AHMAD HAKMI

FROM OASIS TO METROPOLIS: A STUDY ON THE URBAN DEVELOPMENT TRENDS IN RIYADH AND DUBA I

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A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES OF NEAR EAST UNIVERSITY

By
AHMAD HAKMI

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Architecture

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Approval of Director of Graduate School of Applied Sciences

Prof. Dr. Nadire ÇAVUŞ

We certify this thesis is satisfactory for the award of the degree of Masters of Science in Architecture

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that I have fully cited and referenced all materials and results that are not original to this work, as required by these rules and conduct.

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To my parents...

ABSTRACT

Oasis is an isolated place in the arid region where vegetation and water can be found. Also it serves as abode for animals and humans. The discovery of oasis has been very important for trade and transportation route in the arid regions.

Apart from political and economic prerequisites, oases need to develop both environmentally and socially in order to become a sustainable metropolis. Two cities in the Arabian Peninsula were considered for a detailed analysis and comparison with reference to oasis and sustainable development. Firstly, the Saudi Arabian capital Riyadh, which is the largest metropolis with over 5 million inhabitants. And second, the Emirate of Dubai, which is much smaller with only 3 million inhabitants, but due to its current construction boom attracts all the more attention. The two are very contrasting cities. Against the background of the non-renewable of the raw material oil, it is particularly interesting to see what the future metropolis development looks like and whether there can be anything like a sustainable oasis development.

Despite the high-level commitment in sustainable development in the gulf cities, many national policies have largely failed to effectively manage their natural resources base of two important oases Riyadh and Dubai through absence of comprehensive and integrated policies. Hence, this study aims to critically analyze Riyadh and Dubai as sustainable oasis development to metropolis.

***Keywords*:** Sustainable oasis development; settlement development; ecological aspects; oasis; Arabian Peninsula

ÖZET

Oasis, bitki örtüsü ve suyun bulunabileceği kurak bölgede izole edilmiş bir yerdir. Ayrıca, hayvanlar ve insanlar için bir mesken görevi görür. Vahaların keşfi kurak bölgelerde ticaret ve ulaşım yolu için çok önemli olmuştur.

Politik ve ekonomik ön koşulların yanı sıra, sürdürülebilir bir metropol olabilmek için vahaların hem çevresel hem de sosyal olarak gelişmesi gerekir. Arap Yarımadası'ndaki iki şehir, vaha ve sürdürülebilir kalkınmaya referans olarak detaylı bir analiz ve karşılaştırma için değerlendirildi. İlk olarak, 5 milyondan fazla nüfusuyla en büyük metropol olan Suudi Arabistan'ın başkenti Riyad. İkincisi, yalnızca 3 milyon nüfusuyla daha küçük olan Dubai Emirliği, mevcut inşaat patlaması nedeniyle daha da dikkat çekiyor. İkisi çok zıt şehirler. Hammadde yağının inceliğinin arka planında, gelecekteki metropol gelişiminin nasıl göründüğünü ve sürdürülebilir bir vaha gelişimi gibi bir şey olup olmadığını görmek ilginçtir.

Körfez şehirlerinde sürdürülebilir kalkınma konusundaki üst düzey bağlılığa rağmen, birçok ulusal politika, kapsamlı ve entegre politikaların yokluğunda, Riyad ve Dubai'nin iki önemli alandaki doğal kaynak tabanını etkin bir şekilde yönetemedi. Bu nedenle, bu çalışma metropol için sürdürülebilir bir vaha gelişimi olarak Riyad ve Dubai'yi eleştirel olarak analiz etmeyi amaçlamaktadır.

Anahtar Kelimeler: Sürdürülebilir vaha gelişimi; yerleşim geliştirme; ekolojik yönler; vaha; Arap Yarımadası

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LIST OF ABBREVIATIONS

ABCCLIO:	A Publishing Company For Academic Reference
AD:	Anno Domini In The Year Of The Lordthe Year Jesus Was Born
ADA:	Arriyadh Development Authority
AS & P:	Albert Speer PartnerGmbh
BRILL:	A Dutch International Academic Publisher
CBD:	Convention on Biological Diversity
DLC:	Dubai Logistic City
DRUL:	Dubai Rapid Link
EU:	European Union
GCC:	Gulf Cooperation Council
HCDR:	The High Commission for the Development of Riyadh
ICARDA:	International Center For Agricultural Research In The Dry Areas
JAAC:	DM: Dubai Municipality
KAHC:	King Abdulaziz Medical City in Riyadh
LRT:	Light Rail Transit
MEDSTAR:	The Metropolitan Development Strategy for Riyadh Region
MOMRA:	Ministry of Municipal and Rural Affairs
MOP:	Ministry of Planning
OPEC:	The Organization of the Petroleum Exporting Countries
RPTN:	Riyadh public Transport
RTA:	Roads and Transport Authority
UAE:	United Arab Emirates
UIS :	Urban Information System
UNESCO:	The United Nations Educational, Scientific and Cultural Organization
USA:	United states of America

CHAPTER 1

INTRODUCTION

Oasis is an isolated place in the arid region where vegetation can be found. It usually occurs where there is source of water and serves as abode for animals and utilized as a source of water for humans. The discovery of oasis has been very important for trade and transportation route in the arid regions. Caravans needs to journey through oasis in order to replenish the supply of water and food (Häser, 2000).

Each city usually has a historical starting point for later urban development. In the case of the Oil City, it is the oasis city that is the political and economic center of the oil boom. In this context, the questions arise after the construction of the historic oasis city and its fate, after the oil began. In terms of sustainability, the oasis tends to provide the needs of its inhabitants because back in the days' caravans in the desert area depend solely on oasis for food and water including the camels and drivers during challenging journey through the desert. Hence, oasis provides shelter, water and food to its inhabitants (Häser, 2000).

Two cities in the Arabian Peninsula are particularly suitable for a detailed analysis and comparison. Firstly, the Saudi Arabian capital Riyadh, which is the largest metropolis with over 5 million inhabitants and unlike most of the other million cities in the region lies in the interior of the country and not on the coast. And second, the Emirate of Dubai, which is much smaller with only 3 million inhabitants, but due to its current construction boom attracts all the more attention. The two are very contrasting cities, suitable examples to get to know the core of the general city type of the Oil City better. Against the background of the finiteness of the raw material oil, it is particularly interesting to see what the future urban development looks like and whether there can be anything like a "post oil city". The rate of urbanization differs from one country to the other (LeGates, 2006).

Several researcher has contributed to the study of sustainable city design, there is a similarity amongst several urban places although each urban city would be recognized with a distinctive feature (Aldalbahi & Walker, 2015). Common features for all cities include; parks, residential apartments, high rise buildings. It is also important to mention the

significant impact of other social physiological factors such as political, demographical, and cultural factors playing a significant role in urbanization development.

The effect of urbanization happens due to certain changes in the city, mostly as a result of large migration thereby increasing population of the city. Migration may be caused by the excessive movement of people due to occupation in the city (Brunn et al., 2008). Urbanization largely occurs due to large industrial and economic development in the city. Asides migration and industrialization, steady increase in birth rate is a contributing factor towards the rapid development and urbanization. The development of urbanization shows that the there is an interest in the rapid increase of urbanization of rural area.

1.1 Thesis Problem

Despite the effort made by the Emirate of Dubai and Saudi Arabia government proposals in recent years to model the first post-oil urbanization that will lead to the initial economic revolution and open the cities to new policies of open market; the successful development incorporates all the national, international as well as local marketers and investors. Although, urbanization found in Riyadh and Dubai can be regarded to be successful due to the big achievement of this new plans that led to the rapid development in term of metropolitan growth in the region. However, they have failed in some aspects to effectively manage their natural resources base.

Nowadays, the biggest and uncontrolled challenges of the entire Arabian Peninsula are the integral formations of plans and strategies in order to balance the entire system of urban growth and development regarding social and environmental. Hence, the biggest challenges of the regions is make sure the strategies plans in term of development were put in control both in installation and implementations with effective management measures. The occurrence of financial crisis all over the globe has pressurized the region to clearly define the differences between the event and sustainable urbanization. Therefore, this research critically analyzed Rhiyad and Dubai cities as a sustainable oases development to metropolis.

1.2 The Aim of the Thesis

The adoption of planning a sustainable city has gained significance interest of several countries across the world. As fascinating as the idea seems to be, there are several challenges towards the development of an advanced and sustainable city design. Analysis of the development or urbanization that occurs in the oases cities remains a very important factors to be discussed in this research, this stance this thesis work to aimed in;

1. To examine the development from a sustainability point of view of Riyadh and Dubai to metropolis
2. To research, if this fast-urban transformation of the oasis cities to big metropolis is because of the environmental and social developments.
3. To explore and employ the analysis of recent works, figures and the solid facts of both environmental and social indicators of sustainability for Dubai and Riyadh.

The research questions follow by asking the significance, features and characteristic related to oases urbanism with regards to build environment, in the case studies Dubai and Riyadh Are both Dubai and Riyadh fully sustainable in terms of environmental and social development? Therefore, the research is not only scoped to the modern development but also their drawbacks and solutions incorporated in the development strategies.

1.3 The Importance of the Thesis

An integrated urban and regional planning approach is seen to be a major condition in responding to the urbanization of the gulf in a proper way. The central importance of this thesis is to understand in a bigger picture the major consequences, current and future situations related to the sustainable oases development to metropolis in a selected Gulf city, Riyadh and Dubai. This is due to the huge transformation in term of metropolis development and city planning that were to the best of the authors knowledge not yet been analyzed. The general concept of urbanization was confused by many researchers and therefore the idea was still unanswered. Findings by Florian Wiedmann (2010) explained how Post-oil urbanism in the selected Gulf cities bring lot of problem such as spontaneous development,

construction of buildings without proper adhere to building bye laws and regulations, uncoordinated urban growth devoid of any strategic plan as guideline that shapes the development. Thus, the recent transformation of the built environment is resulted from the post-oil urbanism. In the future, the relocation of the oil company after oil finish will make the existing development to be hard to sustain due to the amount energy devised to run each facilities of building, this include the high rise building and manmade islands.

The research bridges the gaps between the researcher of knowledge, students, national and international bodies whose interest laid in the general understanding of Rhiyad and Dubai as a sustainable oasis's development to metropolis.

1.4 Limitation of the Study

The thesis was limited to analyses of social and environmental indicators of sustainability regarding oases urbanization occurring in Dubai and Riyadh cities, this is because the scope of Gulf countries is wider considering these thesis level. The selected case study is confirming to provide the required standard and to meet the objectives of the thesis in understanding the oasis urbanization and development as a metropolis. The urban development in the selected Gulf cities in the past 10 years will be analyzed.

Secondly, the recent progress in Riyadh and Dubai such as social and environmental development which in turn called sustainable organizational development.

Therefore, this work focuses on the built environment in relation to sustainable oasis development to metropolis. In order to evaluate urban planning, the pillars of sustainable development need to be addressed and analyzed.

1.5 Methodology

This research methodology was focused on the means of achieving the aim of the project. The significance of oasis in the development of the sustainable cities namely Riyadh and Dubai into metropolis was the focal point of the methodology: Similarities and differences between these two cities were estimated in terms of sustainability indicators which particularly projects the environmental and social parameters. Analysis of materials such as previous literature, articles, and magazines pertaining to Urban development in the two cities and other Arabian Peninsula and original research works were all engaged in achieving the methodologies. Moreover, more information was reviewed from published papers and Dubai Municipality official documents. The target of attaining the originality of sources ensured derivation of related information from diverse original sources.

CHAPTER 2

URBAN SUSTAINABILITY AND DEVELOPMENT

2.1. General Principles: The Arabian Peninsula

2.1.1 Geography

The Arabian Peninsula Djesirat al Arab, a subcontinent of Asia, is bounded west, east and south of the sea. To the west are the Suez Canal and the Red Sea, which separate the peninsula from North Africa. On the southern side, it is bordered by the Arabian Sea, which belongs to the Indian Ocean, and the Gulf of Aden. To the east are the Arabian Gulf or Arabian Gulf and the Gulf of Oman. In the north, it encounters lands of the so-called fertile crescent, today's Jordan and today's Iraq. Viewed from a tectonic point of view, the peninsula forms the Arabian plate and, from a geological point of view, it belongs to the ancient African continental mass, even though it is separated from it by the rift valley of the Red Sea with a total area of more than three million square kilometers, it is the largest peninsula on earth in front of West Antarctica and the Near East. With a population of approximately 48 million, it is also one of the most sparsely populated areas. The reason for this lies mainly in the vast deserts and barren mountainous regions that extend over the entire peninsula (De Pauw, 2002).

The Arabian Peninsula is a raised bed which is lined on the west and south by mountain ranges and whose eastern slope gently slopes to the Arabian Gulf falls off. The up to 3000-meter-high mountain range is formed from the Asir Mountains in the south and the highlands of the Hijaz in the north. This mountain range gradually merges into the approximately 1000-meter-high central Arabian highlands of the Nedschd, which is characterized by large sandy deserts and limestone plateaus. Here are the deserts Nefud in the north and the Rub al Khali in the south.

They are the largest sandy deserts in the world and occupy much of the Arabian Peninsula. On the Gulf of Oman, the land rises from a roughly 20 km wide coastal plain to another mountainous land, which reaches heights of about 3000 meters. There are no major year-round water-bearing rivers throughout the Arabian Peninsula. The river beds, the so-called wadis, are usually dried out and only in the rare rainfall in the short term to torrents. The

partially rich groundwater resources are located deep in the earth's interior. They form the starting point for the emergence of such civil oases (Ghazanfar & Fisher, 2013).

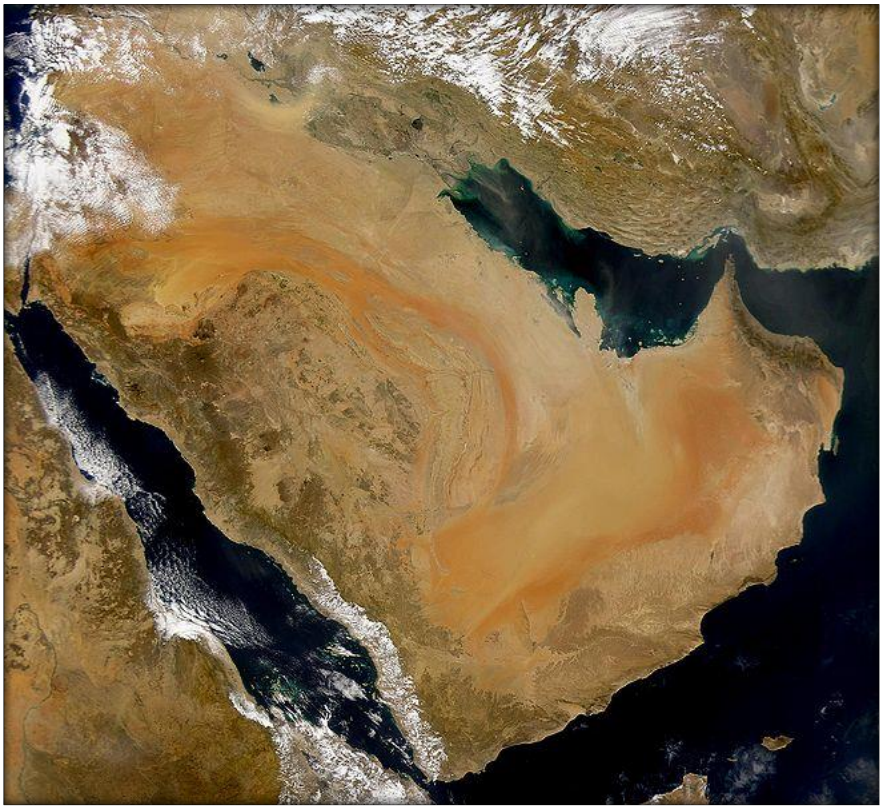

Figure 2.1: Arabian Peninsula (https://eo.wikipedia.org/wiki/Dosiero:ArabianPeninsula_dust_SeaWiFS-2.jpg Last accessed September 2018)

2.1.2 Climate

A key feature of the Arabian Peninsula is its extremely dry climate. Only in a few places is the rainfall more than 178 millimeters. The Tihama, a 20 to 40 km wide desert steppe on the west coast, parts of the Yemen and the north coast of Oman are the only areas where agriculture is possible by taking advantage of the rain. Rainfall is concentrated in the mountains in the southwest, south and east. Most of the annual precipitation falls between November and January. The central highlands are characterized by a dry, subtropical altitude climate with large temperature differences, ranging from day to night up to 40° C (Ghazanfar & Fisher, 2013).

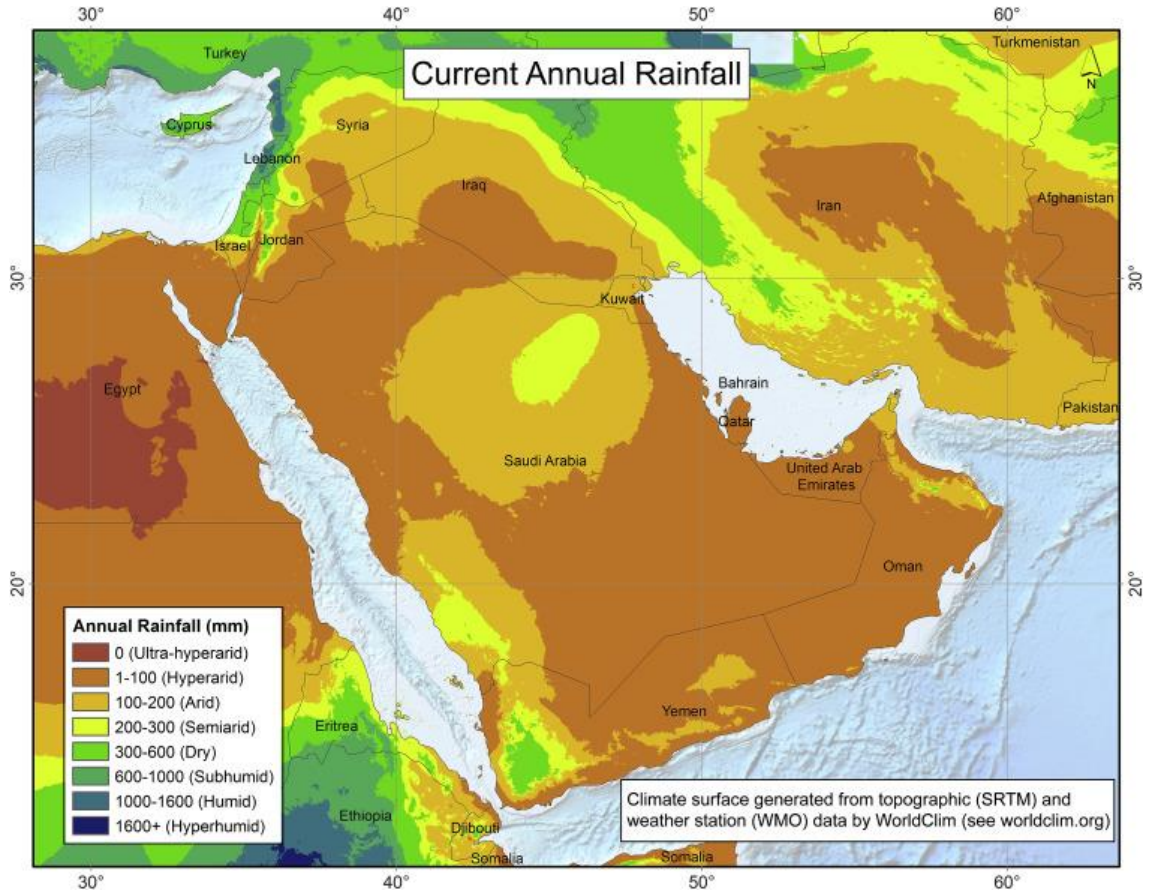

Figure 2.2: Rainfall in the Arabian peninsula (http://www.palaeodeserts.com/wp-content/uploads/2015/03/TheGreening.pdf Last accessed September 2018)

In the summer months, trade winds are coming from the south across the Arabian Peninsula. These dry-hot winds also cause the temperatures to rise sharply. In winter, cold air masses flow in from Central Asia, occasionally also warmer humid air from the Mediterranean. Sandstorms can occur all year depending on the geographical location. In the Gulf region, the winter months are particularly affected when the wind blows over the sandy deserts towards the coast. The Arabian Peninsula can be divided into three climatic zones: the central highlands, where there is usually high pressure in cloudless skies. Here, the air is dry and it can come to sandstorms, especially in winter. Summer temperatures average 40° C maximum temperatures 45-50° during the day and 25° C at night. In winter, the temperatures vary between 5° C and 20° C, rarely the thermometer drops below 0° C. The rainfall is on average only about 90 mm. The climate of the Asir and Hejaz Mountains is similar to that of the central highlands. In the southern part of the peninsula begins the sphere of influence

of the southwest monsoon. The summer heat is comparable to that of the central highlands. In the warmer winter months, the average temperature is 25° C. In the coastal regions, the climate is very hot in summer about 40 ° C and the humidity high 50 - 80%. In the Arabian Gulf, the winter months at 20 ° C and about 170 mm annual precipitation are mild (Ghazanfar & Fisher, 2013).

2.1.3 Economy

Economically, the Gulf States are primarily dependent on oil production. The capital of the petrodollar was partly invested in different countries with different emphases. Building infrastructure and industry was a top priority. The built industry was directly or indirectly related to the oil or gas produced. Since the 1970s, due to the economic situation, the major urban centers have skyrocketed. Without the resource wealth such a development would not have been possible within a few decades. Nowhere else on earth is petroleum pumped faster and cheaper than on the Arabian Peninsula. The fossil fuel shaped the history of the second half of the 20th century, when the oil boom began to boost the economy of the Gulf States. Currently the largest known oil reserves are in the area of the Arabian Peninsula.

In particular, along the Arabian Gulf from Kuwait to Oman, almost 50% of the world's total oil reserves are stored. Oil is suspected throughout the world. Basically, it is found in places where sedimentary rocks are present. Thousands of millions of years ago, dead microorganisms and other organic remains of the ancient seas were deposited in the cavities of the sedimentary rocks. These in turn formed a sludge, which is due to the depth Oxygen deficiency could not decompose and over the millennia transformed by oxygen-independent bacteria in hydrocarbon droplets. Through tectonic faults, the resulting oil droplets collected in cavities of the sedimentary rock, from where they moved as bubbles under pressure to solid rock formations and formed underground lakes. The plate shifts have led to oil deposits occurring both on land and in the oceans (Al-Ghafri et al., 2007).

Figure 2.3: Dammam No7 the first commercial oil well in Saudi Arabia struck (Https://en.wikipedia.org/wiki/History_of_the_oil_industry_in_Saudi_Arabia#/media/File:Dammam_No._7_on_March_4,_1938.jpg Last accessed October 2018)

To this day, no region in the world could be found where oil is stored in such large quantities near the surface of the earth. Favored by the climate and the geographical situation, the Gulf region from the beginning had great advantages over other assisted areas such as Alaska or Siberia. Oil was found in Bahrain and Saudi Arabia as early as the 1930s, but only after World War II did oil production begin on a large scale. The largest oil reserves are owned by Saudi Arabia, which has the world's largest oil field, the 240-kilometer-long and 35-kilometer-wide Ghawar district in the east of the Arabian Gulf. The largest offshore oil deposit is also in Saudi Arabia (Al-Ghafri et al., 2007).

Economically, Dubai today plays a special role in the Arabian Peninsula. For the first time tourism plays a role as an economic sector. Many hotels have been built, and while tourism is not the main source of income, it is making an important contribution to city marketing, which should make the site attractive to investors from all over the world in the long run. Dubai is on its way to becoming the first Global City of the Arabian Peninsula.

With the exception of Oman and Bahrain, all Gulf states belong to OPEC. The petroleum cartel only produces 50% of the world's oil market, as countries such as Russia and Norway did not join OPEC. The oil deposits are limited. Dubai is expected to be around 40 years old Crude oil production and in Qatar at about 30 years. The Gulf States' industry is very focused on fossil fuel processing, with petrochemicals as an important industrial sector, for example. The Gulf States are gradually trying to escape this dependence by investing in new sectors of the economy. The Emirate of Dubai seems to have taken on a pioneering role in this context and serves many Gulf States as a model to realign their own economy (Heck, 2004).

