The city shifted from a modest pre-oil settlement to a futuristic post-oil metropolis, emphasizing discrete services hubs as a model of the city of the 21st century. The situation in the early phase of the city was similar to other Gulf cities: using local materials for building and arguably more primitive methods of construction. Salama states that "homes based on the inherited dwelling construction knowledge of the indigenous population used local building materials such as palm fronds and trunks as well as coral, stones and mud" (Salama 2013). According to Khaled Adham the urban transformation of the city, between 1949 and 1990 might be categorized into four unique phases: firstly urbanity of transition (1949-1955), secondly urbanity of necessity (1956-1971), thirdly urbanity of modernization (1972-1984), and the fourth urbanity of stagnation (mid-1980s to early 1990s). The period before the beginning of the formal foreign planning process, which expanded from the 1950s until the mid 1960s, seemed haphazard and uncontrolled (Salama 2013). In 1974 the British firm Llewelyn Davis was hired to craft the first master plan for the city, which determined the guidelines for the city urban growth until 1990, based largely on the concept of the ring road and the division of the area into 69 administrative areas. Furthermore the plan aimed to revitalize the city center by removing older buildings in order to create a space for a modern commercial & governmental building. In 1977 the American consultancy William L. Pereira was contracted to produce a new master plan for a designated area (NDOD) North District of Doha (Salama 2013).

2.3. Kuwait City, Kuwait

The beginning of Kuwait as an urban settlement goes back to the 17th century when the Amir of Bni Khaled tribe built a *kote*, a small castle to spend his springtime beside the sea (Saleh 1994). This modest castle changed over time to become a small village surrounded by a defense wall, which was built to protect the local people from various attacks. This fortification was rebuilt three times over three centuries: the first one was built in 1760, followed by another wall in 1811, and finally the last wall was built in 1921 (Yasser 2008). Notwithstanding the deep history of Kuwait, such as the story of Failaka Island which was the home of an ancient civilization in 2000 B.C, the proposition of an emerging global city created by oil wealth, without precedent, still prevailed (Gardiner & Cook 1983).

The discovery of oil in the 1930s encouraged the ruler, Sheikh Abdullah Al-Salem Al- Sabah, to commence with modernization of the city -- by 1951 the first master plan for Kuwait City was depicted by the British firms of Minoprio + Spencely and P. W. Macfarlane. The master plan was based on the concept of a car-oriented environment, which comprised five main roads radiating from the city center (intersecting with ring roads that divided the new development area) to reach smaller neighborhoods that were self sufficient with facilities and amenities (Reem 2009). The dramatic consequences of this bold master plan's implementation proved unacceptable to environmental design professionals and the public alike. Mahgoub (2008) states that "this rapid urbanization created a built environment that was criticized by specialists and the public as being unfriendly, hostile and lacking a sense of belonging". This criticism precipitated by the failure of the first master plan then led to a new master plan being conceived (1967-68) by Colin Buchanan & Partners. Their process began from a critical evaluation of the first master plan, ushering in improvements to the road system and the creation of new areas to attract people from the inner city while concurrently tackling congestion problems (Yasser 2008). The third phase of the master plan, crafted in 1990, arose through the collaboration of the firm SSH from Kuwait and W.S Atkins from the United Kingdom. This team was commissioned by the Kuwait Municipality to produce a new development plan for the city – one that anticipated and guided the city through rapid urbanization over the past three decades.

3.0 TALL BUILDING TYPOLOGY

In the late 19th century and beginning of the 20th century, a first generation of tall buildings arose in North American cities, most notably New York and Chicago. In fact Chicago's nine-story 1884 Home Insurance Building is considered as the first tall building driven by modern technology. While there were numerous dimensions of building technology which shaped the inaugural generation of tall buildings, three factors in particular paved the way towards skyscrapers as an emergent typology. The first breakthrough was the

invention of the elevator which allowed occupants rapid movement within higher reaching structures. The second feature was the development of the skeletal iron frame, an innovation that liberated the building skin from structural responsibility, making the walls lighter and construction faster. The third development was the invention of the curtain wall. (Abel 2003). A common characteristic for the first generation towers was the adoption of a tripartite vertical segmentation – much like the inspirational Classical Greek column. The early skyscrapers divided the façade into three formal parts: the base, the shaft and the top. This division was seen in pioneering towers such as New York's Flat Iron building of 1902, and most of the tall buildings in Chicago of this same era. (Abel 2003).