2.2 The Oasis City

2.2.1 Concept of oasis

Oasis is an isolated area of vegetation in a desert, typically surrounding a spring or similar water source. Oases (more than one oasis) also provide habitat for animals and even humans if the area is big enough. The general idea of oasis is developed from the fertile fresh water surrounding of a location, these includes natural springs, underground water with variying sizes. There are several benefitting factors to the presence of oases in a localty, one of which includes the irrigation of cropland, maintenance of sustainable aquatic life while others its transportation routes in desert areas.

The Oases are sadly challenged by several life-threatening conditions which not only affects the agricultural crops around it, but acts as a threat to both animal and human lives that depends on the foods, crops planted around the parameters of the oases.

The larger majority of the world underground supplies evolves from the underground water beneath the Sahara Desert covering over 90 major oases thereby forming a tourist center of attraction. Furthermore, traders and merchant who ideally travel along such routes would most likely make stops at the oases for travelling supplies, food and water; Transforming oasis into a political, economic and military movement (Malkki, 1992).

2.2.2 Oasis in the Arabian Peninsula

The Arabian Peninsula is one of the lowest-rainfall regions in the world. Over the years, enormous amounts of groundwater have been collected underground which is stored mainly in great depths and only in a few places does it emerges as spring water out onto the surface. These so-called oases, which have their own flora and fauna, are created in these special places.

Cities such as Al-Husa in Saudi Arabia house important oasis as it lies in one of the richest field in the world marking it an international trading unit. The area has been known for rich farming in the Arabian Peninsula for decades of years up till today leading in agricultural production of rice, sheep, cattles etc. other type of significant oasis include the large and elongated Oasis in Delta, Egypt with high fertility of the Nile river (Shirazi & Falahat, 2015).

Figure 2.4: Oasis in Riyadh.
(https://ar.wikipedia.org/wiki/media/File:Riyadh_desert.jpg Last Accessed April 2018)

2.2.3 Importance of oases

The significant impact of Oases cannot be over emphasized in plant production, fresh crop agriculture, and maintenance of a stable, sustainable ecosystem. A vivid example is observed in the Falaj irrigation system in the oases of Oman, where galleries and guttered gullies lead the water from the mountains and the edges of the wadi to the settlements and their cultivated areas (Al-Ghafri et al., 2007).

The oases were once the centers of life and thus the starting point of all settlements in the Arabian Peninsula. The nomads used them as trading places and the caravans as important ones Supply points. All human life was dependent on those few places that over the entire Arabian Peninsula except for the large sandy deserts were to be found. The result was an oasis culture that represented a uniting life form and environment that had been shaped and conditioned for millennia. Depending on the circumstances, settlements around oases could reach large number of with significant impact on cultivation of plant, thereby sustaining human lives. The oasis population exchanged their products with the nomadic tribes wandering around, who in turn offered their goods for sale serving as a business opportunity for international investors and tourist (Häser, 2000).

2.2.4 The effects of oasis city on the environment

Oasis City adapts to the environment. The dense, closed buildings, road guides and coiled roads reduce the impact of hot winds that often carry sand. Walls, such as immunization, act as additional barriers to wind on the outskirts of settlements. The buildings are close to each other and shading each other. In this way, the building is not heated and the roads are protected from the sun. In some cases, the pergola is used to shade roads or lanes. All elements of this type of city have been optimally adapted to the harsh conditions and enabled people to live in this to lead the barren area of the earth (Hawker, 2008).

2.2.5 Structure of the oasis city

The structure of the oasis city largely depends on the size of the oasis and its agricultural cultivating area. On the coast, fishing, maritime and other aquatic trade serves as a fundamental economic basis of the settlements. In summary, the structure of oasis greatly depends on the agricultural cultivation around the oases as this greatly influence the sustainability of the oasis in general. The development of the cities further promotes the economic and social adaptation to the environment (Hassan, 2001).

Figure 2.5: Ruins of the Medieval Fortress of ShaliSiwa Oasis Matrouh GovernorateEgyptof_the_Medieval_Fortress_of (https://commons.wikimedia.org/wiki/File:Ruins_of_the_medieval_fortress_of_Shali,_Siwa_Oasis,_Matrouh_Governorate,_Egypt.jpgLast Accessed February 2018**)**

In general, the oasis cities resemble each other and form a city type whose elements differ only slightly from city to city. The oasis city of the Arabian Peninsula is located in the Islamic cultural area and is thus also assigned to the Islamic city type. In terms of urban policy, the most powerful tribe took the lead (Eben, 1999).

2.2.6 Structural elements of Arabian City

The structural elements revolving around the creation of a sustainable oasis city development are detailed as thus;

- ***Basic requirements***

With a few exceptions, all the oasis towns had a fortification ring to protect the city from attacks by enemy tribes. This formed the boundaries of the city and usually consisted of built walls. The most important part of the fortification was the citadel.

Figure 2.6: Al-`Ula old town, Saudi Arabia, the compact structure of the old cities works as a fortress (https://www.atlasobscura.com/places/al-ulaLast Accessed Mai 2018)

In many cases, this fortress served as a seat of rule and allowed the ruler to escape in two directions. Often there were towers from which the environment was survivable. Another basic requirement in addition to the fortification were the main access roads that met in the city center (Brown & Brown, 1973).

- ***The center mosque***

The mosque is typically the center of major crossroads of the main axes of the Arabian city, it occurs as the core of the settlement as the most important public institution. The size of the mosque depended on the number of believers they visited on Friday prayers. With increasing population, it was enlarged and thus reflected the settlement size again. The prosperity of a city was also evident, which had the most striking architecture next to the ruler's palace.

Their function was not limited only to that of the place of prayer, it was at the same time meeting place and discussion forum of the population. Important matters of jurisprudence were settled in the mosque, which thus also assumed the function of a court. Furthermore, she was often attached to a Koran school, which was usually the only educational institution of the smaller oasis cities (Brown & Brown, 1973).

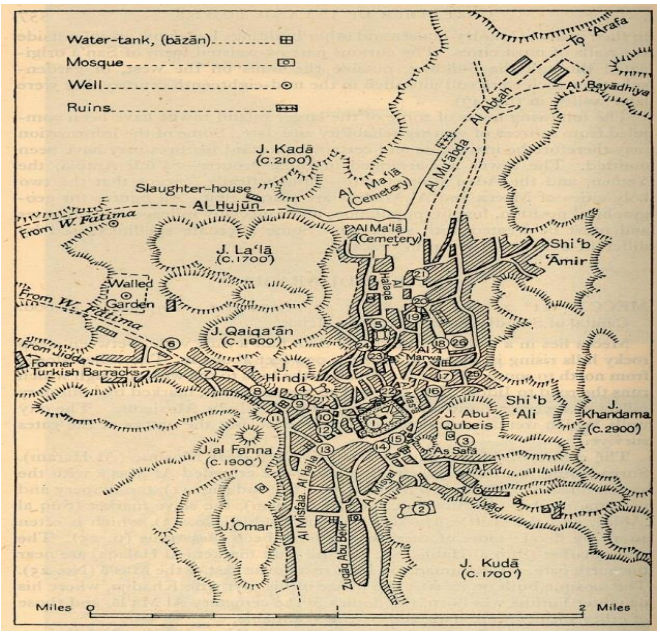

Figure 2.7: Plan of Mecca, Alharam "Alka'ba" in the center of the City and The market "Souq" is near the Haram (http://legacy.lib.utexas.edu/maps/historical/mecca_plan_1946.jpg Last Accessed April 2018)

The mosque was in the center and formed with the Souq, In Arabic means the market, the center of all public life. The building of the mosque was usually built so that it could be further expanded. Thus, the upstream courtyard was often generously sized to increasing population to allow an extension of the Friday Mosque. Around the mosque and in the main streets was the souq, which served exclusively the purpose of commodity production and trade. Basically, the souq was arranged linearly along the thoroughfares, which generally had no residential development. The linear arrangement facilitated the parceling and thus the marketing.

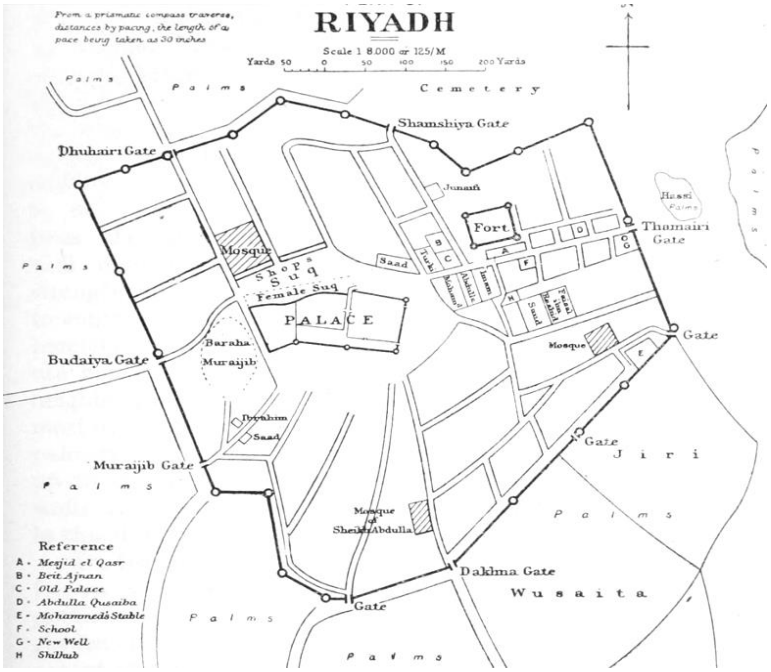

Figure 2.8: Riyadh city plan 1922 (https://en.wikipedia.org/wiki/Riyadh#/media/File:1922_map_Riyadh_by_Philby.pngLast Accessed April 2018)

In many cases, the souq was strictly divided among the different industries and had an entrance gate that could be completed after closing time. The souq has been the center of the social life of an oasis city for centuries. In larger cities there were schools and universities as well as hospitals and government buildings. All these institutions were normally located near the center. Public places or even parks were neither in the center nor in the oasis cities to be found in the rest of the city. The only major squares lay on the outskirts of the city and served to trade in larger goods, such as cattle trade (Dempsey, 2014)

- ***Neighborhoods***

The pattern of a mosque and a market at the intersection of the development axes was repeated on a smaller scale in the city quarters. The mosques there were smaller and served daily prayer. The markets consisted of smaller shops for daily. The quarters consisted predominantly of residential buildings, which had been closed to the outside. Each clan inhabited a group of houses, which, depending on the circumstances, were dense was

arranged together or slightly looser. This division of residential quarters into clans led to a segregation of the population within the city (Saliba, 2016).

The residential quarters were accessed via a hierarchical road system. The wider thoroughfares led to a system of secondary roads, from which in turn branched off small paths to the individual houses. As a rule, these roads initially had a lockable gate and ended as dead ends in the center of the groups of houses. The hierarchy of roads and paths prevented strangers from entering residential areas freely (Jayyusi et al., 2008). However, this road system did not follow a geometric grid, but subordinated itself to the environment and buildings. The narrow winding network of streets and the closed buildings dominated the neighborhoods and characterized the oasis cities as introverted and closed.

2.2.7 Design of the oasis city

The building materials used in the oasis towns are almost always from the region. The most important building material is clay, which is present in large quantities in the area. Clay as a building material is crushed and mixed with other materials to improve on its strength resulting into a viscous mass that becomes resistant to cracks after drying. Often, organic additives such as cow dung have been added to improve weatherability while straw are mixed to improve on the thermal insulation effect of clay buildings (Dempsey, 2014).

Figure 2.9: AitBenhaddou Village Morocco (https://vagrantsoftheworld.com/road-trip-the-atlas-mountains-marrakech-to-fez/Last Accessed Mai 2018)

Clay walls formed by a layering of hand-shaped balls. In this technique, the wall surface was smoothly painted while still wet by pressing the moist clay into wood molds and dry. Traditional houses are usually made of loam walls, which have large thicknesses of about 40 cm because of the static property of the material, which allows little tensile load. For the construction of ceilings, traditional clay was used, on quartered or halved palm trunks and subcarriers made of mats of palm branches forms the conclusion of the ceiling or the roof. The applied clay layer reaches thicknesses of up to 30 cm. The roof has the same structure and, as a walk-in flat roof, is an important usable area of the house. Clay has good insulation properties and protects the interior from the large temperature differences in the exterior. Due to the evaporation of the stored moisture, there is also a tolerable indoor climate, even in hot outside temperatures (Minke, 2012).

Through different wall openings, the room climate is additionally regulated by using clay as a building material. In addition to windows, there are special vents, through which the heated

outside air flows just above the floor into the interior and rises through the chimney effect to the top, where it escapes from other openings to the outside.

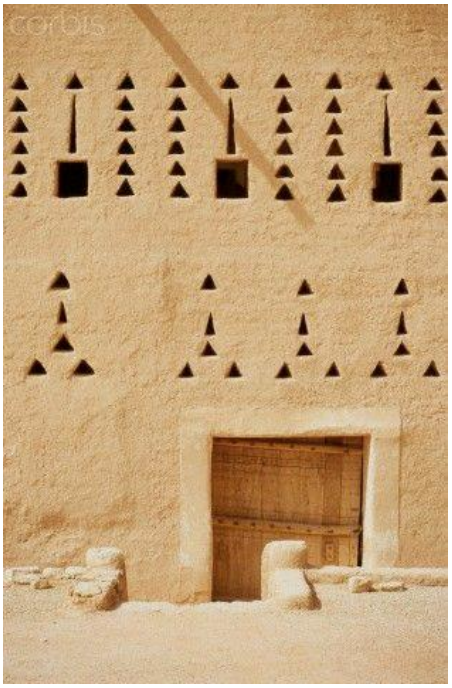

Figure 2.10: Old palace at dir'aiyh, riyadh, saudiarabia, different sizes of windows leads to natural air circulation (https://vagrantsoftheworld.com/roadtrip-the-atlas-mountains-marrakech-to-fez/Last Accessed Mai 2018)

This air circulation leads to a more pleasant room climate. Regionally, some different ventilation systems have developed on the Arabian Peninsula. In addition to the described Variant, which can be found in the oasis cities of Oman, there are the so-called wind towers in the Arabian Gulf. This Persian variant improves the indoor climate by up to 15-Meter-high towers with 4 chambers. Cooler air flows through two chambers of the wind tower into the house and pulls through the other two chambers back up (Hawker, 2008). These examples show how the architecture of the oasis cities adapted to the climatic conditions of the region. Depending on the wealth of the owners, the houses also have a courtyard. The Courtyard house type as a building block of the Islamic city is not always the rule. Among other things, it was built in larger cities to improve the lighting conditions in the houses, which were built close together. Smaller oasis cities are made up of court houses and simple cube-like Buildings, which in turn can form groups of houses with courtyards. The number

of bullets is in turn determined by the possibilities and conditions. As a rule, the traditional mud houses have one to two stories. An exception is, for example, the oasis city of Shibam in Yemen, which consists of houses with seven to eight stories (Ragette, 2003).

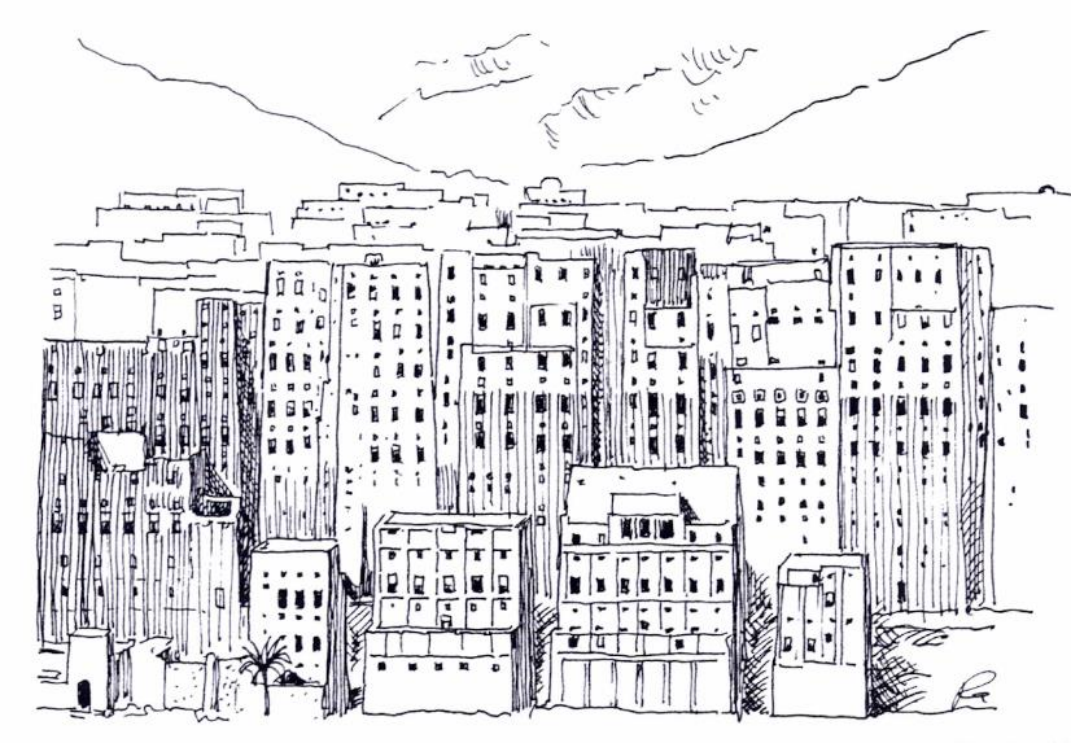

Figure 2.11: Shibam, Yemen (Ragette, 2003)

The flat roof of the houses is fully utilized at each story height and serves as a private residence area for the women. Here is cooked, dates dried and slept. An attic up to two meters high protects the roof area from the view of the neighboring houses. The ground floor is the darkest part of the house, as there are hardly any openings for lighting and ventilation due to static reasons. It serves as a warehouse of dates and other goods. The most important floor is the upper floor where the family of the house lives. Latticed windows and ventilation openings create a private atmosphere and a tolerable indoor climate.

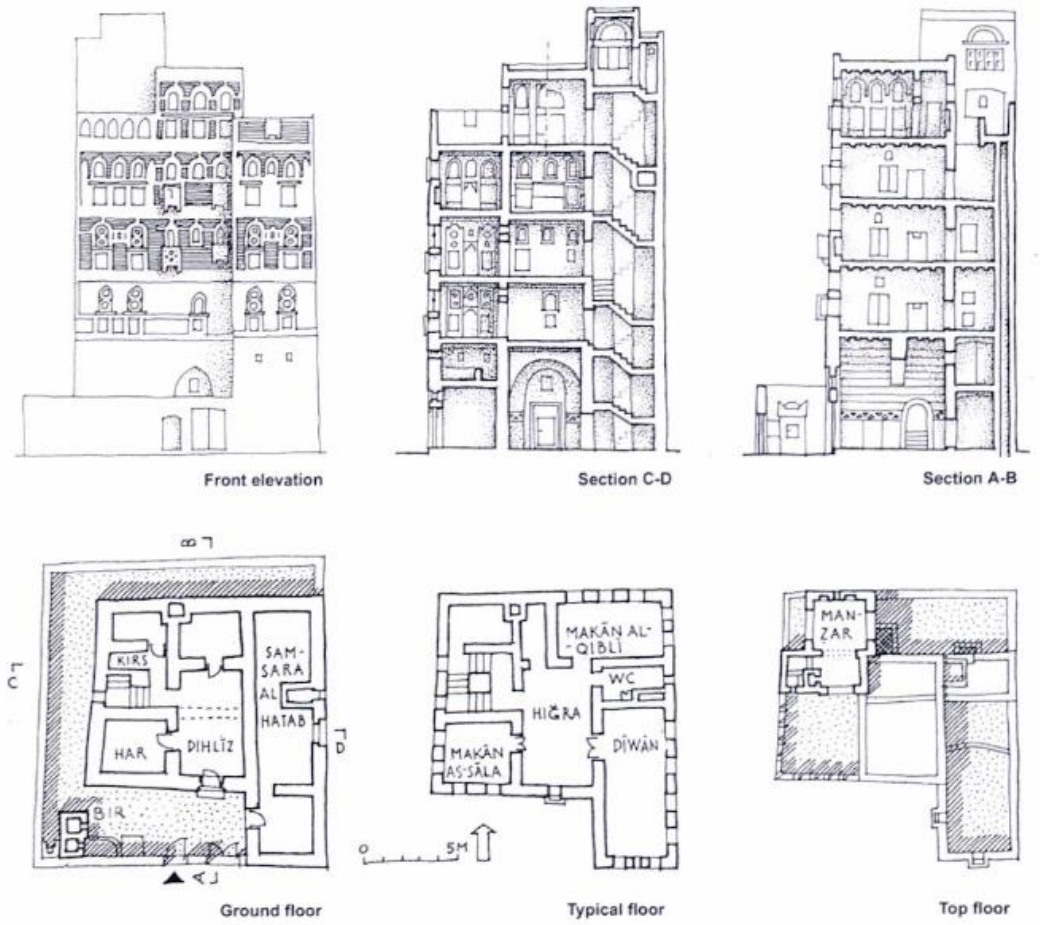

Figure 2.12: Sanaa,Yemen, (Ragette, 2003)

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The floor plan organizations may vary slightly from region to region. In general, the residential buildings are simple to the outside and form a unit with the surrounding houses. Even the mosques usually have simple facades. This introversion and the great significance of the interior are rooted in culture and its spatial conception. The breadth and frugality of the surrounding landscape leads psychologically to the desire of unity. This has an effect on the formal language of the architecture, which is oriented inwards to provide people with protection and security. Due to the barren desert landscape, gardens and water surfaces are expressions of earthly ideals (Ragette, 2003).

In architecture, these mostly occur in private gardens. Public parks were alien to culture, lacking space and water. The Islamic tradition also meant that family life took place only in private rooms. The courtyard with garden was complete and offered the desired privacy. Only wealthy families could afford such gardens. The prosperity was never outside but

always inside shown. Since in the Islamic religion each element plays the same role as a whole, equality is of particular importance. For this reason, facades of old oasis towns usually differ only in a few details. The uniform architecture contributes to the closed character of the oasis cities (Ragette, 2003).

2.3 Development of the Oasis City

The oasis culture shaped the society of the Arabian Peninsula. After the onset of the oil boom, some traditional oasis towns transformed into big cities. With high energy expenditure, all factors that once limited city growth were eliminated. The most important cause of the rapid change was the oil production. For example, in Yemen, which is the only non-oil producing country in the Arabian Peninsula, there is a significant infrastructure deficit.

Figure 2.13: Left Sana'a in Yemen, Right: Dubai. It is clear the difference Between oil producing Country and non-oil producing Country (https://en.wikipedia.org/wiki/Sana%27a#/media/File:Sana.jpg Last Accessed October 2018)

In the oil-boom regions of the Arabian Gulf, but even in the more rural Oman, the cities have within a few decades of their partial Millennia old form separated. A new, modern transport adapted street system has been created. The ability to desalinate salt water, the water supply was possible with considerable energy expenditure. This expensive infrastructure pushed traditional clay architecture into the background. In most cases, it disappeared almost completely from the cityscape. Since the oasis economy was no longer crucial for the survival of humans and was considered unprofitable, it was greatly reduced or discontinued

in many cases. Many smaller oasis towns became commuter cities after being connected to major cities.

Figure 2.14: Ibra, Oman. Unorganized new Buildings near the historical Old Buildings. Ibra, Oman, Prayer shorts (https://www.youtube.com watch?v=ApkaTrRnw0k Last Accessed October 2018)

In the Omani city of Ibra, which today has about 25,000 inhabitants, gradual transformation processes can be observed. In the first phase, the old town centers were abandoned in favor of a new center. This leads to a disintegration of the old town center, since the time required to keep the clay architecture in order is too high. The residential areas in the immediate vicinity of the new center are initially built in self-construction and follow no targeted urban planning. In the second phase, the traditional village centers are abandoned and on Edge of the oasis city built new houses. Ownership and water supply determine the location. Since there is no planning, the new settlement areas are created in a kind of self-education process in which the building adapts to the conditions. In the third phase, plans are being made for the first time, dividing the area of the new residential areas around the new center into plots. This is done on the basis of a planned development network. The newly designated residential areas connect in some areas with the edges of the old town center (Spiekermann & Gangler, 2003).

In general, you can see two different developments in the former oasis cities. In the case of the big cities, which play a role in terms of power politics or economy, the old oasis city is

completely replaced by a modern infrastructure. Only parts of the old center, such as the Souq and the mosque, remain intact. In the second case, it is usually smaller oasis cities that are decaying due to the withdrawal of the population. Since the oasis as an economic basis is no longer sufficient, many residents commute to the nearest major cities. The old core of the oasis towns and its mud architecture are often no longer inhabited, since it does not meet the requirements and because of the winding narrow streets the car traffic usually cannot be developed. The new city extensions expand in contrast to the economically invested historic oasis cities in the area from. The settlement is usually spontaneous and does not follow deliberate planning. In some cases, planned settlements are being built on traffic routes that lead to large cities. These are completely detached from the old oasis city and form an agglomeration with the abandoned mud city and the spontaneous settlement areas, which has no common center or other connecting elements (Nagieb et al., 2004).

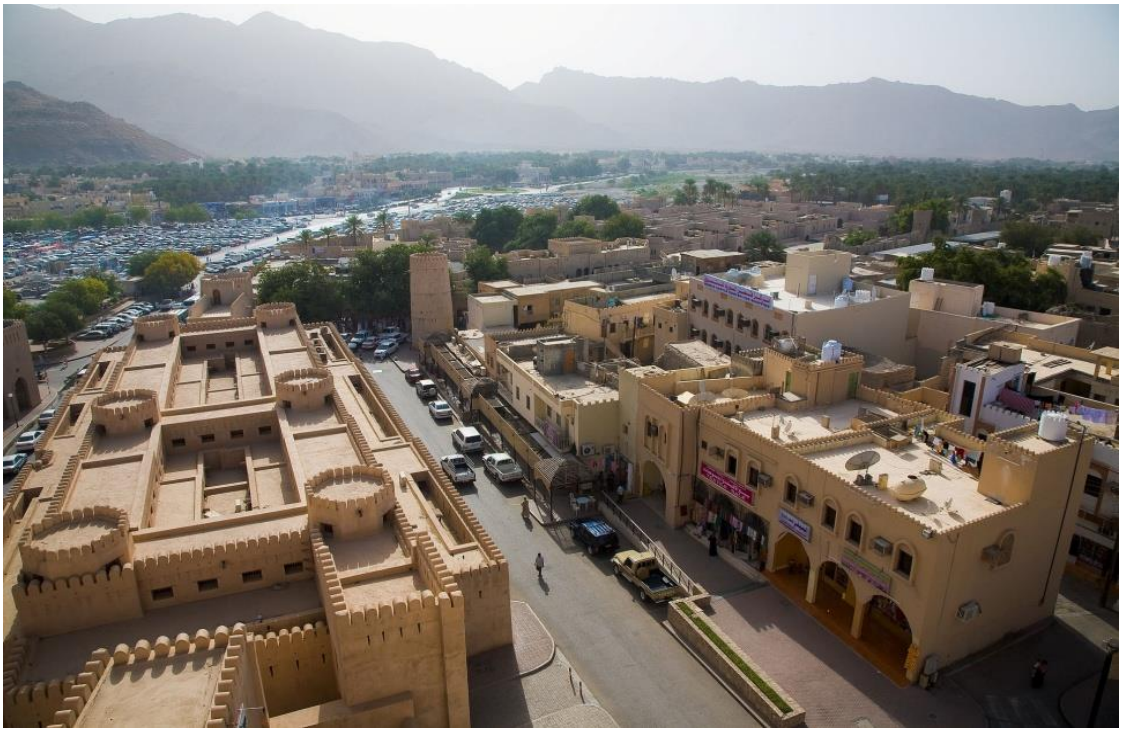

Figure 2.15: Nizwa, Oman (Nagieb et al., 2004**)**

The former agricultural land is often no longer cultivated and in the case of the Omani Oasis city of Nizwa, there was a sprawl of the once-large palm groves. The new form of housing consists of detached houses on relatively large walled land. Due to this typology, the land

consumption is enormous, and the settlement density is low. This means a complex infrastructure and a high water and energy consumption. The only way to prevent the total disintegration of the historical oasis city, now, seems to be tourism. As the case of Oman shows, one recognizes the value of the historical heritage as a tourist attraction and starts from the government side against decay. The oil boom and its consequences have replaced the millennia-old oasis economy and fundamentally changed the people's demands for living standards (Nagieb et al., 2004).

2.4 Sustainability

Sustainability allows the continuity of a materials with adequate life cycle. It is derived from a root Latin word known as “sustinere” which simply means “to hold”. Therefore, a sustainable development involves the ability to improve on the current needs while also protecting future complications of the same material. There are three main branches of a sustainable development, these includes; environmental views of sustainability, social perspectives of sustainable development and economic approach of sustainability (Tanguay et al., 2010).

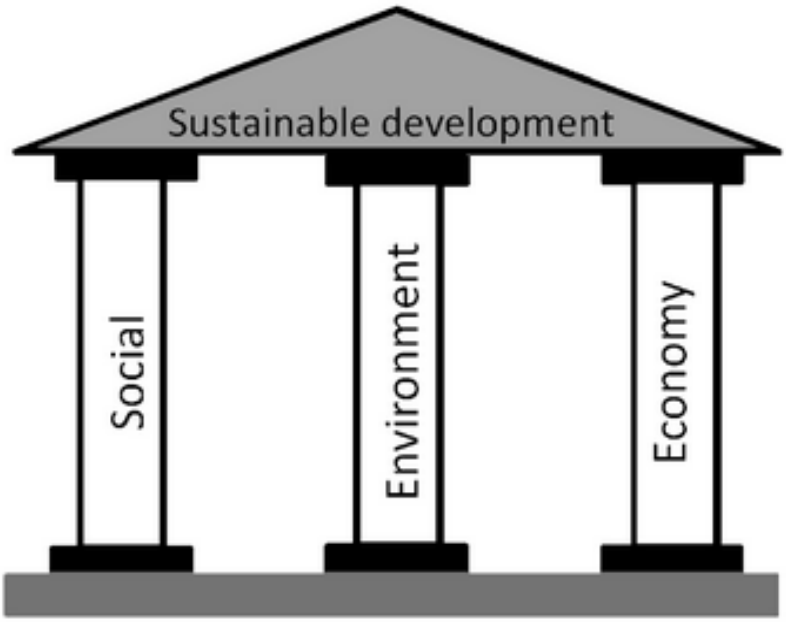

Figure 2.16: The three-pillar model of sustainability (http://www.thwink.org Last Accessed October 2018)

2.4.1 Goals of sustainable development

The overall goal of sustainable development can be assigned to different overall goals of ecological, economic, social and institutional origin. Unfortunately, the institutional overall objective cannot be classified in this way. The institutional level pursues an overall objective that can be described as maintaining traceability, participation, as well as acceptance in the process of design (Joas et al., 2013).

Figure 2.17: The 17 Sustainable Development Goals (Roig, 2015)

2.4.2 Sustainable city

According Kennedy et al. (2007), a city is said to be sustainable when the city accommodates an inflow of renewable energy resources, proper life cycle systems of materials, reduction in pollution emission and proper waste management system. It involves an overall assessment of life cycle, nutrient cycle, and environmental impact assessment that ensures the further development of the city at large.

The aim of sustainable city creation according to the Local Agenda 21 is balance between social, economic and environmental developments. This means that sustainable urban development is not just about environmental protection as it might be mistakenly construed. Agenda 21 is “the global action plan for sustainable development adopted by the United Nations Conference on Environment and Development in June 1992.

The Local Agenda 21 is therefore the part of the action plan which acknowledges that local authorities play a major role in the actualization of the objectives of sustainable development. The Local Agenda 21 considers that economic development should not hamper the potentials of both social and environmental development, the same way environmental development should not hinder sustainable economic and social developments. Likewise, for social development. However, focus has been on the impact of economic development on social and environmental developments, in which case an imbalance will threaten the sustainability of the urban development. Meanwhile, it is highly likely for economic development to grow out of proportion in the balancing structure due to certain commanding incentives. These incentives are referred to as imperatives for the different components of sustainability to grow out of proportion. As a result, sustainable development is considered as a balanced intersection of social, economic and environmental developments (Local Agenda 21, 1996).

2.4.3 How sustainable cities created

An ideal sustainable city provides the necessity of the population of the city. Necessary infrastructures such as building infrastructure, health buildings, schools and transport system that provides good services to the society at large. A sustainable city is one in which the economic, social and environmental developments efforts are such that are balanced and do not threaten the potential of future generations in meeting their developmental needs. For proper building development and infrastructure, a sustainable city design allows sufficient design that caters for housing system in both rural and urban settlements (Marzukhi et al., 2012). A sustainable city is therefore created through the conscious and strategic planning and balancing of the economic, social and environmental aspects of a place. The process of creating a sustainable city therefore requires the review of existing policies on the socio-economic dimensions of the city and environmental exploitation. It further into creating a set of policies with scalable effects to ensure that the environmental resilience is not destroyed in the process of building the economy.

Jenks & Jones (2010) stated that the dimensions of the city design comprises of the land usage, space distribution, shapes and type of available material in the city. For environmental section of the sustainability design, the design of adequate transport is a key factor in the creation of a sustainable city thereby considering the interest of the entire population of the city (Rosales, 2010).

The indicators of Urban sustainability are markers that indicates the significant impacts of sustainability in urban city development. They include proper waste development, life cycle assessment, and pollution emission reduction. The length of the mentioned factors can be used to determine the level of sustainable development of a city (Othman et al., 2013).

The "Leipzig Charter on Sustainable European Cities" shows that sustainable and integrated urban development is also accepted and promoted by the Europeans. Since 2007, this charter has laid the foundation for a new, sustainable urban policy in Europe by formulating demands for a sustainable city and offering measures to achieve its goals (Joas et al., 2013).

Indicators of sustainability are therefore those sets of measurable factors that characterize sustainability in the plan, design, organization and administration of an urban settlement. The sustainable urban development framework provided by the Local Agenda 21 presents a basis to measure sustainability indicators across the three dimensions to sustainability. The environmental dimension which is concerned with areas such efficiency in land and resources use, effect of development activities on the climate, waste management and ecological balance, measures sustainability by measuring these factors. Sustainability is measured in the social dimension by measuring the social wellbeing in terms of health, public recreations, housing, security and human life protection, and mobility. Sustainability from the economic dimension is however measured from areas of employment, per capita income, national income and productivity, access to qualitative education and access to capital (Lynch et al., 2010). The summary of the individual indicators from each dimensions is presented in table 2.1. While it is important to know that the indicators reflect measurable and scalable factors, it is also important to note that the indicators may refer to both quantitative and qualitative factors (Lee 2012).

A major contributing factor to urban city development is population density which is a factor of immigration and birth rate. It caters for the population of the people occupying the urban space per square mile. Majorly, the increase in population mainly as a result of migration due to industrialization of the city allows for the energy consumption in the city. The increase in business transaction in the city also calls for the need to implement further sustainable design.

2.5 Metropolis Sustainability Indicators

The three dimensions of sustainable development are therefore measured across the subcategories of each dimension as summarized in table 2.1. These subcategories serves as indicators of development in each dimension. As expressed in the Local Agenda 21 (1996) economic activities show how cities address activities that take place within its boundaries to achieve environmental sustainability basically through ensuring efficiency in energy consumption.

2.5.1 Economic dimension

- ***Jobs:*** Urban development leads to increase in population due to procreation and immigration. As population increases, there is a rise in the demand for the available employment. Sustainable development planning there has to take into consideration the sustainable provision of jobs for the urban population. The rate of employment, unemployment and underemployment are thus part of the indicators of economic development for sustainable development. It is also important to consider the available education to the labor force.

- ***Economic growth:*** This another important indicator of sustainable development from the economic dimension. Economic growth is measured in terms of Foreign Direct Investments, Gross Domestic Products, Gross National Product, and Net Export Growth. Public finances in terms of net income, net expenditure and debt must be balanced to ensure economic sustainability.

2.5.2 Environmental dimension

- ***Air Quality**:* Economic prosperity usually leads to the increase in consumption of economic and social goods and services. The impact of this is the release of particulate matter into the air leading to air pollution. It is necessary to keep air pollution in check for sustainable development.

- ***Energy Efficiency**:* Consumption of energy has a huge impact on the environment, especially the climate. Sustainable city design usually consider the reduction in greenhouse gases emission by reducing consumption of fossil fuels or energy from non-renewable sources. The use of local bicycle services for instance reduces the density of cars on the road and thus reduce energy consumption. Likewise, the use of energy efficient cars and solar powered metro buses help to reduce the number of individual cars on the road. Other options include the use of hybrid or electric cars, and the use of solar power for domestic energy consumption are parts of the measures for ensuring sustainability in urban development.

- ***Green Spaces**:* Greenhouse gas emission is reduced drastically by promoting nature development from tree plants. The green space would create in parks, playgrounds, and open space of better atmosphere.

- ***Mobility**:* An efficient mode of transportation that allows easy commute, affordable cost, with low environmental impacts. Split transportation mode also helps to reduce the rate of traffic jam and ease commuters' experience. The average time and cost of commuting is of high relevance in assessing the sustainability of a city.

- ***Waste Management**:* Economic development lead to increase in domestic waste generation, just as economic activities generate massive industrial wastes. It is therefore important to design and utilize an efficient and sustainable waste management scheme. This involves waste reduction, use of biodegradable materials for packaging, and recycling. There is a constant need of reminder of the reduction in the usage of plastic bags as it is not environmentally friendly.

Table 2.1: Sustainable Cities International's Sustainability Indicators (European Commission 2018)

Dimension	Indicator	Measures
Economy	Economic Growth	GDP, GNP, Net Export Growth, Foreign Direct Investments.
	Jobs	Unemployment/employment/underemployment rate Percentage of green jobs Average professional education years of labor force.
Social	Health	Mortality rate/life expectancy, Percentage of population access to healthcare services
	Sanitation	Percentage of access to sewage and sanitary infrastructure,
	Compact City	Crime rates Access to local services within short distance Income distribution and inequality.
	House	Cheap housing Division of housing breakdown
	Quality Public Space Distribution	Good roadways
	School	Inrease in educational seminars
Environment	Air Quality	levels of particulate matter
	Energy Efficiency	Total greenhouse gases (GHG) per capita Percentage of total energy consumed from renewable and non-renewable sources
	Green Spaces	Percentage of reserved areas, Percentage of vegetation in relation to city size and population size.
	Mobility	Transportation mode split Average commute time and cost
	Waste Management	Volume of waste generated, Recycling rate
	Quality of Water	Water availability Index of water quality Treated drinking water

***Water Quality**:* Water demand rises as population increases. Hence, total available water and the quality of available water becomes important aspect to put into consideration as the urban area develops. Energy efficient programmers can also improve the quality of drinking water available by allowing the purchase of water conservation devices in homes to reduce wastage of high quality water.

2.5.3 Social dimension

- ***Health:*** Urban development requires health services to address the health needs of the population. Sustainable city requires that mortality rate be reduced by reducing negative economic externalities and improving healthcare services available to the people. Hence, increased life expectancy, reduced mortality and access to healthcare services are indicator of social sustainability in urban development.
- ***Sanitation:*** Since people generate waste daily, there is a need for adequately planned sewage system and sanitary infrastructure that helps to convey sewage away from public spaces where it could constitute any form of pollution or threat to health.
- ***Compact City:*** Sustainable cities are usually designed to be compact in terms of proximity to local services. Such cities have the necessary services within range for residents to access. The neighborliness of such cities helps to reduce crime rate and tracing of offenders within a short period.
- ***Housing:*** Usually, the housing pattern is a reflection of income distribution within the population. Hence, inequality is clearly reflected in the pattern of houses occupancy, either owned or rented. Sustainable urban development also put into consideration the design of affordable social housing. Therefore, the percentage of affordable housing serves as an indicator of sustainability
- ***Quality Public Space:*** This include available road networks and the conditions of the roads, parks and green spaces. Public spaces are important for social interaction and socialization. Sustainability is therefore concerned with the size of land allocated to public spaces that relates to the total city space.

- ***Education:*** Sustainability requires that there exist a system of transfer of knowledge and skills across generations for the purpose of sustaining technology across generations. It is therefore important to consider adult literacy level, the general literacy level and the available environmental programs available in schools.

CHAPTER 3

CITY ANALYSIS

3.1 Riyadh Megacity in The Desert

Riyadh is the capital of Saudi Arabia and by far the largest city in the Arabian Peninsula with about 4.3 million inhabitants. Unlike the megacities on the Arabian Gulf, Riyadh is inland rather than coastal. The city holds the world record for the fastest growth. Since the founding of the state in 1932 and the appointment of Riyadh as capital, the population has increased by a factor of 200 and the city area by a thousand times.

This spectacular growth took place especially after 1950, when oil production made Saudi Arabia one of the richest states in the world. Saudi Arabia is the most conservative of all Arab countries. It has no written constitution, no parliament, no parties and no unions. Elections do not take place and the press only has a stabilizing function. Women are subject to additional restrictions. Saudi Arabia describes its form of government as the Islamic Arab monarchy. The king acts as absolute ruler, chief judge and spiritual leader. The dynastic succession is hereditary to the family Al Saud bound.

The seat of the royal family was since 1902 the city of Riyadh, which thus already before the Founding of the state in the early 1930s was an important political and social center. The city of Riyadh and all of its development is closely linked to the history of the Al-Saud tribe, which made the former oasis city the capital and administrative center of the country (Al-Rasheed, 2010).

3.1.1 Geography and climate

The city is in the eastern part of the Central Arabian Highlands, the Nedschd Plateau, below 24° 38' north latitude and 46° 43' east longitude. Like most of the Arabian Peninsula, the Nedschd Plateau belongs to the large Afro-Asian dry belt. It is a low-vegetation rocky desert, which deposit sand and dunes in places. The average sea level of the plateau 1000 m above sea level - Riad lies at an altitude of 611 m above sea level due to a dry subtropical altitude

climate of a typical continental expression. To the north, the highlands lean towards the Nefud desert, eastward across the Ad Dhana to the Arabian Gulf, and toward the south to the "Empty Quarter," the Rub al Khali desert. In the west it is bordered by the rim of the Red Sea. Deep canyon-like wadis divide the calcareous plateau into numerous tablets. These characterize the topographical situation of the city, which lies in the mouth of two wadis. In northwest-southeastern direction runs to the west of the city, the wadi Hanifah, which opens just south of the city to a shallow mouth. At this point The Wadi Batha flows from the north coming at an acute angle into the main valley. This Flat-trained wadi divides the city into an eastern and a western half. On its west bank lies the Old town. At a depth of 24 meters, both wadis carry abundant groundwater resources, which were necessary for the creation and development of the city.

In addition to the central, spacious location, Riyadh also has a favorable location traffic geographical situation. But this is relativized by two facts. First, the distances to the actual economic centers of the country on the Arabian Gulf with 600 km and the active areas on the Red Sea with about 1200 km are very far. On the other hand, the city is located in a very poor environment. The few surrounding settlements are oases whose location and existence depend on the groundwater resources of the wadis. The climate of the city is characterized by low rainfall and high temperature differences. The coldest month is January with the average winter temperature being 11 °C. In summer, the average temperature is 42 ° C and July is usually the hottest month. The irregular precipitation falls in the months of November to May. Due to the central location, the few water areas and rainfall, the climate is very dry. The average humidity is 47% in winter and 19% in summer (Cybriwsky, 2013).

3.1.2 Urban development

- ***From the oasis to the capital***

The city of Riyadh was originally built from the oasis city of Hajr. This already had a fortification and was since the 6th century as an important trading center of the region. It lay at the crossroads of two caravan routes. One led from South Arabia towards the Arabian Gulf and the other from the ports of Bahrain to the Red Sea. The fortified oasis city flourished

in the 11th century and its decline began in the 15th century. Finally, a drought period in the 16th century left only a number of smaller villages behind. In the 18th century, the small agglomeration of settlements was first called Riad. Riad means The Gardens. The origin of the name is due to the green plant carpet that appeared after the rainy season and briefly colored the desert green. The name also indicates the relative fertility of the oasis of Riyadh (Facey, 1992).

The year 1730 is considered the founding year of the city of Riyadh, which for the first time became the capital and spiritual center of the Wahhabis at that time. Wahhabism was a reformist religious movement that wanted to reduce Islam to simplicity and rigor. The movement goes back to Abdul Wahab died 1787. This was taken by the tribe Al Saud to unite with his help the tribes and to win this for their own policies. The seat of the tribe Al Saud and thus the capital of the Wahhabi had to be relocated in 1738 from Riyadh to 20 miles away Diriyah. At the beginning of the 19th century, the Wahhabi movement, led by the tribe of Al Saud, was defeated by the Ottoman occupiers and pushed to the north. It was not until 1902 that Abdul Aziz Ibn Saud succeeded in reconquering the city of Riyadh for his tribe. In the decades that followed, Abdul Aziz, who had gone down in history as Ibn Saud, pursued the unanimous agreement of Arabia (Facey, 1992).

In 1921, the Wahhabi state included today's state territory of Saudi Arabia. Due to domestic and foreign policy difficulties, the Kingdom of Saudi Arabia was officially founded in 1932. As a result, the city of Riyadh, the seat of the Saudis, officially became the capital. Riyadh has been a crossroads of caravan routes and capital of the Nedschd region since its inception. Since its appointment as provincial capital, it has continuously been developed into the administrative center of a strictly centralist state. Urban development has always been linked to political events. Due to the changing power relations and struggles, the city could not grow out of the 1750 built fortification until 1930 (Facey, 1992).

In addition, the Wahhabi doctrine forced a strict isolation to the outside. For a long time Riyadh was unaffected by technical innovations. Until the middle of the 20th century was traditionally built with clay. The clay architecture of the Nedsch region has some special characteristics, such as battlements on the attics of the flat roofs, wall reliefs and triangular vents. In the floor plan, the gender segregation was realized in such a way that there were

different entrances and rooms for men and women. The residential buildings usually had a maximum of two floors. The old riad was built like an old oasis city, with Friday mosque, souq and ruler's palace in the center. The entire city was protected by an 8-meter-high fastening ring. The so-called Al Masmak Palace was built near the Friday Mosque and connected to it by a bridge. As usual, there was a souq on the larger streets. The residential areas were tapped by a system of narrow winding streets and dead ends. In the 1920s, administration buildings began to be built in the immediate vicinity of the center. In the following decades, the decisive turn came in urban development. The city began to expand beyond the attachment ring. From 1900 to 1920, the population increased from 5,000 to 19,000 inhabitants (Facey, 1992).

- ***The 50s and 60s in the wake of the onset of the oil boom***

In the 1950s, rising oil production initiated a decisive change in the urban development of Riad. In a relatively short period of time, Arab society was confronted with modernity. The sudden wealth fundamentally changed Riad's face. In order to further expand Riyadh, the water supply had to be secured. In the 1950s, pipelines from Wadi Hanifah replaced the supply of simple wells. The next important measure was the connection of the city to a transport network. Thus, in 1951, the first railway line, the Riad combined with the oil port Dammam on the Arabian Gulf. At the same time, the construction of the transcontinental road crossing the entire Arabian Peninsula, with a length of about 2,000 km, began. It was completed in 1967 and has been connecting the economic, administrative and intellectual centers of the country ever since (Al-Rasheed, 2010).