Tall buildings in the first half of the 20th century subscribed to a similar spatial arrangement: typical floor plates repeating as the building reached skyward -- consequently leading to a predictable and conventional form (Abel 2003). A next breed of tall building emerged mid-century, focusing on the structure's role in shaping building height and form. Such advancements are seen in the pioneering work of engineer Fazular Khan, an innovator who played a crucial role in realizing unprecedented structural systems, such as the tube approach in tall buildings. Brave structural strategies afforded opportunities for buildings to reach adventurous heights – for example, Khan implemented his leading ideas on two iconic towers in Chicago, namely the Sears Tower of 1974, and the John Hancock Building of 1969 (Abel 2003). Antony Wood (2008), in considering the typology's place in a resource-challenged world, argued that the tall building is a sound option to achieve sustainability in the built environment. There are demonstrable advantages of building tall, including their roles in achieving higher density cities, reducing transportation costs, countering urban sprawl, and managing infrastructural implications as well as a high potential for renewable energy (e.g., wind and solar)(Wood 2008). Conversely and often controversially, tall buildings are recognized by many as serious contributors to greenhouse gases and CO2 emissions. The waste generated from this emerging type of building is larger than that of low-rise buildings. Additionally, tall buildings need an impressive amount of resources for construction, operation and maintenance (Roaf + Crichton 2005). Clearly there are both advantages and disadvantages to building tall in our contemporary times. The present authors accept this dichotomy to be a major challenge, and in response are researching ways in which advancements can be made on technological, sociological, psychological, cultural, political and other realms. There is no doubt that the typology is complex as are the associated opportunities and obstacles surrounding their creation and operation.

Figures 2 - 3 - 4: Burj Khalifa | Sinclair & Students Skyscraper Studio Field Trip | Mehrdad Amjadi Studio Project

4.0 CASE STUDIES

Given the significance of skyscrapers to the development of modern global cities, the researchers deemed case studies to be a valuable mechanism to better grasp the variables at play and the possibilities at hand. In looking critically at Sinclair's Holistic Framework for Design + Planning, in light of the tall building typology, it is vital to explore in some depth the qualities and characteristics of skyscrapers that define them in the context of modern environmental design. Specifically, the authors identified three high-profile and praise-worthy towers in the Gulf Region, one in each of the three cities examined in the Master Planning section of the present paper. A key goal of the present research was to revisit and refine the conceptual framework given dimensions identified within

said case studies. With respect to the following skyscraper case studies, the authors deployed a structure for description/investigation which is typical for analysis of Architectural projects.

4.1. Burj Khalifa – Dubai, United Arab Emirates

Overview: The soaring Burj Khalifa is the tallest building in the world, an icon that places Dubai well ahead of the competition in the heated race for the sky. The tower, designed by SOM's Adrian Smith, has a height of 828m and is comprised of 163 floors. The construction of this award-winning tower started in 2004 and was completed in 2010.

Concept and Form: The goal of this project was not to merely build the tallest building, but rather to push the limits of human achievement (Weismantle, Smith & Sheriff 2007). The tower's form is Y-shaped, inspired by both a traditional desert flower and an Islamic pattern -- the architectural form relates to the architectural context of the place in such formal natural + cultural aspects. Although the three wings that shape the tower work efficiently, in a way that provides inhabitants with unobstructed views, from a structural point of view the reduction of these wings towards the top helps the tower resist the severe lateral forces from the wind. This is a good example where performance can be demonstrated in multiple domains, including cultural, sculptural and technical.