Riyadh was connected to the international air network with the construction of the first airport in 1953. Also in 1953, all the ministries from Jeddah were relocated to Riyadh, so that during the 1950s, the city increasingly became the administrative center of Saudi Arabia. In the following years, hospitals and schools were built, the first university was created in 1961. In the course of modernization in 1954, the city wall was removed. The old city center was expanded as a business district. A palace building in Al-Nasriyah, which was first elected in 1950 as a reinforced concrete building, led to a decisive change in the, until then, traditionally influenced architecture (Al-Rasheed, 2010).

In the following years, modern building methods were used more and more frequently. Since all ministries of the country moved to Riyadh, many new administration buildings were built in a new construction along the airport road. Due to the increasing need for housing for the drawn officials and their families, the Al-Malaz project was born. The new residential area, later called the New Riad, was built 4.5 km northeast of the city center on the eastern side of the Airport Street. It covered an area of over 500 hectares and consisted of 750 residential buildings and three larger blocks of flats. These blocks of flats were a novelty to Riyadh. Living in apartments was foreign to the people of Riyadh until that time. Also new were the detached houses, on larger plots were built and protected by high walls against view. This new type was to replace the traditional yard Haus more and more in the next few years. The Al Malaz Project was also one of the first large-scale urban development projects planned and thus new to urban development, which until then was relatively uncontrolled (Al-Rasheed, 2010).

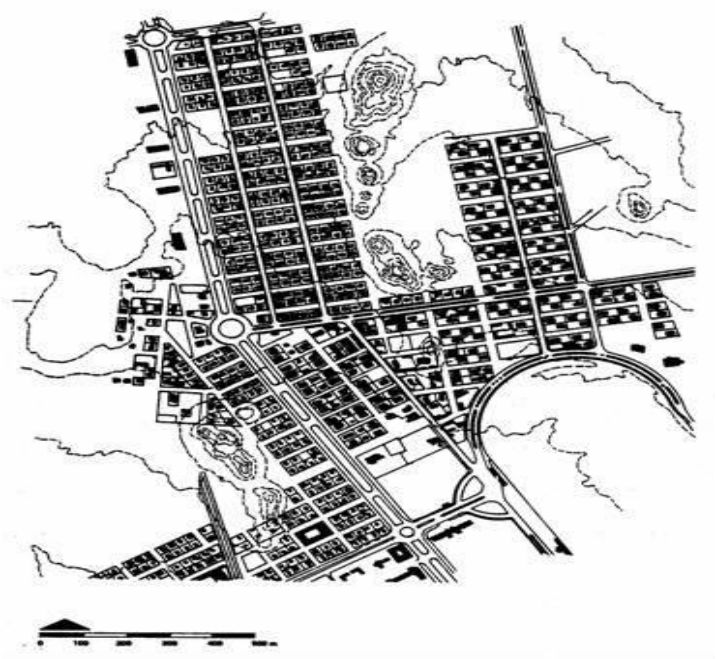

Figure 3.1: A layout plan of al-Malaz Housing Project known as al-Riyadh al-Jadidah located to the northeast of the old city center of Riyadh. (http://new.csbe.org/publications-and-resources/articles-and-lectures-on-architectural Last Accessed October 2018)

Another major project was the expansion of the village of Al Nasriyah, where numerous new residences of the royal family emerged. Together with the administrative buildings along the airport road and the Al Malaz project, this development formed a signpost for future urban development. In particular, the modern road network should replace the winding paths and dead ends in no time. The 1950s thus mark one a departure from traditional urbanism, as well as traditional clay architecture, which has been replaced by the use of modern building materials. The large increase in population from 82,000 inhabitants in 1950 to more than 160,000 inhabitants in 1960 and about 300,000 inhabitants at the end of the 1960s led to an increase in space requirements, which increased due to the new construction method. In addition to the rise of the indigenous population, more and more guest workers, mainly from neighboring Arab countries such as Yemen, poured into the country to participate in the construction. These guest workers lived partly in apartment blocks since the end of the 50s reinforced were built. One of the first six-story blocks of flats was built in 1959. It was of particular importance that the height of the building does not violate the privacy of the neighboring buildings, since in the Islamic context, no insight into the courtyards of the usually one- to two-story residential buildings is allowed. The construction of higher neighboring buildings was so difficult from a legal point of view that Riyadh expanded flat with increased land use. The developments of this period were directed as far as possible by a national town planning authority. As a consequence of the economic development also social differences developed depending on the income class. The wealthier classes lived preferably in detached villas with walls (Rahmaan, 2011).

At the beginning of the influx of guest workers, there was still no segregation between locals and guest workers in Riyadh, as this situation was no problem for one Society, which was ethnically homogeneous for centuries, was completely new. Only the amount of the rent or the land price led to a kind of segregation, which did not directly affect the origin, but only the income class. Land prices rose dramatically during the 1960s due to speculation and stagnant urban growth. But the gap between poor and rich was still limited due to the great economic wealth (Al-Hathloul, 2002).

- ***Riyadh before the master plan at the end of the 60s***

At the end of the 1960s Riyadh had no administrative boundary. The densely built-up old town center was clearly different from the new residential areas. In general, one can divide the urban area in this development phase according to two main features. On the one hand in the area with a dead-end floor plan and on the other hand in the area with a checkerboard floor plan. The dead-end floor plan is a typical feature of an Islamic oriental city. Its structure is random and characteristic of traditional residential areas. The developed house type is the courtyard house with an average size of 10 x 12 m and a building depth of 3 - 4 m. The individual houses were strung together without a predetermined line of flight, and so an intricate system of streets and streets was created (Steele, 1989).

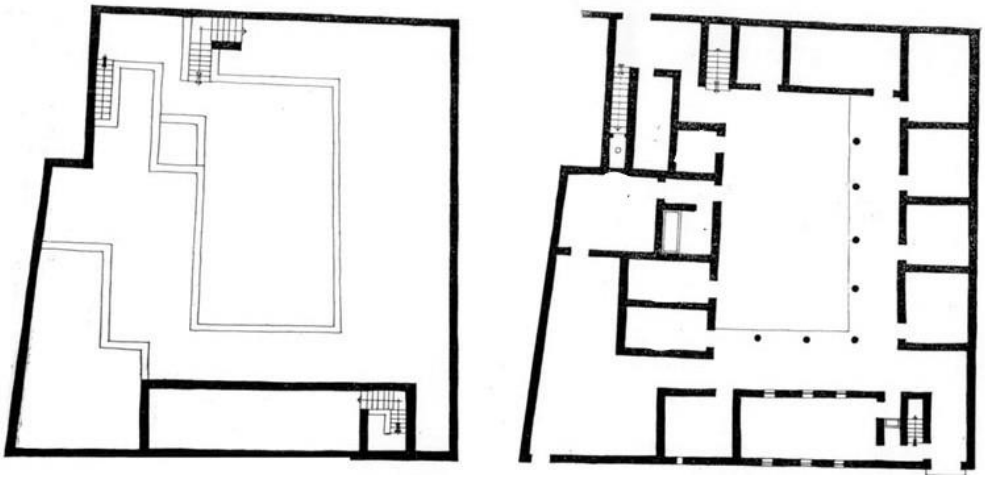

Figure 3.2: Village of Dareeya, Saudi Arabian. (Steele, 1989).

The rule was not the only construction principle. In the case of Riyadh, you can find four more principles. One is the heap-like arrangement of houses around a rectangular one Place. In addition to this heap principle, there is the axis principle, in which an axis gives the view of a mosque free. The mosque forms the optical conclusion. The third principle is the radial principle. It marks the situation when the mosque and forecourt are free in the center of the city Subspace lie, whereupon the streets run radially. The last principle to be established is the block principle, in which the mosque and the surrounding residential buildings form almost rectangular blocks.

Figure 3.3: A town map of Riyadh,chief town of the Najed, Arabia. 1866AD (https://www.reddit.com/r/MapPorn/comments/663i1e/a_town_map_of_riyadh_chief_town_of_the_najed/ Last Accessed October 2018)

The old town core of Riyadh is largely divided into blocks by a system of lanes. These increasingly take on the shape of stripes in the direction of the edge districts. This building was not built until after 1930 and marks the transition to the checkerboard floor plan, as it has no branched development. Within this new structure are rectangular spaces for public buildings, mainly mosques, embedded.

The old city center covers approximately 35 ha, which is relatively small compared to other Islamic cities, such as Damascus with an area of approximately 135 ha. After overcoming the city wall in the 1930s, architecture remained traditional for a long time. However, the new settlements did not condense and there was no narrow winding development, which can be found from then on only in the area of the old town center (Al-Rasheed, 2010).

Since the city was opened to traffic from Wadi Batha, on whose western shore it originated, the old center was connected by short access roads. In order to facilitate the development of the traffic, large straight-line breakthrough roads, which run through the grown floor plan in the form of aisles, were built. From this point on, the checkerboard floor plan was created, which is characterized by a geometrically exact guided road system compared to the dead end floor plan. The roads are usually orthogonal to each other. The houses are free on the property, are individually designed and built in Brick construction created. The courtyard was abandoned and replaced by an outdoor courtyard with high privacy walls. The checkerboard floor plan usually appears as a closed complex. It originated either as a result of new planned settlements or because of the breakthrough streets that dissolved the internal structure of the old road system. It created a new network of roads, which was based only partially on the existing road. The newly developed fields were rectangular and were rebuilt over time to a checkerboard layout. This transformation took place especially since the end of the 50s (Al-Rasheed, 2010). The new development areas were basically planned with the checkerboard layout. Thus, in the north of the city, a large development area with a checkerboard floor plan was created in a radial system running streets. The location between the city center and the ministries on the west side of the airport road may have influenced the radial shape. The residential area was reserved for the higher income class. With an average floor space of only 1.3 in 1968, Riyadh was one of the slimmest cities in the world and should remain so in the following decades. Almost 80% of the buildings were built in 1968. This was partly due to the traditional construction method of clay, with which about 46% of all houses were built. On the other hand, the new houses were built in a single-story bungalow style of western-Mediterranean character. Even at the end of the 60s, it was quite common to build houses made of clay. The new building materials were increasingly used, but did not replace the traditional building material loam.

The city of Riyadh in 1968 consisted of the remains of the traditional city and the Extension areas to the north and west. In the city center were still the Friday Mosque and the old Souq. The cul-de-sac ground plan was partially replaced in the center by the checkerboard ground plan. The city center was largely avoided by traffic. The residential quarters of the old town were inhabited by the low-income population, in contrast to the new housing estates in the north, which were well connected to the transport network and where, above all, the wealthy

layer settled. To the northwest were the palaces and residences of the royal family. Residential quarters for the middle class were created between these and the old town, which, with the newly built quarters along the east side of the Airport Street, represented the largest new housing estates. Exclusive residential quarters were built in a northerly direction behind the residential district of Murabaa. The most important development axis was the road along the Wadi Bathna to the airport. Here, in addition to numerous new residential quarters, the administrative district was built. The airport road also divided the old town in two halves. At the height of the residential district of Murabaa there are several main roads. In the northeast runs the Transcontinental Street, which leads from the Arabian Gulf to Jeddah on the Red Sea. At the end of the 60s, the city of Riyadh was disorderly. The old city center was still clearly recognizable and was under renovation. The construction activity focused mainly on the development of new settlement areas. In the 1970s, a master plan was to direct the city's rapid growth into new orderly paths (Al-Rasheed, 2010).

- ***Between revitalization and high-rise construction (1990 till Today)***

Since the 70s, the revitalization of the old center of Riyadh has been planned. The Italian architect Marco Albini designed a master plan for the area around the Qasr Al Hokm and the Friday Mosque. At the beginning of the 1980s, Beah Group Consultants developed the plan for a comprehensive renovation of the center. Subsequently, it was the ADA, which was heavily involved in the urban development of the old city center (Al-Rasheed, 2010).

Figure 3.4: Riyadh, 1970, Sites of the three major building programs and other related areas affecting Riyadh development in the 1950. 1-Old Riyadh, 2-al-Murabba, 3-Nasriyah, 4-al-Malaz, 5-Airport, 6-Railway Station. (Al-Hathloul, 2002)

In 1992, the project was finally completed. The special architecture, which inherited elements from the traditional construction of the Nedzh region, has won numerous prizes, including the Aga Khan Prize in 1995 and the Arab Architectural Award for Building Arabian Cities in 1990. The sensitive handling of the historical heritage and the integration of the historical center within the city structure led to the preservation of part of the original character. Another similar large-scale project was the construction of the historic center of King Abd Al Aziz on the 37-acre Al Murabaa grounds north of the old center. The project included numerous renovations of the old palace complex and replicas of buildings that

could no longer be repaired. After a relatively short construction period of just 13 months, the project was completed in 1999 (Al-Hathloul, 2002).

Figure 3.5: Aerial view of al-Murabba Palace in 1950. Courtesy of Saudi Aramco. (http://iaste.berkeley.edu/iaste/wp-content/uploads/2012/09/2017/02/Al-Solaiman_27.2_TDSR.pdf Last Accessed September 2018)

In addition, the Saudi Arabian National Museum and "Darat Al Malik Abd Al Aziz" (a foundation for research and archives). Striking is above all the landscape architecture of the area. The German planners around the landscape architect Bödeker designed a place with 100 palm trees, which today represents a core of the area (Al Hathloul, 2002). At the turn of the millennium, two modern skyscrapers were created as new Landmarks of the city.

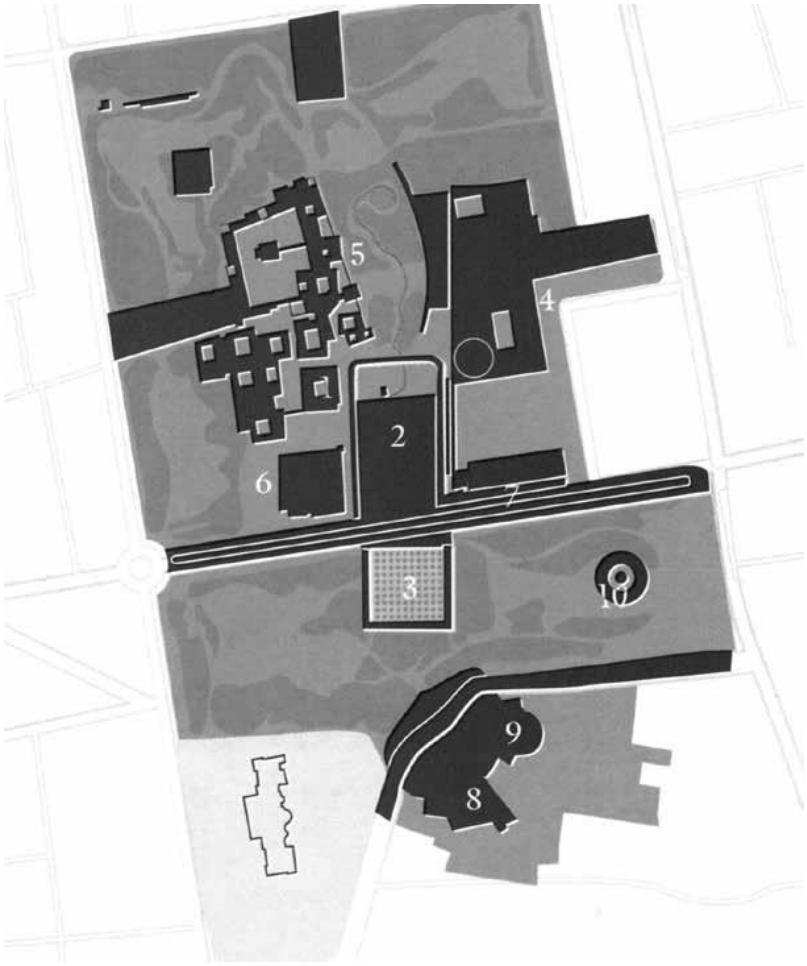

Figure 3.6: Master plan of the KAHC (http://iaste.berkeley.edu/iaste/wp-content/uploads/2012/09/2017/02/Al-Solaiman_27.2_TDSR.pdf Last Accessed October 2018)

1) Al-Murabba Palace (the diwan is to the right and the mud-brick palaces are to the left).

2) Central maidan (plaza).

3) Palm grove.

4) National Museum.

5) Darat al-Malik Abdulaziz.

6) King Abdulaziz Mosque.

7) Department of Antiquities and Museums.

8) King Abdulaziz Public Library.

9) Auditorium.

10) Riyadh Water Tower. Source: Arriyadh Development Authority, The King Abdulaziz Historical Centre (Riyadh: Arriyadh Development Authority, 2000).

Figure 3.7: Aerial view of the KAHCTaken from the north, showing the Darat, the mud brick houses, and the mosque to the right and the National Museum to the left.(http://iaste.berkeley.edu/iaste/wp-content/uploads/2012/09/2017/02/Al-Solaiman_27.2_TDSR.pdf Last Access September 2018)

It all started with the 267-meter Al Faisaliah Tower, designed by Norman Foster and Partners. When completed in 2000, it was the tallest building in Saudi Arabia. The pointed shape of the skyscraper was crowned by the construction of a lantern with a sphere as the highest point of the building. The entire complex includes a 5-star hotel, huge office space and a shopping mall.

Since the year 2002, it has been surpassed by the 302-meter-high Kingdom. The skyscraper was designed by Omrania and Associates with the support of the American company Ellerbe Becket. The tower opens up in a parabolic shape and is completed by a bridge on the top floor. The use of the building is similar to that of the Al Faisaliah Tower. In addition to its function as an office building, it houses a five-star hotel and other commercial uses. With only 41 storeys and over 300 meters in height, the skyscraper is one of the tallest buildings with less than 50 storeys.

Figure 3.8: Al faisaliah tower, (Walker, Butler & Schulte-Peevers, 2011).

Both skyscrapers stand on the north-south axis and form the new cores of the CBD ("Central Business District") of the city. They are visible in the otherwise flat city from afar and serve as landmarks. Their architecture can be described as modern and global (Walker, Butler & Schulte-Peevers, 2011).

- ***Summary of the development stages***

After the city had exceeded the city boundary defined by the historic city wall after 1930, it grew steadily until 1950. The traditional architecture of mainly one to two-storey buildings led to a rapid, initially uncontrolled spread in the area. The growth was limited to the immediate urban environment with a slight northward trend, where a preferred residential area of the higher income class emerged. Altogether, the city had about 80,000 inhabitants in the middle of the 20th century. In the northwest were the suburbs Dirriyah and Arqah, where still traditional oasis economy took place.

The 1950s were the first major turning point in architecture and urban planning. The first planned large housing estates replace the principle of uncontrolled self-construction. The clay architecture is still common construction but is increasingly replaced by the construction of modern building materials. The detached villa on a plot with walls began to replace more and more the traditional yard House (Al-Rasheed, 2010).

Another important stage of development was connected to the city functioning transport network reached. From railroads, transcontinental roads to an international airport, Riyadh has been developed within a decade. This was only possible through the profits from the rising oil production. In 1960, the population already had 160,000 inhabitants, of which a large proportion were guest workers. The city growth was accordingly large. The city spread mainly to the north along the new airport axis. The ministries moved to Riyadh gradually lined up along the airport road. The new palace complexes in the northwest led to increased growth of the city in this direction. In the following decades, city growth should continue in an increased form.

At the beginning of the 1970s, the population already numbered around 370,000, with a strong upward trend. The next decades were marked by an incomparable construction boom. Due to the large housing needs also sporadically large satellite towns emerged. However, this did not lead to any decisive change in the city structure. As before, they built detached, one- to two-storey residential buildings, which spread in masses and contributed to increased land use (Steele, 1989).

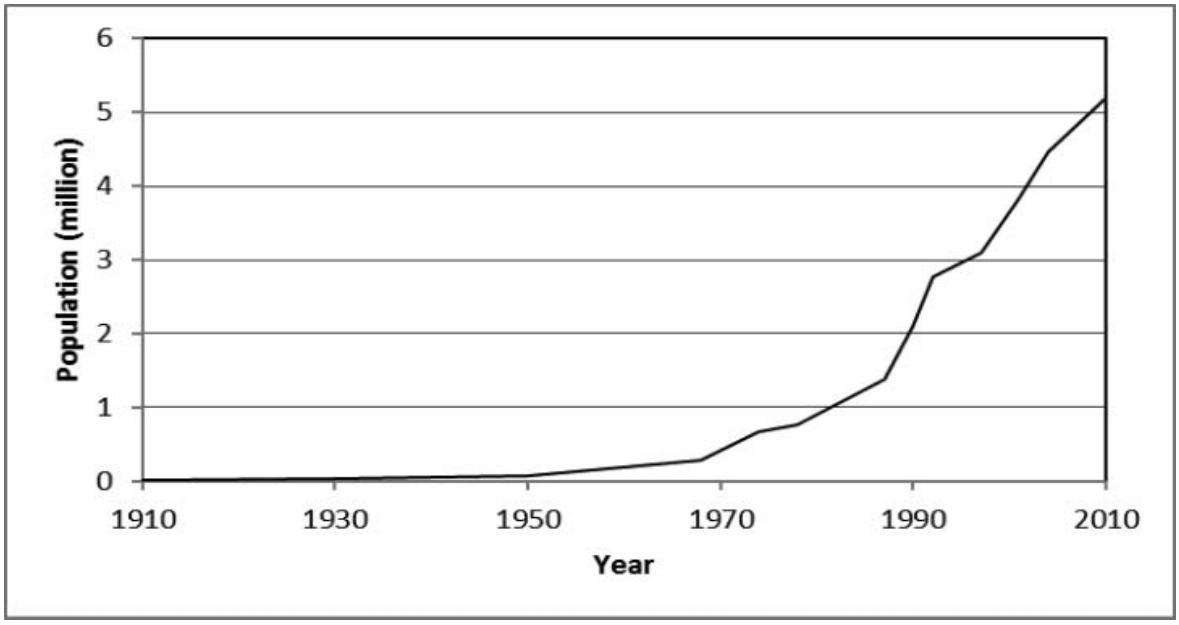

Figure 3.9: Riyadh Population Growth (Sharif et al., 2016).

For the first time, growth was to be given a controlled direction by commissioning Doxiadis to design a master plan. This master plan with its network of 2 x 2 km large supergrids should shape the face of the city from now on. His goal was to limit urban development to a north-south axis. A so-called Central Spine was to form the north-south axis as a new linear city center. In contrast to this 1971 plan, the city developed until 1980 mostly horizontal. Although the wadi was intended as a natural limitation of urban growth in the west and southwest, more and more settlements were formed between the canyon-like arms of the wadis. In the same way, the settlements stretched to the east, due to the transport links to the Arabian Gulf. At the same time, the city grew along the "Central Spine" to the north.

While in 1980 there were 1.25 million inhabitants, in 1990 the population rapidly approached the two million mark with 1.975 million. The Doxiadis master plan, planned for the year 2000, had long been outdated at the time. The city continued to grow in all four directions. Growth was concentrated along major transport links to the north and east, especially towards the new airport in the northeast. In the northwest, the city grew to the Wadi, where, among other things, the diplomacy district and the University emerged. The suburb of Dirriyah was now part of the enormous urban area of Riyadh. As the city expanded, its old center was revitalized and became an important cultural site of the city (Rahmaan, 2011).

By the turn of the millennium, the population was already well over 3 million. In 2004, the four million mark was finally crossed. The city area continued to grow in all directions and with an increased tendency to the north, where the settlement area had almost reached the airport, which is more than 30 km from the city center. Growth is governed by several factors. One factor is the natural limitation due to geographical conditions, such as for example, the wadi in the west. Another factor is the land use; so the industrial area in the south and southeast inhibits city growth in this direction. The most important factor for increased growth is the existing infrastructure. The road network is being steadily expanded and expanded. Already in the 80s, the ring road, which leads around the entire center. The huge intersections of multi-lane city highways became landmarks in the course of time, making Riyadh one of a kind Sample example of a car city.

3.1.3 City image and problems

Riyadh is often referred to as a city without character. This is primarily due to the monotony of typology. A sea of two-story villas behind high walls determines the cityscape. Due to this form of living, the transport network had to be expanded further and further. Increasing traffic led to multi-lane city highways, which meet in huge intersections. Striking elements of the road system are in addition to the huge motorway junctions many designed roundabouts. The rest of the design of the street space is very restrained, only a few successful road bridges and parks enhance the traffic environment.

Riad is probably one of the largest car cities in the world and therefore has all the negative features of this city type. Without a car, the city is as good as cannot be experienced. The pedestrian is a foreign body and can only move very restrictedly. There is little public life in Riyadh. Only a few parks and public facilities can be found within the huge city area. The reasons for the few public areas are complex. On the one hand, there was never the opportunity in the historic oasis city to use larger areas within the building as public spaces. For centuries, public life was reduced only to the mosque and the souq. The demand for public space was therefore not available for a long time due to cultural reasons. Furthermore, any public space would only be animated, though easily accessible. Due to the settlement and dependence on the motor vehicle, the existing public areas are often difficult to reach. The shopping mall took on the role of the Souq as a public center.

Figure 3.10: Riyadh, as a city without character (www.arabianbusiness.com Last Accessed September 2018).

The need for leisure time is much greater today, and therefore it is not surprising that more attention is paid to public space. The focus is on the pleasure and the change from everyday life, as far as culture allows. Wahhabi Islam and above all the Saudi royal family itself have a decisive influence on the face of the city and its development. There is no political participation on the part of the population (Fox & NADA, 2006).

Riyadh is the capital of a centralized country, and as such is the administrative center. A large part of the population works for the government and gets its reward through the profits of oil production. Today's city is thus a direct product of the abundance of raw materials from which the service sector indirectly depends. Due to the land development, a spatial segregation between rich and poor arose. The administration divided the urban area into parcels, which have different minimum sizes depending on the location. The land areas in the old center and in the southern districts are on average 150 to 250 m² much smaller compared to the north, where one finds plot with a minimum of about 400 m². This division gave rise to the poorer south and the richer north, which also finds its counterpart in many

other megacities of the world. With this segregation, Riad ended the tradition of mixed living of all income classes that the historic Riad had before the middle of the 20th century (Gharipour, 2016).

Since the 1980s, Riyadh has sought to promote modern architecture with elements of regional style. This Arab variant of postmodern architecture focused mainly on public and state representative buildings. Due to the strong guidelines concerning the building height, Riad is a flat city with few striking elements. Only two skyscrapers have managed since the turn of the millennium, as important landmarks in the city's history. They characterize the linear CBD and emphasize the north-south orientation of the city (Al-Rasheed, 2010).

Riad has more than 10 km of elongated "Central Spine" characteristics of a band city. The extensive spread of residential development in all directions, especially after East could not prevent the linear orientation of the center. The high degree of suburbanization causes a multitude of problems. A large percentage of the developed area is not yet developed. Due to the large sales of oil production, there were also more and more wealthy people, but due to the Islamic prohibition of interest their money mainly invested in real estate and land. The result was an exponential increase in suburbanization (Al-Rasheed, 2010).

Since many investors did not sell their land for speculative reasons and the population growth was very large, more and more settlement areas were opened. This development promoted the strong sprawl of a vast area, which is sparsely populated worldwide. Economic, social and ecological problems were ignored and a Rapid City growth standardized.

From urban development to architecture, people trusted the same building blocks. Thus, the 2x2 km Super grid became a frame element of growth that could easily be copied in all directions. The square settlement area of 4 km² was developed and divided into land parcels of uniform size. The usually square plots are also extremely uneconomical from the point of view of infrastructure development, as the longer distances lead to larger ones Cost of maintenance and repair lead. Socially it is problematic that the population has been torn from its traditional context (Al-Rasheed, 2010).

In ancient Riyadh, clans lived close together in the neighborhood, and there was no segregation between rich and poor. Above all, the old center and the southern districts offer social explosives, since here lives the lower income layer densely crowded. An increasing problem is the unemployment among the indigenous population, which is hard to find in the lower service sector. As the Saudi population is very young and growing rapidly, there is an increasing political effort to replace migrant workers with local workers. The city of Riyadh is highly uneconomical due to its urban design, architecture and location. The consumption of energy is especially in the summer months due to the Air conditioning very high. In addition, the developed groundwater resources are not sufficient to supply the city of Riyadh, and it must be desalinated significant amounts of seawater and Riyadh be transported. The extensive suburbanization of the desert led to a constantly growing demand for energy and water. This development has a large number of ecological problems as a result. For example, a large part of the wadi was settled in the west of the city, an important natural area in the immediate vicinity of the city was lost forever (Gharipour, 2016).

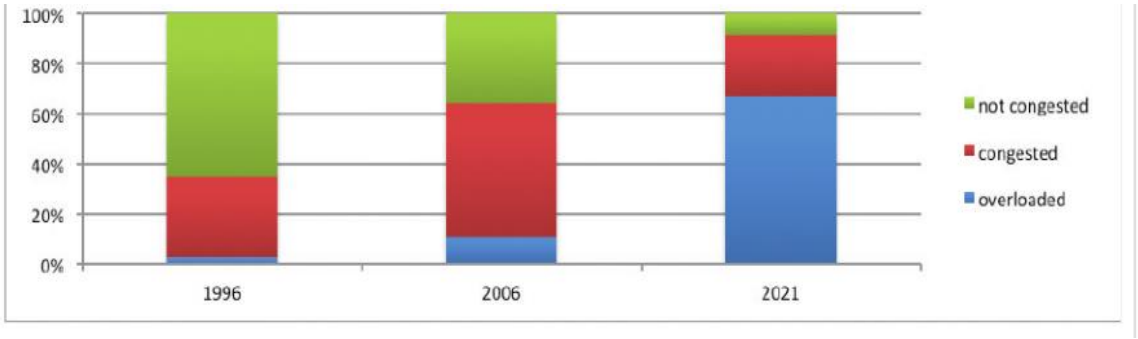

Figure 3.11: Riyadh Transportation condition over time (Aldalbahi & Walker, 2016).

Since 1991, the water supply has not been able to keep up with the increasing demand. Most of the water is desalinated seawater from the Arabian Gulf, 460 km away. It is mixed with groundwater from 8 different sources and then forwarded to the households. The high government subsidies for water consumption aggravate the problem, as they promote the waste of water. Due to rising consumption, the groundwater level drops in some places, some sources are threatening to dry up. Elsewhere, the groundwater level rose due to the impact of the development. In the south of the city there are neighborhoods threatened by flooding. Due to leaks in the sewage system, the groundwater is also contaminated. After clarifying

the wastewater, it is disposed of in Wadi Hanifah, where over the years a truly green lake landscape has developed. The planning responded to the high water demand by using treated wastewater used for irrigation of green spaces. One of the pioneers in this area was the planning for the graduate quarter. However, there is still the problem of using gray water in Riyadh. The tap water has drinking water quality and consists of the already mentioned mixture of desalinated seawater and groundwater, which serves to improve the taste. Spar valves try to reduce water consumption (Gharipour, 2016).

In addition to the water problem, increasing traffic and all its negative consequences is one of the main problems. Parallel to the larger settlement area also the traffic grew. Air pollution is a serious problem that severely limits the quality of life. With the ever-increasing traffic and the storage risk grew. Driving is cheap at low gasoline prices and is considered as the only means of transportation. Due to the poor distribution of land use, the population sometimes has to travel long distances for their daily lives.

The public traffic is limited to bus lines and is due to the still existing advantages of own motor vehicle almost only by the poorer Used by the population. The congestion problem concentrates on all city highways, where the traffic, especially in times of rush hour strongly concentrated. Almost a million vehicles are registered in Riyadh. In addition to air pollution and noise, the loss of time due to congestion is a side effect that worsens the living conditions of the population. In addition, the loss of time has a negative impact on the entire economy (Fox & NADA, 2006).

Such a big city in the desert is undoubtedly one of the most expensive cities in the world. Without oil wealth, a city in this shape and size would be inconceivable. Since the finiteness of the abundance of raw materials is fixed, the question of sustainability is all the more urgent. At the moment, in the case of Riyadh, there is no major change in thinking. One still trusts in the great wealth of the country, which will probably also be the basis of growth in the next decades. At the same time, there is an attempt to locate new industries, such as communications technology, in Riyadh in order to open up new sectors of the economy and reduce the threat of unemployment (Al-Rasheed, 2010).

3.1.4 Future development

The city of Riyadh will continue to grow in the future, it is estimated that in 2021 it has about 10 million inhabitants. To better manage this growth at all levels, the ADA (Al Riyadh Development Authority) has developed a master plan. It provides for how the city should develop politically, economically and urbanistically by the year 2021. In order to provide a framework for growth, three satellite cities in the north, east and south are set to set limits in the future. In the west in the direction of the wadi, the city growth is to be completely discontinued. The northern satellite city has a planned area of 163 km² and due to its proximity to the airport will become a center for the information technology industry. In addition, it is directly connected to Riyadh and the linear CBD due to the strong north-south axis. It is estimated that about 950,000 people will live in this new satellite city (Oxford Business Group, 2008).

In the east, a 183 km ² satellite city with a population of about 880 000 is expected. Due to its location in the east, in the direction of the Arabian Gulf industrial center, it is intended to become an important commercial center. Import, export and redistribution of goods should become economic priorities of this satellite city. Two highways to Dammam and Al Khobar pass through the satellite city towards the Arabian Gulf. A newly developed axis in the west should connect the eastern city extension with the center of Riads. The southern satellite city is being considered, but not yet planned. This is primarily due to the limited urban growth in this direction due to the industrial area in the south. For all satellite cities, a buffer zone to the urban area is planned in the form of a green belt. The main axis of the city will continue to be the north-south axis. One plans in the future another skyscraper, the Al Rajihi Tower. Its modern architecture continues the trend of the already existing two skyscrapers (Al-Hathloul, 2017).

The Central Spine will be the center of the largest architectural projects ever seen in Riyadh. Toward the east, a new axis is to be expanded and take over important city functions. The so-called Prince Abdullah Corridor is said to be about 22 km long and firmly connect the more developed east with the center of Riyadh and its CBD. An approximately 1.7 km long section with the crossing point of the corridor with the Central Spine is to be expanded as Boulevard Precinct. The planning office AS & P took over the design of the corridor and its

core by the order of the ADA. The city highway is to be guided partly underground, in order to make the area pedestrian-friendly. The novelty is an electric tram that connects the east with the center. Many green spaces and intensive street design are planned. Another example of this is the current project to visually enhance the appeal of a multitude of street spaces throughout the city through avenues and green spaces. In order to promote the decentralization of city management, it was decided to develop five sub-centers at key strategic points. It also hopes to improve the urban space and create many new jobs. A major problem of the city is the very limited mixing of living and working. This has led to a dramatic increase in traffic, which in turn has reduced the quality of life of the population (Al-Hathloul, 2017).

The new sub-centers will also be central to public life in order to improve urban life in Riyadh. In the north, a 2.7 km ^{2} large sub-center at the intersection of King Fahd Street and the Northern Ring Road is planned. In the east, a sub-center is to complete the newly planned Prince Abdullah corridor at the height of the eastern ring road. In the very south, a sub-center is planned near the new housing estates, which will be partially enclosed by a newly planned green belt. The last two subcentres are located in the west or southwest of the city. The western sub-center is located near the intersection of the ring road with the connection to Jeddah. In the southwest one plans a subcenter at the intersection of the ring road with the highway to Dirab. All subcentres are approximately the same size and are all located near the ring road or at important crossroads. They therefore have approximately equal distances to the actual city center. (Oxford Business Group, 2008)

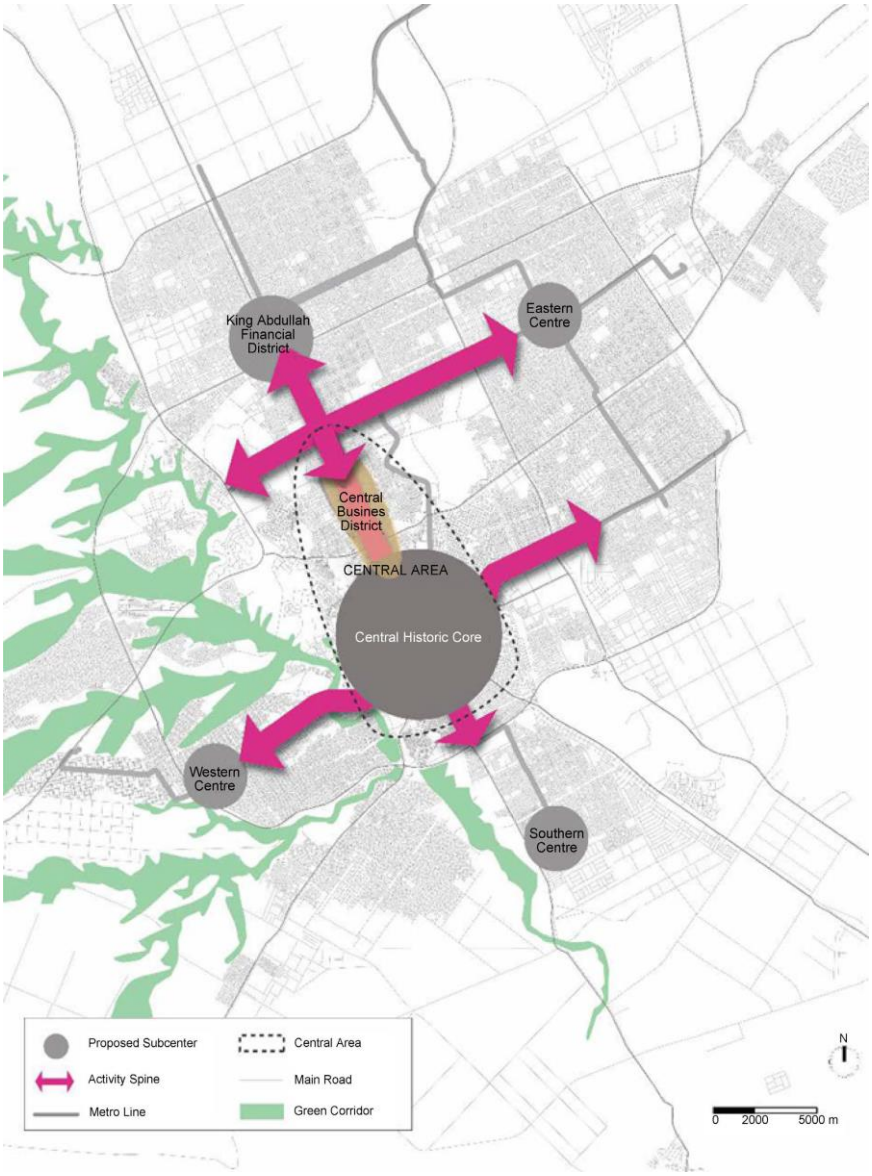

Figure 3.12: Riyadh metropolitan TOD strategy-subcenters (Al-Hathloul, 2017).

The immediate center of the city will also be reorganized in the future between three important nuclei. In the north, the entire site of the old airport is to be transformed into a Central Park. The old historic core forms the southern end of the newly defined center. In the west, it is the diplomatic quarter, the royal palace complex and the newly planned Sport city, which together form a nucleus. In the enclosed area the commercial use concentrates, since here the "Central Spine" merges into the Transition Spine.

In addition, almost all ministries and administrative buildings are located in this zone. This reorganization of the city into suburbs, subcentres and core zones will improve the city functionally in the future. Given the doubling of the population over the next two decades, the master plan seeks to solve urgent problems, such as the decentralization of city functions.

Another important project of the next few years is the restoration of Wadi Hanifah as a natural area and recreational area. For decades, large parts of the wadi were used as landfill. Since 2001, the ten-year plan has been used to protect the wadi as a park and nature reserve from urban sprawl and pollution. It also promises to preserve the remaining groundwater resources, which will become increasingly important in the future. In addition to being used as a recreational area, the wadi is also to be used partly for agricultural purposes.

In addition to the Wadi Hanifah and the Central Park in the future, a third large-scale theme park called Thumamah Park is to be created. The park is located west of the city and will in future be the largest entertainment complex in Riyadh, covering an area of 375 km². In addition to a safari park, which will occupy the largest part, there is a natural history museum and adventure playgrounds. The planned park is a sign of the increasing need of the population for leisure and variety. In addition, it is hoped that the park will invest in a major tourist attraction. Another future large-scale project is the revitalization of the historic city of Dariyah, which has been reached by city growth in recent decades and is located in the western outskirts of the wadi. The old clay architecture is to become an important attraction for tourists and residents (Wright, 2013).

In the future, especially the improvement of public transport will be an important topic of planning. For the first time, two Train lines are being planned. On the one hand along the north-south axis and on the other hand from east to west along the already mentioned Prinz-Abdullah corridor. Both railways have a total length of 39 km. The schedule envisages opening the first railway lines by 2013. In the future, the rail network will be further expanded and the airport and the industrial area will be connected. In order to make the rail project possible, parallel work is being done on the establishment of a shuttle bus service. The buses run from the individual residential areas to the train stops. The hope is for stronger economic growth along the railway lines that will open up the entire center and connect key

sub-centers. In order to establish public transport, it is planned to demand higher parking fees in the future and thus to restrict individual traffic (Menoret, 2014).

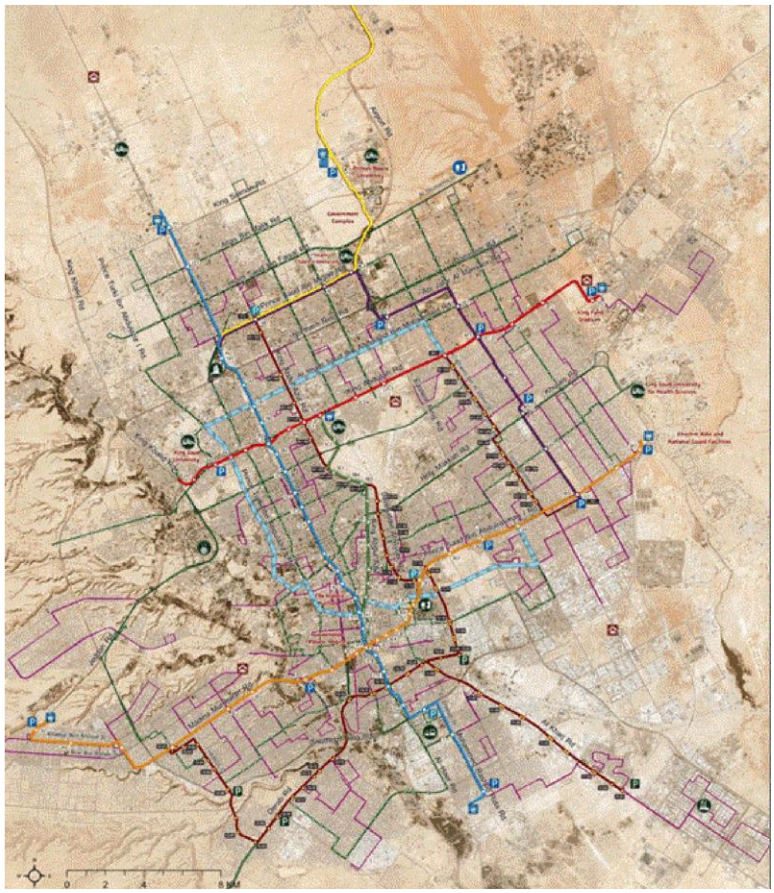

Figure 3.13: Plan of RPTN project (Menoret, 2014).

In the future, traffic planning will have to face the major challenge of establishing effective management to avoid a dramatic deterioration in the traffic situation in Riyadh. In addition to the revision of land use, which, for example, city functions are decentralized or large shopping centers are planned with greater distance to city highways, also economic measures must be taken. Higher gas prices and the introduction of fees could significantly reduce traffic in the future. To counteract the rush hour problem, a flexible shift in working hours could help. The road construction or Road development alone will not be able to solve the traffic problem sustainably (Menoret, 2014).

3.1.5 Planning development

Riad evolved within a century from a small oasis town with only 1 km ² settlement area and a few thousand inhabitants to a megacity in the desert, which today occupies more than 1600 km ². Even today, Riyadh has a remarkable annual growth rate of 8% and is forecasting 10 million inhabitants by 2020. In order to get this growth under control, effective planning management is indispensable. After 1930, a system was gradually developed to guide urban development. The problems initially lay in the lack of institutions that could take over the planning. For this reason, the city initially grew relatively uncontrolled. It was not until the 1950s that planning became more and more institutionalized against the backdrop of the slow onset of the oil boom. The infrastructure has been greatly expanded in no time. After the relocation of the ministries to Riyadh, Al Malaz was the first major urban planning project. (Al-Hathloul, 2017).

By the end of the 1960s, several national development management institutions had already been established. In addition, a structure of local management emerged. An important turning point in a very limited urban planning was the master plan of Doxiadis. Here, for the first time, a plan was developed that covered the entire city in all its elements. The 70s and 80s were marked by the oil boom. This era resulted in annual growth of more than 8%. Since one had not expected this explosive growth, the planning was overwhelmed. The master plan was obsolete in no time and had to be overhauled in the beginning of the 80s. On the state side, the planning ministry, MOP for short, oversaw national development. One stage below was the Ministry of Rural and Municipal Affairs, MOMRA for short, overseeing regional development (Al-Hathloul, 2017).

In 1977, the municipalities were granted a degree of financial and administrative independence. Otherwise, nothing changed in the structure of national planning management, which can be described as strongly centralized. One of the most urgent problems was the huge demand for land. In addition to the provision and concession of several thousand land parcels, a real estate fund was set up for the granting of construction loans. Due to the very limited foresight, planning was standardized and the same pattern was monotonously copied in all directions. Also, the revision of the Doxiadis master plan of SCET in the early 1980s did not change that. One of the main problems of planning was the

lack of coordination between the different institutions and the weak data (Al-Hathloul, 2017).

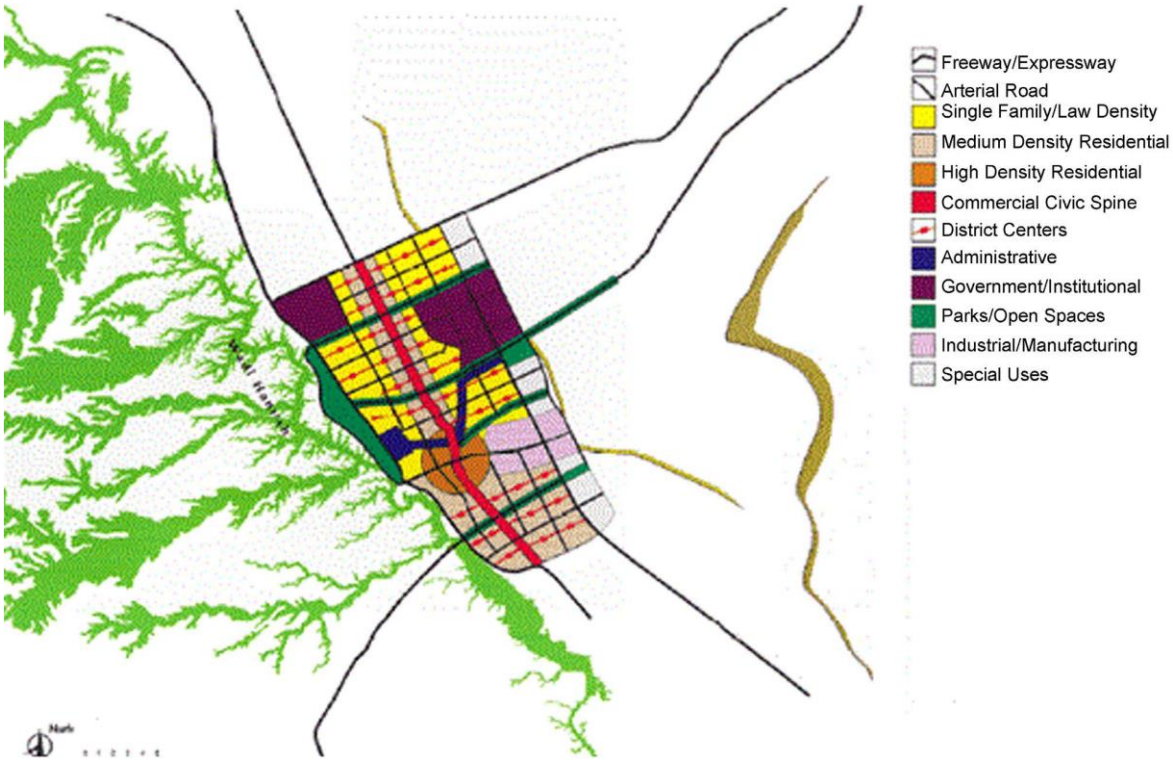

Figure 3.14: Riyadh - Dioxides master plan 1972 (Al-Hathloul, 2017).