Environmental Concerns: Avoiding more explicit sustainable techniques in the tower such as wind turbines and photovoltaic cells, which have been a conventional approach in many towers around the world, the firm instead elected to pursue a sustainable approach to design which connects building and context. For example, one of the strongest features of the building is the open terraces at top levels of the tower. This strategy, deemed unacceptable in super tall buildings before then, proved successful in the Burj Khalifa. Typically the higher zones of tall buildings encounter high speed winds, resulting in uncomfortable conditions for occupants. However, in the Burj Khalifa the bold design, coupled with an integrated team of specialized engineers engaged in early wind modelling, led to wind effect mitigation, comfortable occupancy and breathtaking views. In arid dry climates such as Dubai, water is a rare resource and irrigation of landscapes is challenging. To address such realities the firm devised innovative approaches to condense hot humid air outside the building in order to provide moist air inside the building, a design gesture that resulted in a significant amount of water captured for irrigation of tower landscapes (approximately 15 million gallons per year)(Smith 2008).

Site & Context: The context of the Burj Khalifa is distinctive and unique, with the tower placed as the centerpiece of the new development area which is called the Dubai downtown (the traditional center was Dubai Creek). This new urban area consists of mixed-use residential, retail, and office development. The landscape for the area is well designed and well connected to public transportation (both train & bus networks). Additionally, the scale of the building relative to the context was an urban challenge for the designers—the solution sees a stepping back gradually towards the sky. In effecting these reductions as the tower rises, an elegant solution for the undeniable scale of this mega tower was achieved.

4.2. Doha Tower - Doha, Qatar

Overview: Doha Tower, the newest tall building in the country of Qatar and the sixth tallest tower in Doha, reaches to a height of 238m. It comprises 46 stories used primarily for offices with some for residential and hospitality aspects. This bold tower, designed by the well-known French architect Jean Nouvel, has a total area of 110,000 sq m. It creates an elegant landmark for the city of Doha with its impressive presence and innovative design. Moreover the building won the Council for Tall Buildings and Urban Habitat (CTBUH) award as the best building in the Middle East and Africa in 2012.

Concept and Form: The form of the tower is simple, with its design driven towards optimal spatial efficiency. The cylindrical geometry makes effective use of floor-to-window area and situates elevators in relative proximity for all offices (Wood 2012). Though the form is straightforward in its massing and disposition, the concept is focused more on the skin of the tower. Nouvel is a designer who has proven his abilities to reinterpret cultural and traditional symbols in architecture, making buildings that fit within historic settings in modern ways. The inspiration in the Doha Tower is the mashrabiya, which is a traditional pattern of timber lattice utilized in the region.

Environmental Concerns: The main sustainable feature in this building is the thoughtful consideration of the design of the envelope, the skin of the building, in a manner directly inspired by the Islamic mashrabiya. This technique protects the internal spaces of the project from heat gain while at the same time providing maximum levels of privacy – a quality which is important within traditional Islamic society and architecture. In this way Nouvel creatively designed the façade to not only perform technically but to reflect the deep roots of the local culture. From an energy savings perspective this innovative skin treatment reduced cooling load by 20%. The main theme for the façade tectonic deploys a single geometric motive, that is then repeated in different scales.

Through this mechanism diverse opacity levels are realized -- 40% on the south and 60% on the east and west (Al-Kodmany 2014).

Site & Context: The site for the Doha Tower is a suitable area for a high-rise building in the city, namely the new business district in West Bay. This urban district was planned to accommodate mixed-use development and to shape the city skyline. With future public transportation and the appropriate infrastructure in progress, the area contains a culmination of high rise buildings across Doha's waterfront. Furthermore this strategy of locating towers in a specific zone, with its applicable transportation system and sound infrastructure (i.e., designated for tall building) is arguably more sensible and sustainable (Goncalves 2010).

4.3. Al Hamra Firdous Tower – Kuwait City, Kuwait

Overview: Al Hamra Tower rises 412m in a temperate manner, providing the urban fabric of Kuwait City with an iconic building which sets the pinnacle of the skyline in elegant balance between the environment and the culture. Designed by Skidmore, Owings & Merrill (SOM) in 2005 and completed in 2011, Time Magazine recognized the building as one of the top innovations in design (Al Hamra 2014). The tower was conceived in a unique way that helps to achieve the designer's goal of thinking globally and working locally -- the project connects in a sensitive way with context, including the crafting of a form that reduces harmful solar gain, while concurrently maximizing views of the breathtaking Arabian Gulf.