In 1985, city expansion was halted nationwide for two years to better manage future planning. The MOMRA was commissioned to develop an expansion plan for the next 50 years, taking into account the economic development plans. This action illustrates how far the planning was behind the actual development. This problem did not change in the period that followed. After 1990, Riyadh is talking about the post-oil boom era, even though the economic dependence on oil has not changed. City growth was also unbroken until today. A sign of the ineffectiveness of planning in recent decades is that in 2003 an estimated one-third of the city's area did not yet have fully-equipped infrastructure. This concerned water supply, sanitation, electricity and roads. However, compared to 1990, when only about 52% of the population was fully supplied with infrastructure, a clear improvement can be seen.

Important planning issues in the 1990s were land speculation, uncontrolled growth, lack of data from landowners, congestion and pollution. While the HCDR (High Commission for

Development in Riyadh) oversaw the planning and development of the city, the ADA (Arriyadh Development Authority), as the body of the HCDR, was responsible for direct planning. She supervised the master plan and worked with him. In addition, she was commissioned by city planning and architecture projects and involved in the planning. The local administration took over the implementation of the plan in everyday life of the city and tried to implement the guidelines of the master plan. In addition to these responsible persons, other actors, like other ministries, were involved in the planning.(Al-Hathloul, 2017).

One of the main problems was to find a way to better plan and coordinate planning. Due to the multitude and differences between the participants, it has always been difficult to exercise effective planning. In 1990, SCET's master plan was already obsolete and MOMRA initiated a project for a Metropolitan Development Strategy (MEDSTAR). The MEDSTAR project began in 1996 under the leadership of a team of specialists and consultants from the ADA and the local administration. The large-scale project was designed to identify the city's problems and develop a dynamic coping strategy. First, data were collected and used to build a vision for the next 50 years of the city of Riyadh (Al-Hathloul, 2017).

To date, there is a strong continuity of development in urban developmen at the national level. All facilities, including the ADA, were built during the oil boom era of the 1970s and 1980s. The structure is still very centralistic, which inevitably leads to an overload of certain organs. This delays reform processes and important decisions. In many areas, therefore, the planning is not yet completed. The local planning level was limited to developing one's own management and there was no involvement in decision-making at the national level. In other countries, it is customary for the national level to provide a framework within which local leaders can operate freely. In Saudi Arabia, local institutions are merely agents of national ministries and not autonomous actors who make major decisions. This structural problem has serious consequences (Rahmaan, 2011).

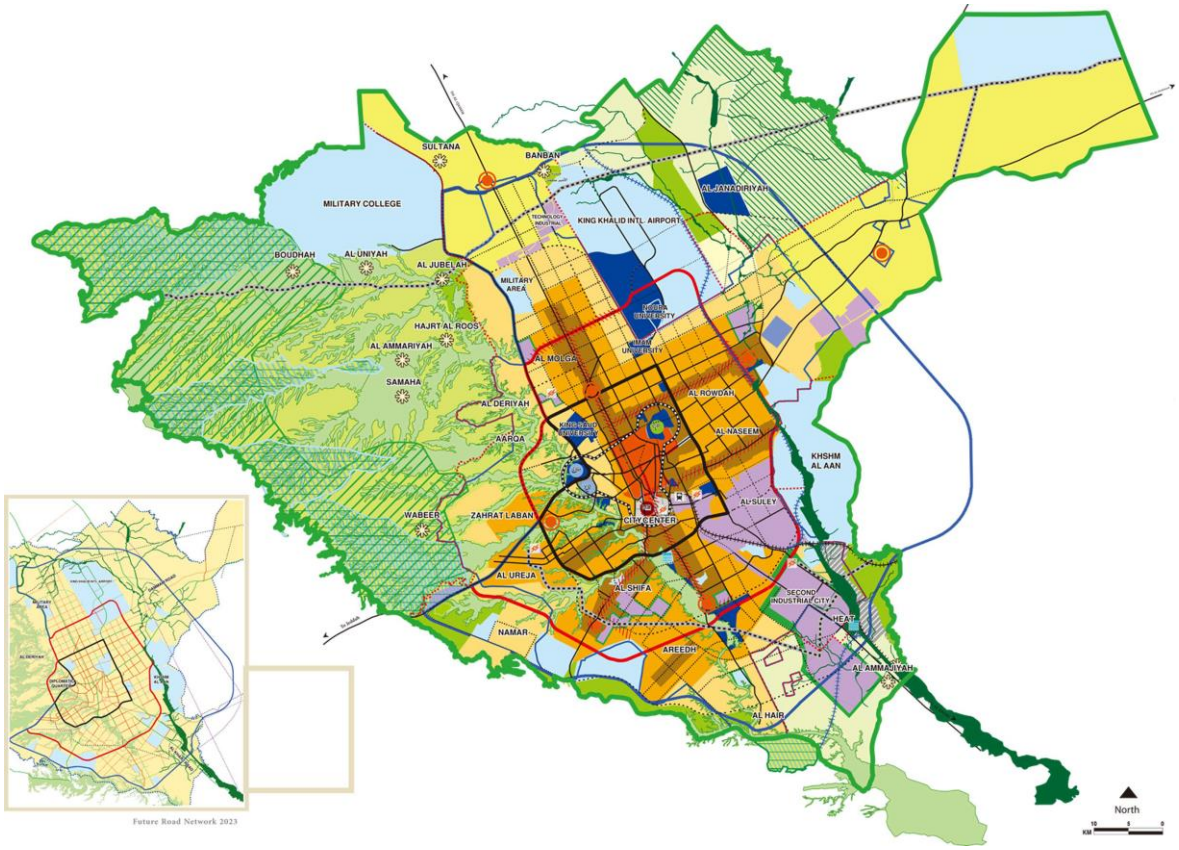

Figure 3.15: Riyadh-MEDSTAR structure plan 2030 (Al-Hathloul, 2017)

As decisions are made at a more distant national level, they are often wrong and may lead to aggravation or new problems. For example, in the phase of acute housing shortage, it was decided to grant many construction loans through real estate funds and to make many plots available for free. This led inexorably to land speculation and a limitless expansion of the settlement area, the extent of which today are the main problem of Riyadh.

Planning management has hardly changed after 20 years without reforms. And until today there is a big lack of clear definitions of who is taking over which role in city management. Outdated laws, the lack of networking among the individual institutions and the weak data make planning difficult. There is a very weak coordination between the planning actors and those who are finally to implement the planning. This leads to a very pronounced inefficiency and thus to a great loss of time. In addition, mistakes in the planning cannot be ruled out. The database developed by the ADA called UIS (Urban Information System) is intended to optimize planning and management in the future (Aldalbahi & Walker, 2015).

However, it is not yet available at the local level and only helps in planning. Only reforms will help in the future to solve the problems in the management structure of planning. Decentralization would be the right keyword in this context. There is still a lack of many professionals, and one has to rely on consultants and experts from abroad. The problem is that they are often not based in Riyadh and know the problems from the outside rather than from the inside. Since the beginning of oil exploration, many foreign architects and planners have come to Riyadh. For example, both master plans came from European planning offices. A very committed German planning office was and is AS & P from Frankfurt (Aldalbahi & Walker, 2015).

3.1.6 Summary

The city of Riyadh was originally a classic oasis city. The fertile area near the wadis made agriculture possible, which for centuries formed the economic basis. At the beginning of the 20th century, Riyadh once again became the tribal seat of Al Saud. Under his leadership followed in 1932, the founding of Saudi Arabia. Riyadh, as a tribal seat, became capital of the kingdom and gradually expanded into the administrative center of the country. The most important economic basis was and is oil production.

The oil boom began in the middle of the 20th century and allowed the construction of a separate industry (mainly petrochemicals). The huge administrative apparatus with several hundred thousand employees is maintained until today mainly by the profits of the oil business. As a result, the services sector also depends to a large extent on oil indirectly. The Riads society is predominantly Arab traditional. The core of Saudi society is still the extended family. Since the oil boom, the birth rate has risen sharply and the average age has fallen accordingly (Aldalbahi & Walker, 2015).

Today, there is an unemployment rate of about 12% among the Saudi population with an upward trend. Work in the lower service sector is usually rejected because there are government subsidies. The great wealth allowed the political leadership large expenditures for the urban development. Due to the lack of expertise, within the own population, many foreign experts were brought into the country. Thousands of guest workers, mainly from

neighboring Arab countries, came in the course of building the new city and filled the lower service sector with their workforce. Based on the planning of the 50s and 60s, a modern infrastructure was created. A hierarchical road network broke through the old structures and opened up new settlements. The first master plan by C. Doxiadis possessed the functionalist orientation that was characteristic of the planner generation of the 1960s. A regular network of streets consistently opened up large residential areas. The linear CBD should grow dynamically as the city expands. The modularity and the appearance of predictability characterize this urban planning (Al-Hathloul, 2017).

As a result of the foreign engagement, a new typology has been introduced: the Mediterranean villa. Although it did not meet climatic or cultural requirements, it replaced the traditional courtyard house. A high privacy wall was the cultural response to preserve Islamic privacy. It was followed by legal provisions that should prevent the insight into the neighboring property. The building height was usually limited to two floors. Due to the favorable economic conditions, it came in the context of the oil boom to an incomparable population explosion. Millions of locals and guest workers moved to the capital. The result was a big housing shortage.

The political leadership responded with a land allocation policy, which provided for a quick parceling and distribution of land. The procedure has been standardized and applied over decades. The negative concomitant was the real estate speculation, which led to ever larger urban areas were opened. The consequence of the oil boom was a city with the highest degree of decomposition and energy consumption of this earth. For the most part, Riyadh consists of low-density suburban areas. The most important framework element of the residential areas is the 2x 2 km "Super grid" (Doxiadis master plan). The monotonous typology of the two-story villa development characterizes the cityscape. Riyadh is therefore one of the slimmest cities in the world. The city center is typologically more heterogeneous and densely built-up (Aldalbahi & Walker, 2015).

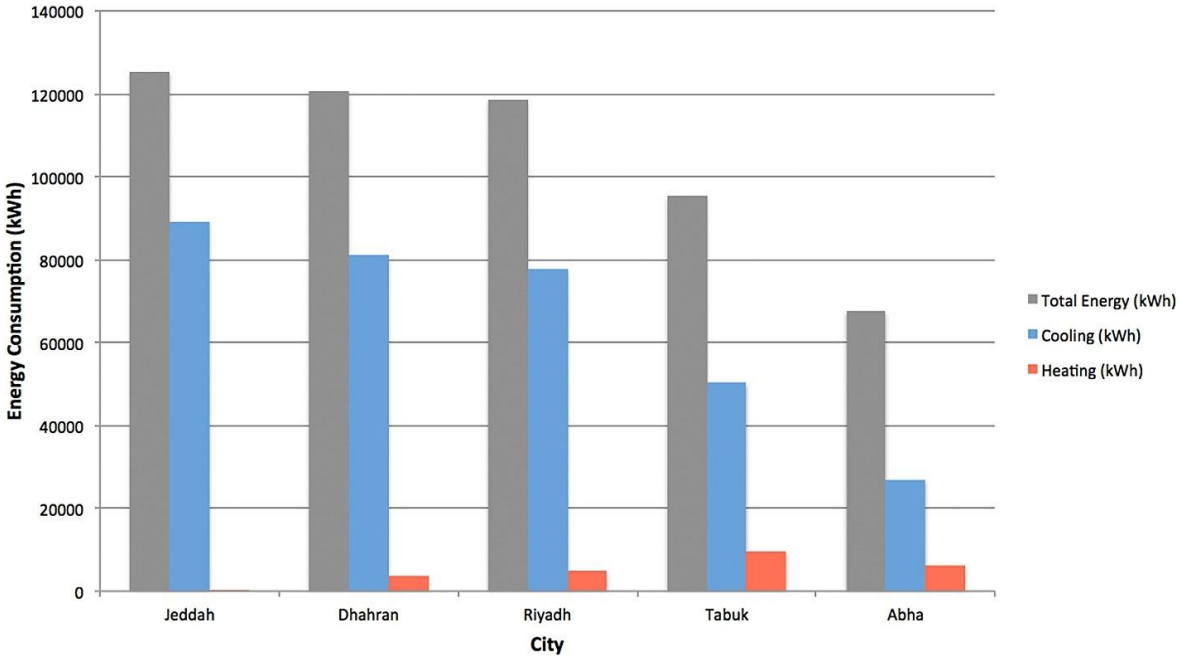

Figure 3.16: Energy consumption of Riyadh compared to other regions in Saudi Arabia (Krarti et al., 2017)

In addition to residential development, there is also commercial use. Above all, the lower income bracket lives in the old city center and its immediate surroundings, especially in the south. The segregation between poor south and rich north is part of today's city. The most important economic center is the linear "Central Spine" on which today's CBD is located. This north-south axis was also based on the master plan of Doxiadis. Only two skyscrapers characterize the CBD and are the city's most important landmarks. There are hardly any public places within the CBD. The air-conditioned shopping mall is the replacement of the traditional souq. The only means of transport in Riyadh is the motor vehicle. Large multi-lane traffic aisles and motorway junctions characterize the city (Krarti et al., 2017).

The high degree of suburbanization led to an overload of the transport system. In addition to major economic losses, increasing traffic threatens the environment and, as a result, the quality of life of the population. The high energy consumption of the city is due primarily to traffic. Apart from traffic, millions of air conditioners and the desalination of vast quantities of seawater make Riyadh one of the most uneconomic cities. Sustainability has not received much attention in previous planning. Only hesitant are projects such as public transport. A

compression of the development and a restriction of the individual traffic are still not recognizable today.

By 2021, with an annual growth rate of 8%, more than 10 million people are expected. Riyadh would be the first megacity in the desert. In order to set limits on city growth, satellite cities are planned at the end points of the main growth directions in the north and east of the city. In addition to the expansion of the north-south axis is to create a west-east axis to enlarge the CBD and relocate. New sub-centers along the ring road are to decentralize the city functions. The long distances between work and living should be avoided in this way in the future. Riyadh is a prime example of an "oil city" and will probably remain so for several decades. There is hardly any diversification of the economy today. At the end of the oil boom, only a mature domestic labor market is expected to save the city from ruin (Al-Hathloul, 2017).

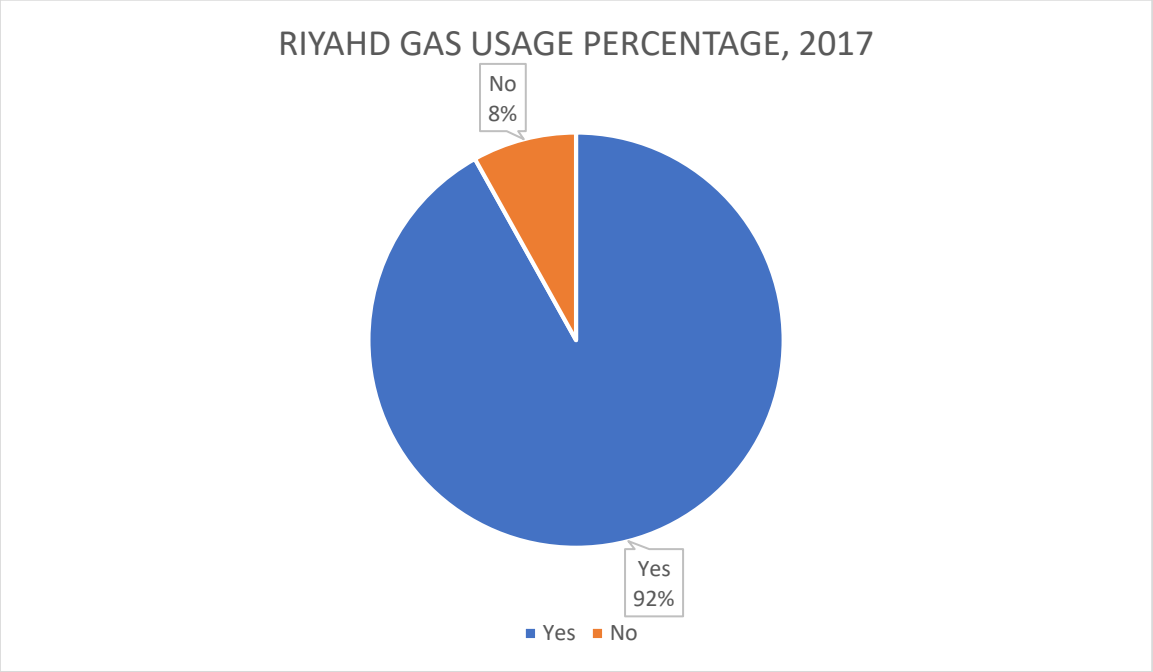

Figure 3.17: Chart showing the percentage usage of gas in Riyadh. (adopted from General Authority for Statistics, 2017)

3.2 Dubai Global City on the Gulf

With over 1.2 million inhabitants, Dubai is the fourth largest city in the Arabian Peninsula after Riyadh, Jeddah and Abu Dhabi. Due to the gigantic growth, it is expected that the population will more than double by the year 2017. The metropolis stands for the beginning of the "post-oil" era like no other. Already in the 90s, the emirate was economically largely independent of oil production. The oil wealth of Dubai is also relatively limited, and it is expected that the crude oil will be used up at a constant flow rate within the next 40 years. The rulers of Dubai began early to invest their wealth in the expansion of various economic sectors to avoid dependence on oil. Dubai developed into the banking and trading center of the United Arab Emirates. Due to the free trade zones, many companies, especially from the software industry, moved to Dubai. Today, the emirate is also considered the region's most important tourist center, due to large investments in tourist infrastructure, cheap shopping and the comparatively liberal political stance.

Dubai is the second largest emirate in the United Arab Emirates, covering more than 4,000 square kilometers. Sharjah is a neighbor's emirate and borders the northern city limits of Dubai. The UAE government is formed by the Council of Rulers of the Seven Emirates. The president of this council is according to the constitution of the Emir of Abu Dhabi. His deputy is the Emir of Dubai (Lis, 2010).

Each emirate manages itself and is therefore largely autonomous. In the future it is planned to set up a central administration in Abu Dhabi. The UAE's budget is largely oil revenues Abu Dhabi 75%, Dubai 25%. The population of the UAE is 80% foreign. As a rule, immigrants have a residence permit (Lis, 2010).

3.2.1 Geography and climate

The UAE and Oman form the eastern part of the Arabian Peninsula. They have about 600 km of coastline on the Arabian Gulf and another 100 km on the Gulf of Oman, beyond the top of the Musandam peninsula, which extends into the Strait of Hormuz and is Omani national territory. Cities and people are concentrated on these long, gently sloping coasts

with only a few gutters reaching into the hinterland. The coast is preceded by coral reefs, which separate larger lagoons and extensive, periodically flooded salt flats on the mainland from the open sea. Behind the coast begins the desert. Flat sandy plains and undulating gravel surfaces alternate each other. Sand dunes migrate from the sea in a southeasterly direction because of the constant wind. In the hinterland of the UAE, there are very few oases like Al Ain and Liwa. In the south, the desert includes Rub Al Khali (Lis, 2010).

In the east of the UAE begins the Hajar mountain range, which reaches heights of more than 3000 meters. Climatically, the coast and the hinterland lie in the subtropical dry belt. They are one of the hottest areas in the world in summer.

Dubai lies 25 degrees north and 55 degrees east latitude on the Arabian Gulf and is characterized by a narrow inlet that extends 14 km into the flat desert area due to a whim of nature. Even today, this inlet is under the English name "Creek" most important geographical feature of Dubai in the otherwise flat and very sparsely vegetated desert environment. The urban climate of Dubai can be described as subtropical and arid. Rainfalls are rare and irregular (Lis, 2010).

3.2.2 Urban development

- ***From the beginning to the turn of the century***

The coast of the Arabian Gulf was settled very early. Excavations occupy human settlements dating back to 5000 BC. Chr. In the sixth century, established individual trading branches, including in Jumairah, which is in today's urban area of Dubai. Initially, however, this branch was limited to only one caravan station.

In the middle of the 18th century, due to a political vacuum, several smaller settlements developed along the coastline of the Arabian Gulf. On the one hand, the population consisted of sedentary Bedouin tribes, on the other hand, experienced Arabs moved into the maritime trade. Apart from trade, the inhabitants of these settlements lived from the pearl diving. The most important foundation for each settlement was a freshwater spring. The growing involvement of the major seafaring nations, especially Britain, in trade with India has led to

a political revaluation of the region. And due to the lively maritime trade, piracy became a new source of income for the tribes (Davidson, 2008).

Figure 3.18: Early Life in Dubai (https://www.onecentral.ae/english/pages/about Last Accessed October 2018)

In 1761, the Bani-Yas tribe moved from the Liwa Oasis in the interior to the Abu Dhabi Peninsula. In the north, it was the tribe of Qawasim, who settled in the areas of today's Sharjah and Ras Al Khaimah. In 1820, Britain signed a contract with major Gulf Coast tribes to end piracy. This was the birth of the Trucial States. Although Britain was politically very present, no colonial settlements were established. Even the existing settlements were not changed by the British presence. In 1822, a British naval officer describes a settlement on what is now Dubai as a collection of mud huts surrounded by a low wall. At that time, the small fishing village already had the name Bur Dubai (Davidson, 2008).

The origin of the name Dubai is still unknown. It is believed that it is either the composition of the Persian words for two and brothers and the two opposite settlements on the banks of

the creek are meant. Or the name comes from the Arabic term Daba, which means thriving market.

In 1833, there was a break within the tribe Bani Yas. The clan leader Maktoum Al Butti moved with his clan, which numbered about 800 people, in the hitherto insignificant settlement "Bur Dubai". This is considered the actual birth of today's emirate, which is still dominated by the Al Maktoum dynasty. Around 1894, Dubai's Sheikh Maktoum ibn Hasher Al Maktoum promoted trade through extensive tax and duty-free treatment. This was trend-setting for the future growth of the city (Davidson, 2008).

The city of Dubai grew at the turn of the century from 1500 inhabitants in 1833 to more than 10 000 inhabitants. They first concentrated in their circumference on the two sides of the bank of the narrow inlet. The simple cityscape was determined by the simple Bedouin Barasti mud houses. Walls were also often built from coral blocks and plastered with lime.

Figure 3.19: Heritage House Museum, Dubai. (https://www.turbo pass.com/dubai/heritage-house-dubai.html Last Accessed September 2018)

Next to the ruler's palace at the mouth of the creek, there was a Friday mosque. This was near the fortress built in 1860 called Al Fahidi Fort. The citadel, which remains today as the oldest building in the city, was located on the southeastern outskirts near the Creek. Immediately after the mosque and citadel there was a souq. The city fortification was not very strong due to the small threat and consisted of a simple mud wall. The most important economic basis was in addition to trade pearl diving and fishing. Until the turn of the century, the population consisted mainly of the tribe of Al Maktoum (Davidson, 2008).

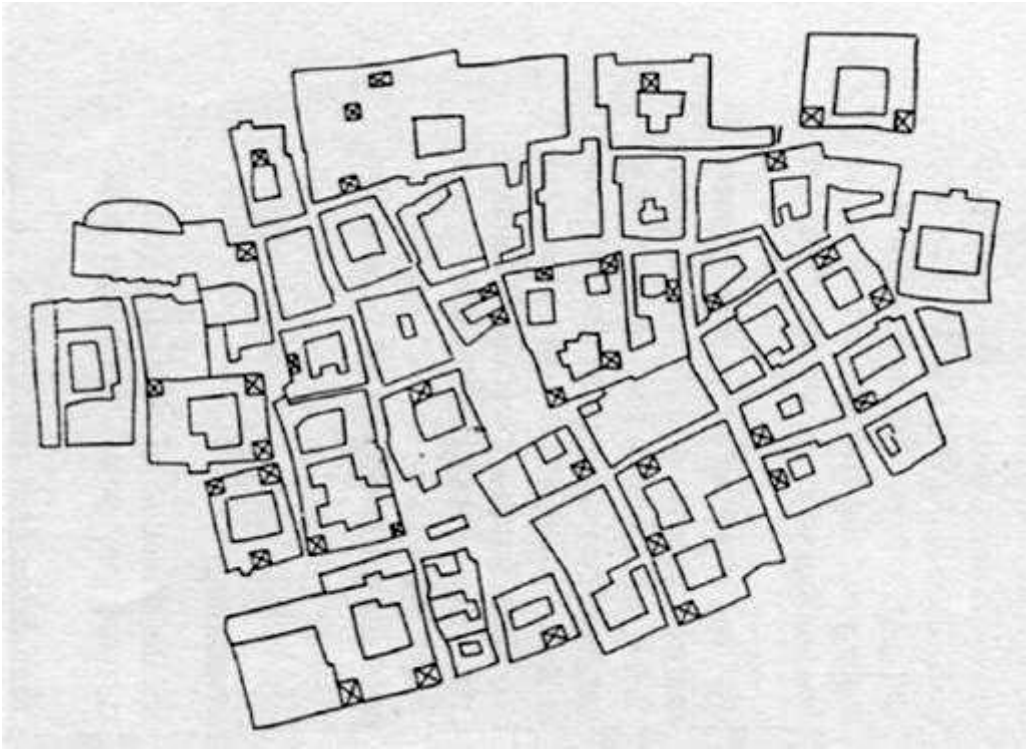

Figure 3.20: Old city of Dubai the Bastakia (UNESCO, 1981)

- ***Against the backdrop of the onset of the oil boom (1955-1970)***

In the neighboring Emirate of Abu Dhabi, petroleum, which was found by British ß companies, was already being promoted in 1958. The oil boom era began, and Dubai was to benefit greatly from it. Although in Dubai, for a long time, oil was not found for a long time, the economic situation improved. The first bank office in Dubai opened in 1946 and over the decades has developed into the banking center of the region. It was not until 1966 that oil was also found in the Emirate of Dubai. The oil deposits were offshore in the Arabian Gulf and were significantly lower than that of neighboring Abu Dhabi.

Even before the era of the oil boom in 1960 was the first master plan for Dubai, which came from a British architect. This master plan included the development of a modern development system, the division of the urban area into zones and the allocation of different land uses. In addition, a new city center was planned. The objectives of the Master Plan were modest and met economic expectations before oil was found. The strategy of the Master Plan was characterized by a strictly centralized urban development. The principal of the plan was the Dubai city council, which in 1957 was given the authority to coordinate all administrative services under the supervision of a city council. This city council consisted largely of leading figures in the economy. In addition, the pattern of urban development was strongly influenced by the structure of the real estate market, which differs substantially from the Western model (Davidson, 2008).

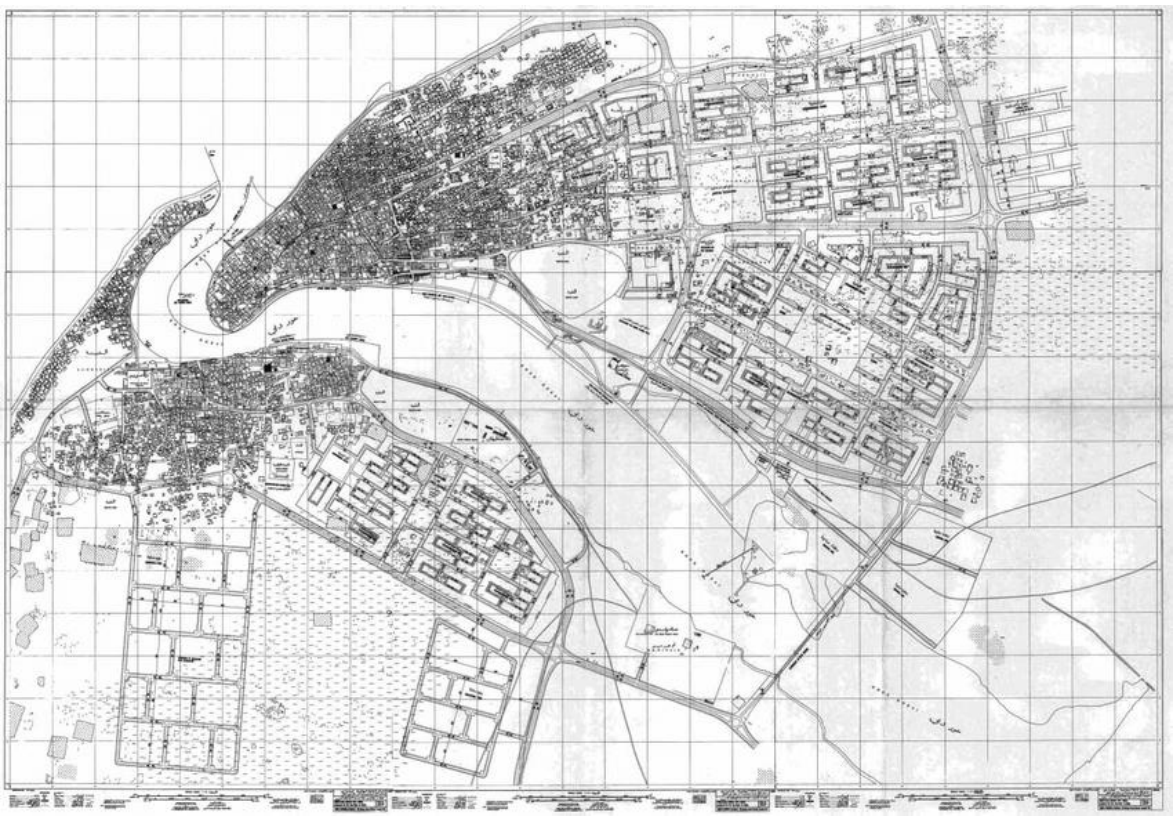

Figure 3.21: John Harris's first Master Plan of Dubai from 1960(https://www.researchgate.net/figure/John-Harriss-first-Master-Plan-of-Dubai-from-1960-14_fig5_320860098 Last Accessed Oktober 2018)

According to the Arabic-Islamic traditions, the ownership of a property is based on two principles. Every piece of land within a settlement that is being developed and inhabited for a long period of time belongs to the owner of the house. The ruler determines the rest of the non-populated land. In Dubai, these principles were codified by law in 1960. From then on, each property belonged to the respective homeowner. The rest of the uncultivated land was now owned by the ruler and was rented or sold by him. He could also assign it to any state use. If the ruler forgave land without claiming payment, he could reclaim it under this law in the future. The owners of still undeveloped land in 1960 were not expropriated. They were only obliged to build their land shortly, otherwise they were forced to sell. The centralization of land allocation should facilitate the implementation of a development plan. The advent of modernization also left its mark on the architecture. The first house was built of cement blocks in 1956. In the following years, the Mediterranean villa with contemporary design should replace the old clay architecture quickly. The walled villa was also the new standard of living in Dubai (Nassar et al., 2014).

- ***The first decade after the founding of the state (70s)***

At the beginning of the 70s, the protectorate of Great Britain ended and the United Arab Emirates came into existence. In addition to Sheikh Zayed of Abu Dhabi, it was Sheikh Rashid of Dubai who was the decisive force in the federal process. The development of the oil industry should revolutionize the economy and society of Dubai in no time. The oil made huge projects possible, initially in terms of infrastructure and industry development. In the aftermath, among other things, the huge new ports Port Rashid and Jebel Ali Port emerged. Furthermore, the dry docks, an aluminum production facility and finally the entire industrial area were built in the immediate vicinity of the Jebel Ali Port. Overnight, Dubai became an industrial city, and after the opening of the international airport in 1971, it also gained global importance (Nassar et al., 2014).

Another key factor in the rapid economic development was the density of experienced traders in the population of Dubai who, through their diverse backgrounds, had a network of international contacts. In the field of oil production to marketing, it was particularly important at the outset that the business people were large project co-financers, economic advisers and investment partners in private companies such as the Dubai Telephone

Company. Due to the economic growth, there was a rapid increase in the population. In 1968 there were about 59 000 inhabitants. Within the next two decades, this number should increase more than six-fold. This explosive growth can be explained by the high influx of immigrant workers, who were needed as workers because of their sudden economic growth. In addition to experts from the West and immigrants from neighboring Arab countries, thousands of Asian guest workers immigrated to the lower service sector (Davidson, 2008).

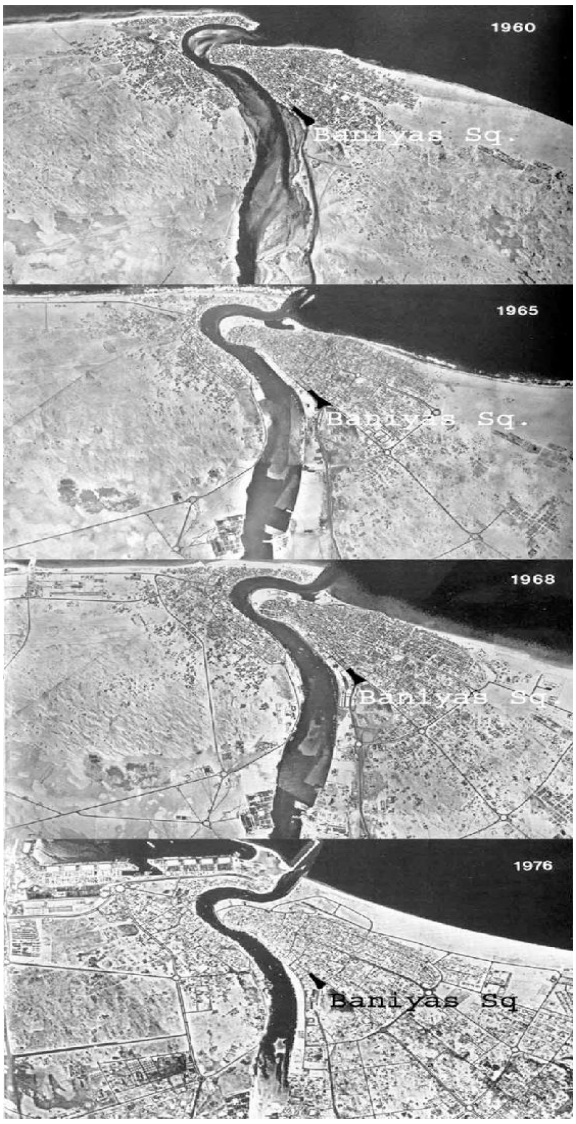

Figure 3.22: Morphological transformation of Baniyas Square and its surrounding Based on aerial imagery courtesy of Dubai Municipality (Nassar et al., 2014)

The 70s are characterized by rapid suburban growth. Around 1971, a new master plan was developed, which was far more ambitious compared to its predecessor and included the new economic growth. The new potential for the development of the city was great and the pressure for expansion grew steadily. The plan was to lay a ring of city highways around the city and develop a radial road network to the new suburbs. Another megaproject in traffic development was the construction of the Shindagha tunnel below the creek. This tunnel was to connect the districts of Deira and Bur Dubai and decisively improve the inner-city development. Furthermore, the two bridges Maktoum and Garhoud were built over the creek. In this way, the two sides of the river were developed so that there was nothing in the way of further development. Previously, people were still dependent on transport by ferry (Davidson, 2008).

Figure 3.23: John Harris's second master Plan of Dubai from 1971 Deira area; B. Bur Dubai area. (https://www.researchgate.net/figure/John-Harriss-second-Master-Plan-of-Dubai-from-1971-15-A-Deira-area-B-Bur-Dubai-area_fig6_320860098 Last Accessed September 2018)

The area east of the creek in the vicinity of Deira quickly became the first economic center. Many banks and government institutions settled there. It was also of great economic importance, as it set up the coastal and re-export service on the north bank of the creek. The international airport was opened at the beginning of the 1970s following this newly created CBD. On the other side of the creek was the international import and container port that stretched along the dry dock. In addition to the large industrial sites, the World Trade Center was also the first landmark in the city (Nassar et al., 2014).

The 39-story high-rise tower was opened in 1979. With a total height of 149 meters, it was the tallest building in the Middle East at that time. It became the figurehead of the economic growth of the region. The dominant skyscraper marks the crossroads between old city expansion and the later following urban areas towards Jebel Ali. It is also terminus of a nearly straight axis to the creek, which was named Trade Center Road. The road led through the WTC towards Jebel Ali and became the main axis of urban growth. Later, the longer part of the road between WTC and Jebel Ali was renamed Sheikh Zayed Road (Davidson, 2008).

Figure 3.24: The World Trade Center, Dubai, 1979 (Davidson, 2008)

In addition to the construction of Port Rashid at the mouth of the Creek, the planning of new housing developments along the coast towards Jebel Ali was envisaged. This huge new settlement area was named Jumeirah. In the south of the city, the development of additional space for health, education and leisure facilities was planned. Great importance for the structure of the modern city was the establishment of the growth corridor along the coast towards Jebel Ali.

Over the years, the multi-lane Trade Center Road became more and more extensive and became the linear center of the new urban area, also known as the New Dubai. This linear commercial and financial center became the city's new CBD in the following decades. The axis connected important economic activity areas in the north and south of the emirate. She also joined in the south directly to the connection to Abu Dhabi (Davidson, 2008).

The walled-up villa became the preferred residential typology in the newly developed settlement areas. Due to the large flow of guest workers, many multi-storey apartment blocks were built. Especially in the old center and its immediate surroundings, the building dandified, and the old typology was replaced. The richer population, especially the favored locals, moved to the new settlements in Jumeirah, whereas the large masses of guest workers, especially those in the lower service sector, lived in the immediate vicinity of the center or industrial sites (Elsheshtawy, 2009).

- ***Towards a global city (1980 to Today)***

Dubai's economy has been exploding since the discovery of oil. In addition, it was favored by the first Gulf War between Iran and Iraq, when a lucrative trade between Iran and Dubai emerged. In addition, the port of Dubai became increasingly important because of the war, as Kuwait and its port were classified as endangered. Since the beginning of the 1980s, trade between Dubai and all GCC states has become more intense, and Dubai has become the most important port in the region (Pacione, 2005).

Because of rising trade, more and more banks settled in Dubai. This in turn increased Dubai's attractiveness as an investor location. Low tax rates, a business-friendly and politically stable environment helped many companies settle in Dubai. The strategy to open the own market led to the establishment of the Jebel Ali Free Trade Area in 1985, which allowed international companies to produce cheaply without legal restrictions and with low paid workers. The most important argument for a head office in the emirate was the extensive exemption from taxes and duties (Pacione, 2005).

In the mid-1990s, there were already more than 800 company branches from 72 different countries. Among other things, large multinational corporations such as Nokia, Daewoo or Reebok have invested in a company headquarters in Dubai to participate in the ever-

expanding market. The number of company branches increased continuously. In 2002, there were more than 2,051 companies that pushed economic development in Dubai.

In Dubai, it was recognized early that the future depends on economic independence from oil. Since the 90s, the city has been intensified to expand as a tourist center. Between 1993 and 2000, the number of hotel rooms grew by more than 37%. The establishment of Dubai as a tourist attraction is also part of the city marketing, so that investors in the future invest their capital in projects of the emirate (Pacione, 2005).

The economic urban development of the 80s and 90s differs from that of the 70s in that less emphasis was put on the expansion of the industry than the rise to the global city. Dubai was to become the region's most important banking and financial center and would be an attractive location for companies from around the world. The eleventh of September 2001 promoted Dubai's economic importance, mainly because of Saudi sanctuary capital flowed into the emirate. For example, one estimates a Saudi investment of $ 7 billion in Dubai's construction projects, for the year 2004 alone (Pacione, 2005).

With the increase in economic importance, the population also increased strongly. In 1985 there were 370,788 inhabitants. Only ten years later, the number had almost doubled with 689 420 inhabitants. In 2002, it was close to exceeding the million dollars. Today more than 1.2 million people live in Dubai. Rapid population growth can be attributed to two factors. First, the massive influx of guest workers, especially in recent years. Today, more than two-thirds of the population comes from abroad. In 2000, it was only about 53% in comparison. And second, the high birth rate, which led to an increase in the native population (Pacione, 2005).

Since 1980, the city expanded in ever-increasing speed. In 2004, the city already took 605 km ². Annual urban growth averages 4%. The current development plan envisages a city area of 501 km² of newly developed area that will almost double the size of the city by 2015.

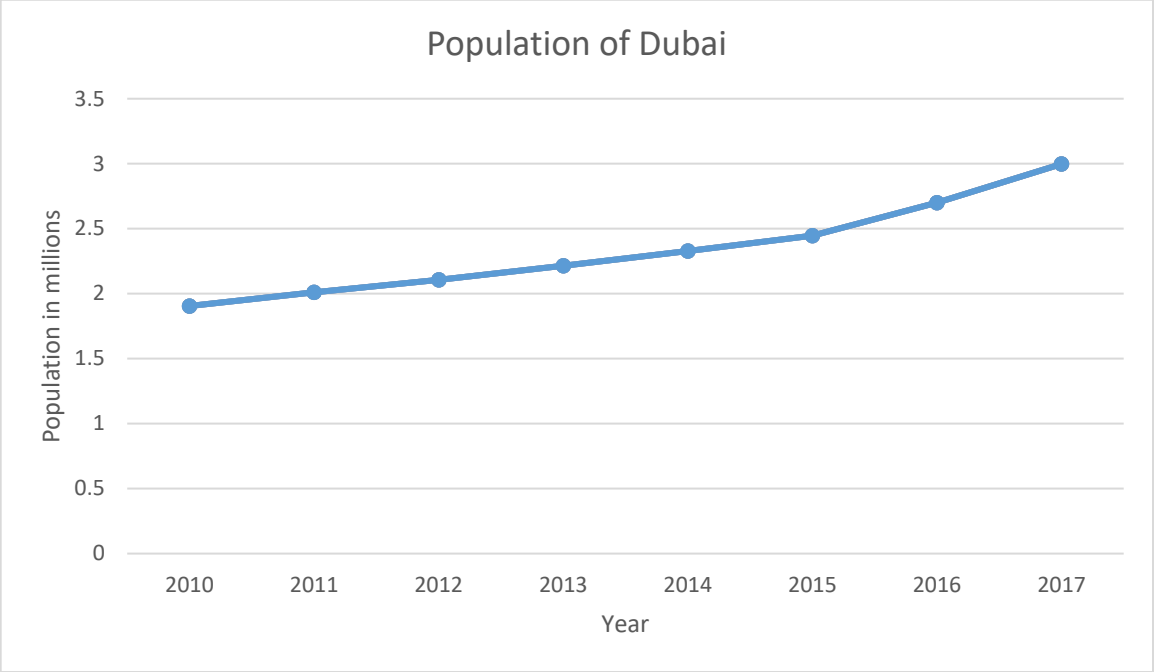

Figure 3.25: Population growth of Dubai in the last decade (adopted from MOCCAE 2017)

In the early 1990s, a new master plan emerged covering development from 1993 to 2012, which concerned the city's physical and economic growth. It was planned in which directions and in what stages new urban areas would be developed in the future and how land use would be distributed. Furthermore, the infrastructure should be further expanded in order to keep pace with growth. The aim of the plan was to create an optimal framework to increase the interests of private investors. Thus, the administration and planning processes of land allocation should be simplified. In addition, efforts were made to create transparency through the plan and to illustrate to investors the future direction of urban development. In order to be able to implement megaprojects, cooperation between state institutions and private sector companies should be further developed and optimized (Pacione, 2005).

To minimize the capital loss caused by the transfer abroad, they tried to convince the expats of an investment in the local market. Due to the multitude of objectives, the development of better management was indispensable. It was important to unite the various interests on a common denominator.

Due to the typology of mainly freestanding single-family homes, the city area grew rapidly, especially along the new axis between Jebel Ali and the city center. As the city grew, the development and expansion of the road network became increasingly important. Dubai is a typical car city, where in recent years less than 5% of the traffic was public. The public transport consisted only of taxis and buses. The heavily loaded Sheikh Zayed Road has been continuously expanded and now has eight tracks. To relieve the important road axis, the parallel running Al Kail Road was built. Furthermore, a ring road was built around the city on Emirates Road, which runs from Abu Dhabi to Sharjah (Pacione, 2005).

Early on, a clear distinction was made between handling the development of new settlements for locals and guest workers. By the policy of land allocation is regulated that every native man over 20 years receives a plot of 1400 m². In addition, locals receive interest-free loans for the purchase of a home. Thus, the procurement of housing for locals is organized and heavily subsidized by the public sector. On the contrary, the procurement of housing for the larger part of the population of guest workers depends solely on private hands. The administration is only responsible for fixing and monitoring which land can be developed as a settlement area. After private investors have acquired the land and the right to cultivate it, the developed living space is leased to the guest workers. Just a few years ago, foreigners can also acquire real estate with restrictions (Pacione, 2005).

This kind of housing policy had many consequences for the physical growth of the city. Since land-use was not provided to households but to individual individuals with land, there was an exponential increase in demand for land. Since locals who had less than 1500 m² of land available, allowed the relocation, there was a disintegration of many abandoned houses within old inner-city neighborhoods. It further accelerated suburbanization and created new suburbs such as Mazhar or Nad Al Hamar on the outskirts of the city. Through the development of neighborhoods close to the city center, such as Har Al Anz or Al Hamriya, attempts were made to counteract the sprawl (Pacione, 2005).

The 1993 General Plan did not provide for state participation in the construction of housing for low paid workers. The main reason was that low-cost housing would be in competition with the private sector. Furthermore, one would be responsible for the administration and repair of public housing projects. To counteract the housing shortage, companies were

encouraged to provide housing for their workers. This is how the workers' settlements developed around Al Quoz and Jebel Ali. The 1993 General Plan did not provide for state participation in the construction of housing for low paid workers. The main reason was that the construction of low-cost housing would put the private sector in competition. Furthermore, one would be responsible for the administration and repair of public housing projects. To counteract the housing shortage, companies were encouraged to provide housing for their workers. This is how the workers' settlements developed around Al Quoz and Jebel Ali (Elsheshtawy, 2009).

In the 80s and 90s, a series of high-rise projects emerged: on the one hand along the Baniyas Road on the north bank of the Creek, where, among other things, the Twin Towers emerged; on the other, along Sheikh Zayed Road, which formed the backbone of the new urban development. Here after the World Trade Center with the Emirates Towers another landmark of the city was created. The two towers have different heights of 355 m and 312 m and are used differently. The Office Tower is a pure office tower and currently the tallest building in the city. The Hotel Tower is a five-star business hotel with over 400 rooms and suites. After four years of construction, both towers were opened in 2000. Since then, they have been a defining element of the high-rise row along Sheikh Zayed Road, where they are slightly offset (Gupte, 2011).

With the completion of the luxury hotel Burj Al Arab, which was completed in 1999, Dubai received another important landmark, which subsequently became the flagship of urban development. At 321 meters, it is higher than the Eiffel Tower. It was built on an island located 280 meters off the mainland near the Jumeirah Beach Resort. In total, more than 4,000 workers were involved in the project for three years. To secure the building statically, the 1.5-meter-thick foundation had to be anchored 45 meters deep into the seabed. 202 two-storey suites with some over 500 m² of living space made the hotel the world's most expensive and well-known. The project was to replace the World Trade Center as Dubai's landmark. The shape of the building is an allusion to a sail that bends to the wind. The architecture can be described as modern and global, even if the Oriental interior is strongly noticeable in the interior design (Elsheshtawy, 2009).

In the aftermath of a series of major architectural and urban projects should change the face of Dubai. The limits of the possible were tested and new ones were shown. Dubai has become a city of superlatives in recent years. In addition to an air-conditioned ski hall, artificial islands were created in the form of a palm tree. And you started building the tallest skyscraper in the world, the Burj Dubai. The architectural style is global, but with a tendency to oriental facelift. So you can often find arabesque ornaments in the facade design. The "Madinat Jumeirah", opened in 2003, was transformed into a huge hotel complex built in a historic architectural style. False wind towers adorn the roofs of the complex, attempting to create a historic atmosphere (Elsheshtawy, 2009).