Concept and Form: The tower's form comprises a spiraling hyperbolic paraboloid -- generated in consideration of two goals: firstly creating a delicate space that gives the occupants the maximum unimpeded views to the Gulf, while secondly, reducing solar gain to the lowest levels possible. The southern façade is protected by a semi-solid stone façade, with small openings that relate to the traditional local architecture. The other facades of the building are wrapped by transparent glass walls. This strategy of designing different sides of the tower in a manner highly responsive to unique climatic conditions led to the distinctive and poetic sculpted form.

Environmental Concerns: The delicate handling of the tower's surfaces resulted in an environmentally responsible tower -- the cut of the south quarter of the plan creates a void that efficiently protects the building from undue heat gain while simultaneously disrupting wind forces which then helps to stabilize the building in consideration of lateral forces (Asci & Sarkisian 2011). From a materiality perspective the tower's primary construction of concrete served as an ideal option given the hot arid weather, with this heavy material operating as a thermal mass that absorbs the heat in the day and releases it at night (Wood 2012).

Site & Context: Located in a distinctive setting within Kuwait City's central zone, the tower works as a remarkable landmark. The Al Hamra Tower connects to the ground in a poetic way, incorporating a 20m high lobby. The innovative use of a concrete lamella structure helps to transfer the structural loads to the ground without blocking space – the space works as a profound integrative space between the strength of the tower and the urban texture of the neighbourhood (Parker & Wood 2013).

5.0 RECONSIDERING SINCLAIR'S HOLISTIC FRAMEWORK

In considering both the master planning of the three Gulf Region cities, and the subsequent case studies of single commanding Architectural projects therein, there are lessons to be grasped. No doubt city planning, when most effective, proves respectful to history and tradition while being sensitive to culture and context. Anticipating change, growth and development is also a vital quality of successful master planning. In many ways successful Architecture, especially at the scale of skyscrapers, also genuinely respects history and tradition, sensitively responds to culture and context, and anticipates tomorrow. Sinclair's Holistic Framework for Design + Planning aims to connect disparate elements in order to more effectively realize culturally-sensitive, better-integrated and more sustainable projects and precincts. The tall building is an especially unique Architectural typology. By virtue of its size, cost and complexity such projects warrant an extraordinary level of care and attention. In reconsidering Sinclair's Framework with tall buildings in mind, several key criticisms and recommendations are advanced by the present researchers:

Agility: The tall building must be able to handle future changes in quick and nimble ways, such as the need for more kinetic systems in façades, building skins that respond to the daily changes in weather, or aspects regarding flexibility in vertical circulation. Tall buildings are costly to construct, significant in volume and high in occupancy – they last a long time which underscores the critical need for agility, mutability and adaptability over

time. Design and operations of tall buildings, due to their presence and permanence, must push the boundaries for agility in ways that exceed other typologies.

Fitness: The manner in which tall buildings relate to the landscape, including how they connect to the ground plane, is a major aspect of design of this typology. The harmony/symbiosis between the tall building and its surroundings is paramount. Designers must pay significant attention to the integration of the tall building with the urban realm, in particular as the scale and scope are commonly without precedent. To this end the researchers contend that these super tall structures need to reach out more assertively and effectively to the public in creative ways. Design must celebrate the tall building not merely as private space for corporations but also as public space for community. Increasingly, tall buildings will be called upon to engage more meaningfully in the life of cities.

Diversity: Tall buildings over much of its existence have been overwhelmingly focused on the provision of office space. However, as with the public's disdain for clinical zoning in city planning, Architectural designers scramble to introduce more messy vitality through a richer mix of uses and users in skyscrapers. Today tall buildings often encompass an array of uses. The present authors suggest that diversity needs to be a key goal of building tall. Dynamic combinations of office, commercial-retail, residential, cultural and recreational spaces, for example, should be included in tall building programs. Unexpected and interesting adjacencies and overlaps should be actively pursued in order to realize greater self-sufficiency, greater inter-dependencies and greater spatial/social interest.

Delight: Sinclair (2009) stressed the central role of delight in architectural equations for sustainability. While this elusive quality is often neglected in green building assessment and sustainability rating systems, it is undeniably a crucial quality of good/great Architecture. In the case of the skyscraper the need to pursue delight is amplified in profound ways. The profile, presence, permanence and power of these towers demands extraordinary efforts by design teams to get the 'delight' right. Design vehicles such as skycourts and vertical gardens, for example, hold promise to enhance the experience of space. Attention to green space and indoor environmental quality can contribute to the well being of occupants. Inclusion of aspects of mystery, surprise and the sensual, inside & outside, can provide pleasant encounters for users, visitors, neighbors and passers-by. Serious study of delight in the design of skyscrapers is lacking, in part due to its qualitative dimensions. That said, it remains a central variable and goal to be pursued with even greater vigor and resolve.

CONCLUSION

"What about guns with sensors in the handles that could detect if you were angry, and if you were, they wouldn't fire, even if you were a police officer? What about skyscrapers made with moving parts, so they could rearrange themselves when they had to, and even open holes in their middles for planes to fly through?" Jonathan Safran Foer

It is clear that the tall building, or skyscraper, has emerged as a dominant Architectural typology of the new millennium. Around the planet in major global cities buildings are reaching higher, in part a testament to advancing technological capabilities and in part a symbol of power, might and majesty. Yet, while the typology is developing and their numbers burgeoning, the authors believe that research in many areas pertaining to tall buildings is seriously lacking. A primary focus, concerning research and development, has been in the technical areas including structures, mechanical systems and building envelopes. While all of these dimensions of skyscrapers are crucial they alone may prove insufficient. Other aspects of tall buildings, including sociological, psychological, urban and landscape explorations, warrant urgent and intense attention. The present paper has critically considered the typology, with an emphasis on the emerging cities and centers of the Arabian Gulf Region. Rapid unprecedented urbanization is a hallmark of this region, including a dramatic presence of skyscrapers. Through the study of master planning efforts in Dubai, Doha and Kuwait City the authors have painted a picture of dramatic upheaval and change. Through the exploration of case studies of three towers in these cities an effort has been made to grasp the magnitude and impacts of building tall. Early in the paper an emphasis was placed on the value of conceptual frameworks to the cause of design and planning. Highlighting Sinclair's Holistic Framework the authors emphasized the value of far greater integration and interdisciplinary thinking when engaging in the complex enterprise of modern design and planning. Considering this framework in light of master plans and skyscrapers in Gulf cities, the researchers delineated key points to address when conceiving and constructing tall buildings – with an elaboration of Agility, Fitness, Diversity and Delight. Growth of tall buildings, in terms of height, volume and numbers, is anticipated to escalate not only in the Gulf Region but

elsewhere internationally, including of course the Asian Pacific arena. The present paper underscores the pressing need to attend to a far more holistic array of variables as skyscrapers are designed and developed. Beyond the obvious economic and political elements of tall buildings, the authors recommend great focus be directed to perception, performance and place-making. Skyscrapers contribute demonstrably and concurrently to the skyline, the district and the street. It is essential for designers and planners to consider the interplay and implications of such scales as tall buildings arrive to our cities. Performance can be measured along numerous lines and across many dimensions of tall buildings. Architects must move beyond the empirical easily-measured spheres and into the more interesting and arguably important ethos of meaning, beauty and value. Finally, place is space overlaid with significance. Space is geometric while place is emotive. Given the extraordinary power and presence of skyscrapers upon our land and within our cities, it is unquestionably imperative to elevate place-making to an art. Returning to the question of the Gulf Region, and given the unbridled pace of development, investing in research to answer these questions will pay huge dividends downstream. Ignoring the spectrum of forces at play, to the contrary, could translate into an assemblage of buildings that prove more liability than asset and more destructive than generative. The stakes are high. Design matters.

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