In contrast to the high investment in the development of the new city extensions, the historical heritage in the city center was rather neglected. In Dubai, hardly any old buildings were preserved. The old structure of the streets is partly still to be found in Deira or Bur Dubai. In contrast, the old clay architecture was almost completely replaced in the 60s and 70s. Only individual buildings, such as palace buildings or parts of the souq are witnesses of the past. The restoration of the old souq in Deira serves mainly tourism, which has gained an important historical attraction (Elsheshtawy, 2009).

- ***Summary of developmental stages***

When in 1833 the clan Al Maktoum left the tribe of the Bani Yas and moved to Burj Dubai, this was still a small fishing village of no importance. Due to the influx, the population grew to 1,500 inhabitants. Until the turn of the century settlement was very simple and one lived in the Bedouin Barasti huts made of clay. Following the usual structural principles of the Islamic city, the Friday Mosque and the Souq were built near the citadel. The city of Dubai had always been divided into two parts by the creek (Helmy, 2008).

In addition to trade and fishing, the population also lived from the lucrative business of pearl diving. By the turn of the century, already had 10 000 inhabitants in the city. The city was divided into three disparate quarters at this time. The Deira district was by far the largest and was on the north side of the Creek shore. Due to the proximity to the port and Sharjah developed there a thriving souq. On the other bank of the creek, there was the small neighborhood of Al Shindagha, where the ruling family lived, and Bur Dubai, where mostly

foreigners settled. The local segregation of the individual population groups proves the Bastakiya district, which was created in the 20s by Persian immigration. The Persian merchant families contributed to the establishment of Dubai as a port and to overcoming the economic problems after the advent of pearl diving (Helmy, 2008).

By the middle of the 20th century, 50,000 people were already living in Dubai. The city area was about 3.2 km ² and was relatively small. The density of buildings was high, almost equal to the density of other Islamic metropolises, such as Cairo. The height of the development was usually two-storey. In the following years, the district of Deira grew to a special extent, as it was the economic asset of the souq. Across the river, the neighborhoods slowly grew and merged. In addition, the urban area extended to the south.

In 1960, the first master plan of Dubai was created by British architects. Although no oil was found in Dubai itself, Dubai as a port city profited from the oil boom in the region. Many bank branches made Dubai an important financial center. In the late 1960s, oil was also found in Dubai, and the emirate began to grow at an unprecedented rate. This particularly affected the population, which in 1968 had only about 59,000 inhabitants (Helmy, 2008).

The year 1971 was landmark in many respects. For one, the Emirate of Dubai became part of the UAE and thereby gained political stability. On the other hand, the international airport was opened and Dubai was globally networked for the first time.

The rapid capital of the oil boom was mainly invested in infrastructure in the 1970s. Two harbors and two industrial areas emerged. In addition, the two districts of Burj Dubai and Deira were connected for the first time with two bridges and a tunnel. Along the Baniyas Road on the north bank of the Creek, the new economic center was built towards the airport (Helmy, 2008).

In the late 1970s, the construction of the World Trade Center initiated an increasing concentration of city growth towards Jebel Ali. As the city was extended to the north by neighboring Sharjah, a new 1970 master plan provided for the construction of a linear center along Sheikh Zayed Road towards Jebel Ali. In the 1980s, the suburbanization of the area known as Jumeirah took its course. Due to the distribution of land to locals and their move from the city center to the new settlement area, the need for new settlement area grew rapidly.

In the 1980s, Dubai benefited from the first Gulf War and became one of the major ports in the region. In 1985 then followed the establishment of the Jebel Ali Free Trade Area at the southwestern end of the urban area. In the following years, hundreds of companies flocked to Dubai to settle there because of the great economic benefits.

Due to the high influx of guest workers, the population of Dubai grew to over 370 000 inhabitants in 1985. Compared to 1970, the population has increased more than sixfold. Accordingly, the urban area grew with the emphasis Jumeirah and the northeastern urban areas. In the mid-1990s, a new master plan for development was adopted by 2012. The population reached meanwhile nearly 700 000 inhabitants. In order to keep up with this pace, infrastructure development was a key planning issue (Helmy, 2008).

At the end of the 20th century, efforts were increasingly made to establish tourism. By striking luxury hotels promised not only tourists, but also a successful city marketing. At the beginning of the millennium, Dubai grew into a city of millions in the shadow of its urban and architectural megaprojects. Dubai has largely freed itself economically from the direct dependence of oil and attracts investors from all over the world as an internationally networked High Tech City, packed in a cosmopolitan shell (Helmy, 2008).

3.2.3 City image and problems

Dubai is considered to Shanghai the largest construction site in the world. This is all the more meaningful, since Shanghai has 10 times as many inhabitants as the small emirate on the Gulf. Dozens of huge-scale investor projects are changing the city day by day. Dubai is most likely comparable to Las Vegas, and the Emir Sheikh Al Maktoum is eager to put the American original in the shade. Only extremely striking projects such as artificial islands, ski halls or the highest skyscraper find favor with the politically responsible. They have set out to establish Dubai as a global city and open the market for investors from all over the world with their liberal policies (Radoine, 2017).

Since the establishment of the free trade zones, Dubai has become a seat of large international companies, thus taking the step towards Global City. A lately growing market

is the real estate business. This in turn is primarily due to the legalization of foreign real estate ownership. The more conspicuous and prestigious the projects of the investors are, the easier it is for new investors to buy the properties for resale. This intermediate trade to the final resident is extremely pronounced in Dubai today. Because of investor-led planning, Dubai is becoming a hodgepodge of limited contiguous neighborhoods based solely on a general master plan. The city in the city is given a new dimension by Dubai. The "Dubai Festival City" or the "International City" are just two examples of future urban structures that will emerge within a vast urban area. To attract attention, the projects break world records or push the limits of the possible. Dubai is well on its way to becoming an oversized Disneyworld. The strong momentum has the connotation of short-term rather than sustainability. Today, the boom is leading to quick profits. But tomorrow, the caravan of investors could move on. The question of security of investment is one of the most urgent and important for future development, due to the unstable political situation in the region (Radoine, 2017).

To counter this, Dubai has probably one of the most succinct City marketing programs worldwide. Every year, millions of visitors confirm the success of the marketing strategy to build Dubai as the region's tourist and leisure center. Since the 90s, people have invested successfully in luxury hotels and theme parks. Apart from sun, sand and sea, tourists from all over the world are attracted by the cheap shopping, the luxury and the extravagance of the surroundings. The golf course or the ski hall in the desert are just two examples of great attractions. This development seems to be in its infancy today.

Figure 3.26: Dubai Festival City - Dubai, United Arab Emirates (Radoine, 2017)

In addition to the magnet for investors and tourists, Dubai is a special attraction for hundreds of thousands of guest workers who earn their living in the Emirate and thus escape the distress of their home countries. Most them are from the Third World, especially from India, Pakistan or the Philippines. Their wages are extremely low, and they have no political rights whatsoever. Especially in the construction sector mainly Indian and Pakistani construction workers are recruited. You work underpaid twelve hours a week, 6.5 days a week. Due to the climate, working conditions are made even more difficult. Labor camps were built on

the outskirts of the city, where six, eight or even twelve workers share a space. This downside of the city is suppressed and separated as much as possible from the image as a tourist center.

Dubai leads in the world ranking as an immigrant city, with a foreign one Population of more than 85%. The guest workers shape the cityscape and leave a cosmopolitan impression. However, this is relativized by the temporary stay of a large part of the population. Only a small part of Dubai feels home. Only a few immigrants live in second or third generation in the emirate. The majority leaves Dubai after just a few years (Radoine, 2017). In addition to the immigrant, tourist and investor city, Dubai is primarily city car. Huge multi-lane city highways and intersections shape the image of the city. The pedestrian is foreign body and highly endangered. In 2006, an average of 19 people died on average each month because of speeding and careless driving. The climatic conditions and the sometimes-long distances between place of residence and workplace made the car with air conditioning the primary means of transportation.

The public space of the city seems to be more of a backdrop. Only in the city center in the winter months something like public city life. The streets are busier, especially because of the guest workers living there, than anywhere else in the city. This exception does not deceive the impression that public life is limited. In the suburbs, which occupy the largest urban area, there are only few public areas. The gated communities exist side by side, and only playgrounds form small public spaces within the compound. There are only a few public parks that are difficult to access due to their location. The most important public areas are air-conditioned shopping malls, which are often combined with amusement parks.

Dubai is a product of globalization, as few cities. International companies benefit from the tax exemption of the free trade zones and from a sea of low paid workers from South Asia. The investor market is flourishing, and the megaprojects are selling well. The company consists primarily of temporary guest workers who do not develop a greater identification with their place of work. Millions of tourists flock to the emirate to shop cheaply and contribute to economic growth. A constant coming and going characterizes the city. That is why it is abstractly comparable to an oversized airport One of Dubai’s problem today is the area of social tension. By Preference and discrimination against certain ethnic groups led to segregation, which has a counterproductive effect on the coexistence of a society. For

example, wages differ between workers of different ethnic backgrounds. In general, guest workers have no political rights and live in the lower service sector like modern slaves. In April 2006, there was a first demonstration of over 2,000 low-paid Indian workers who took to the streets for their rights. The protests for better working conditions gradually lose their peaceful nature and are increasingly violent. The government threatens immediate deportation and takes a hard line against the demonstrators. Since a majority of workers from South Asia are dissatisfied, the social explosive is classified as serious. Large-scale urban sprawl leads to increasingly economic and ecological problems.

Table 3.1: Statistics of Public Transportation in Dubai (Al-Hosani & Salam, 2018)

Total number of users of various modes of transport	**Public Transportation**	**Tram**	**Metro (Green Line)**	**Metro (Red Line)**
2007 | 107,790,218 2014 | 188,840,000 2015 | 140,054,711	2007 | 107,790,218 2014 | 188,840,000 2015 | 140,054,711	2014 | 531,453 2015 | 2,790,388	2012 | 37,576,839 2014 | 60,288,811 2015 | 48,065,761	2010 | 38,887,718 2014 | 104,018,269 2015 | 81,828,334
Total users of water bus	**Total users of ferry**	**Total users of water taxi**	**Total users of Abbra**	
2008 | 407,667 2014 | 526,146 2015 | 332,129	2011 | 26,443 2014 | 97,242 2015 | 70,717	2010 | 4,533 2014 | 23,796 2015 | 20,249	2007 | 27,220,421 2014 | 12,613,216 2015 | 10,250,997	

Energy and water consumption is the highest in the world, as in the entire region. The water requirement is covered mainly by seawater desalination plants. The UAE are the largest producers of desalinated seawater after Saudi Arabia. The seawater is desalted by heating

several times after filtering. The current source of energy for production is natural gas. In the future, the securing of the increasing demand by atomically operated plants is planned (Radoine, 2017).

The high energy waste is also due to the air conditioning and above all by the dependence on the motor vehicle. CO2 emissions in the emirate are correspondingly high. In addition to air pollution, the noise of traffic also reduces the quality of living in the vicinity of busy roads. Another problem is the increasing risk of stowage. At times of rush hour, especially the important central axes, in particular the Sheikh Zayed Road, are almost impassable. Due to the increased urban growth but also the ring roads are more vulnerable in the future. The loss of time has a negative impact on quality of life and economic development. The city can be classified in terms of structure as uneconomical and non-ecological. The strong urban sprawl with its lack of density will continue to cause problems in the future. The enormous consumption of water continues to grow rapidly as new investor projects aim to turn the desert landscape into a garden. The recycling of wastewater is also extremely inadequate and there is a lot of catching up to do in this area. In addition, the new projects in the form of artificial islands along the coast have yet unknowable consequences for the ecosystem. It is clear that there is a risk that there will be insufficient exchange of fresh seawater due to the low water movement within the projects. This in turn would lead to algae and odor. As new territory has been entered, several other unforeseeable problems can be expected (Radoine, 2017).

3.2.4 Future development

The zoning plan for 2012 sees a doubling of the previous ones Settlement area before. The city will extend from the border with the Emirate of Sharjah via Jebel Ali to the southwestern border of Dubai. In addition to this expansion along the coast, the city area will increasingly grow inland. Furthermore, numerous megaprojects of artificial islands and peninsulas are planned, which open up additional settlement areas for the emirate. All these city extensions are planned and implemented by investor groups. Only a general large-scale master plan developed by the city administration in the year 2003 for development until 2012

forms the common basis of the investor projects. The crucial problem is the integration of the individual projects (Radoine, 2017).

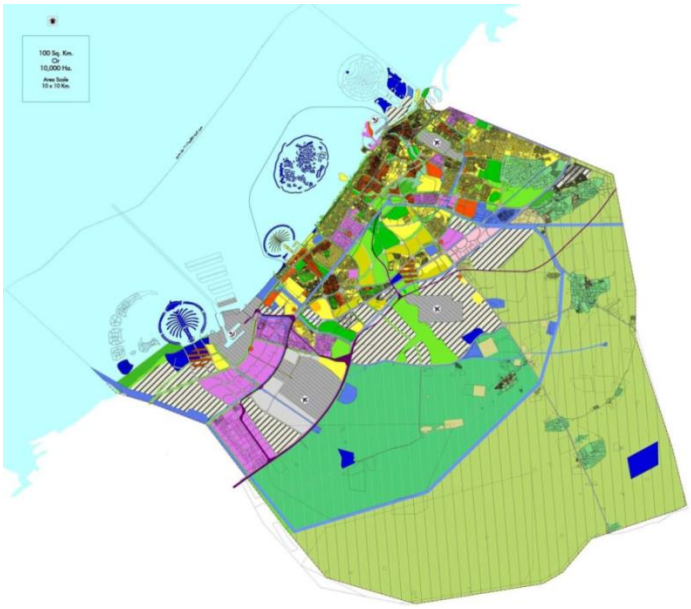

Figure 3.27: Dubai Urban Spatial Structure Plan 2020 and Beyond. Dubai Municipality, Planning Department (Radoine, 2017)

The city's biggest current problem is the concentration of economic assets on a predominantly central axis, Sheikh Zayed Road. This is overloaded by the one-sided orientation and daily due to long traffic jams impassable. Due to the investor projects in the form of small completed sub-centers, hopes in the future, a discharge. Decentralization using the principle of "the city in the city" seems to be the solution currently sought. Dubai's vision of the future resembles a rug of various urban structures that, apart from the context of the common infrastructure, are no longer connected (Radoine, 2017).

Typologically, the new cities will be more different. The higher residential tower typology seems to be promising because the country thereby yields higher returns. In addition, it will be shown whether and, as in other southern metropolises, the luxurious penthouse apartment will replace the villa as a living ideal. In addition to many recreational facilities, it is above all the view, which can certainly convince a walled villa. Nevertheless, in the future, as the project Emirates Hills or the artificial islands prove, larger settlements of luxury villas will emerge. The new modern settlements are designed as garden cities. In

addition to artificial water surfaces and huge green areas, the development structure of older housing estates is also different (Radoine, 2017).

Figure 3.28: Emirates Hills Master Plan **(**http://www.emirateshills.fineandcountry.ae Last Accessed October 2018)

The promotion of an increasing tendency towards public life within the individual projects can generally be observed. As a rule, there is a central zone for pedestrians, where public spaces are created between shops and restaurants. The former model of the isolated villa and the large shopping mall will probably be applied in the future. However, the plans of the new housing estates show a clear desire to create urban qualities within the neighborhoods. The new housing estates function as small towns with their own center. This decentralization of the city promises, above all, a significant relief of traffic. In future, jobs will be created in the immediate vicinity of the housing estates (Wippel et al., 2016).

- ***Infrastructure***

For the future of urban development, a major expansion of the infrastructure is indispensable. The Emirate plans to invest more than $ 6 billion over the next few years in infrastructure projects. Over $500 million will be spent on upgrading the roads. In addition to a 1.5 km tunnel under the airport, the construction of a new 12-lane traffic bridge over the Dubai Creek at the height of the industrial park Ras Al Khor is one of the most striking infrastructure projects. Due to the large congestion problems of the Al Maktoum Bridge, a fourth bridge over the creek is to be built next to it. Major road projects are also the expansion of the eight-lane Sheikh Zayed Road, which will receive a new lane on both sides, and the construction of a new network of roads. This will open up the new settlement areas in the interior and southwest and connect with the rest of the city. Future planning is increasingly focusing on the development of public transport. It has been recognized that only in this way the traffic problem can be solved permanently. That's why most of the $ 6 billion is spent on expanding public infrastructure. The development of the LRT (Light Rail Transit) alone will cost over 4.5 billion US dollars (Barthel &Vignal, 2014).

The new metro line consists of two lines with a total length of over 70 km. The Red Line with a length of 50 km leads from Jebel Ali Port via the free-trade zones DMC and DIC along the Sheikh Zayed Road to the International Airport It has a total of 35 stations. The Green Line with 22 stations is about 20 km long and connects the two banks of the Creek. It leads from the interior to Bur Dubai and crosses the creek at the height of the Shindagha tunnel. About Deira the route continues along the old CBD towards the interior of the country. Both lines run underground in the city center and above ground on an elevated route. Overall, the metro line has a tunnel length of 18 km and a capacity for about 100 trains. Every day about 1.2 million people are to be transported. In 2009, the first section is to be opened. Three years later, the completion of the first metro project is planned. The project is being built by Dubai Rapid Link (DRUL), a Mitsubishi heavy industry consortium. In addition, two other Japanese companies and one Turkish are involved (Barthel &Vignal, 2014).

As part of the metro project, the RTA (Roads and Transport Authority) plans to expand the bus system. In addition to many new bus lines connecting the residential areas with the metro

stations, larger parking garages and parking spaces are to be created near the stops. Furthermore, plans are being made to expand the rail network in the form of a monorail. This will connect the new city extensions such as The Palm Jumeirah and Dubai Land with the main network of the LRT. Another megaproject is the construction of a rail network connecting all the Emirates. The railway project, which is about 700 km long, is intended to bring the interaction of the Emirates on an economic level into a new dimension. In still further future one plans the transport connection of all 6 GCC states (Barthel &Vignal, 2014).

Figure 3.29: Dubai Metro Plan. (https://www.emirates247.com/news/emirates/new-dubai-metro-red-line-station-from-sept-30-new-peak-hour-times-2013-09-22-1.521933Last accessed October 2018)

In addition to the nationwide rail network, the expansion of airport capacity is an important planning goal. With the Jebel Ali Airport, a new modern airport is to be built in the southwest of the city. The construction of the infrastructure of the multi-billion dollar project is scheduled to begin in late 2006. It will become the world's first integrated logistics and transport platform, establishing Dubai as an international hub. Together with the airport, the "Dubai Logistic City" (DLC) is being built. After completion of the first runway in 2007, the operation is already scheduled to start as a cargo airport. At over 25 square kilometers, the DLC will be able to handle over 25 million tons of air freight annually. The ambitious project is to logistically supply the metropolitan area of the Middle East by the year 2050. From 2010, both airports will have a capacity for approximately 190 million passengers per

year. Of this mass, the new Jebel Ali Airport alone will take over 120 million passengers. It will be the largest airport in the world. The project is planned in stages and will be completed in 2050 (Hawker, 2008).

Figure 3.30: Dubai International Airport. (https://www.thenational.ae/business/travel-and-tourism/dubai-international-airport-captured-from-space-1.203913 Last accessed October 2018)

In future, Dubai will be dominated by a number of investor projects. Among the large number of investors, three investment companies are leaders and responsible for the larger urban development projects: Emaar, Nakheel and Dubai Properties.

- ***The Palms***

Figure 3.31: The Palm Jumeirah.
(https://www.timeoutdubai.com/aroundtown/features/77106-whats-happening-on-the-palm-jumeirah Last accessed October 2018)

The most well-known investor projects are the artificial island formations in the Arabian Gulf. Of the three palm projects, The Palm, Jumeirah is nearing completion. The Palm, Jebel Ali is under construction and together with The Palm, Jumeirah is a project of Nakheel. Both islands are predominantly reserved for residential use. There are to be 10 000 residential buildings in the form of detached villas or multi-storey apartment blocks. In addition, a number of leisure and tourism facilities, including 60 luxury hotels, will be built. In total, the two palm projects will add 120 km of coastline to the Emirate. Still in the planning is The Palm, Deira, which will develop on the coast between Creek estuary and Sharjah. In terms of area, it is by far the largest artificial island landscape in the form of a palm tree. The palm shape is an allusion to the date palm that has been around for centuries most important source of food for the Arab Bedouin tribes (Ramos, 2016).

- ***The World***

Figure 3.32: The Palm Jumeirah and the World islands. (https://eoimages.gsfc.nasa.gov/images/imagerecords/42000/42477/ISS022-E-024940_lrg.jpg Last accessed October 2018)

Another form game of artificial islands is the project The World. More than 300 islands between 24 and 84 m² form the world map about 4 km off the coast of Dubai. A total of 326 cubic meters of sand must be moved by dredgers to replicate the globe in an area of nine times seven kilometers. An oval-shaped dam to protect the project from breaking water. In total, the area of the spilled islands covers 9.34 km² and will have an added beach length of over 232 kilometers. Also this project is carried out by the company Nakheel (Ramos, 2016).

- ***Dubai Waterfront***

The last project planned for artificial archipelagos is currently the Dubai Waterfront. In the form of a giant crescent, it forms the southwestern end of the emirate. In total, the project includes 150 settlements both in the countryside and on the six islands, which in turn are linked by bridges. Architect of the mega project is the company GuzonSamton, who designed the master plan. The center of the urban structure bears the name Madinat Al Arab

and is surrounded by water in the heart of the project. The Al Burj is a megahole house planned as a central landmark. With its size dimensions, it is in no way inferior to Burj Dubai, which is already under construction. Like all Waterfront projects, Nakheel is also the main investor and initiator in this case.

Figure 3.33: Dubai waterfront projects (Wilén, 2008)

The new city in the southwest is to become a place of residence for at least half a million people. Together with "The Palm Jebel Ali" there are even over 700 000. In the next 10 years, the infrastructure will be completed and the construction of the building will begin. To speed up the construction, Nakheel intends to give each investor who buys a property just 3.5 years to build. The construction period may not be longer than 6.5 years. These restrictions are intended to prevent speculation and implement the entire project in a limited time frame.

The project will be gradually expanded in the future. An artificial canal is to be dug and, after a huge loop in the interior, close to the Dubai Marina project, flow back into the sea. Generous parks are planned on both banks of the canal. Overall, the project covers a channel length of more than 370 km, which is nine times the sum of all the canals in Venice (Bagaeen, 2007).

- ***Dubai Marina***

A waterfront project that is slowly taking shape is Dubai Marina. The $ 10 billion project will be phased over a period of 20 years. The project is located on the coast in the immediate vicinity of The Palm Jumeirah. The first phase started with the construction of Jumeirah Beach Residence, the center of which is a 3.5 km long artificial canal. Subsequently, a group of high-rise buildings with a total of over 1200 apartments began to be built.

Figure 3.34: Dubai marina (http://www.tanamiproperties.com Last accessed October 2018)

The skyscrapers are equipped with their own intranet and are to point highly technical into the urban future. Further planning is followed by the construction of numerous villas, over 60 commercial buildings and other commercial buildings. The total area covers about 578 hectares and forms a new main center of the city. With its high building density, the project is an attempt to establish new urban structures in Dubai. The high-rise buildings provide plenty of public space for park and leisure facilities. The new city in the city should promote a shift of economic activity areas to the southwest and thus relieve the old centers. Dubai Marina also includes the Dubai Technology and Media Free Zone. The free trade zone includes Dubai Internet City and Dubai Media City. In the future, a training center called

Knowledge Village and various housing projects will be built on their site. Behind the mega-project Dubai Marina stands investor Emaar Properties. In total, more than 100,000 people are expected to live in Dubai Marina in the future (Radoine, 2017).

- ***Jebel Ali Airport City (JAAC) Dubai World Central***

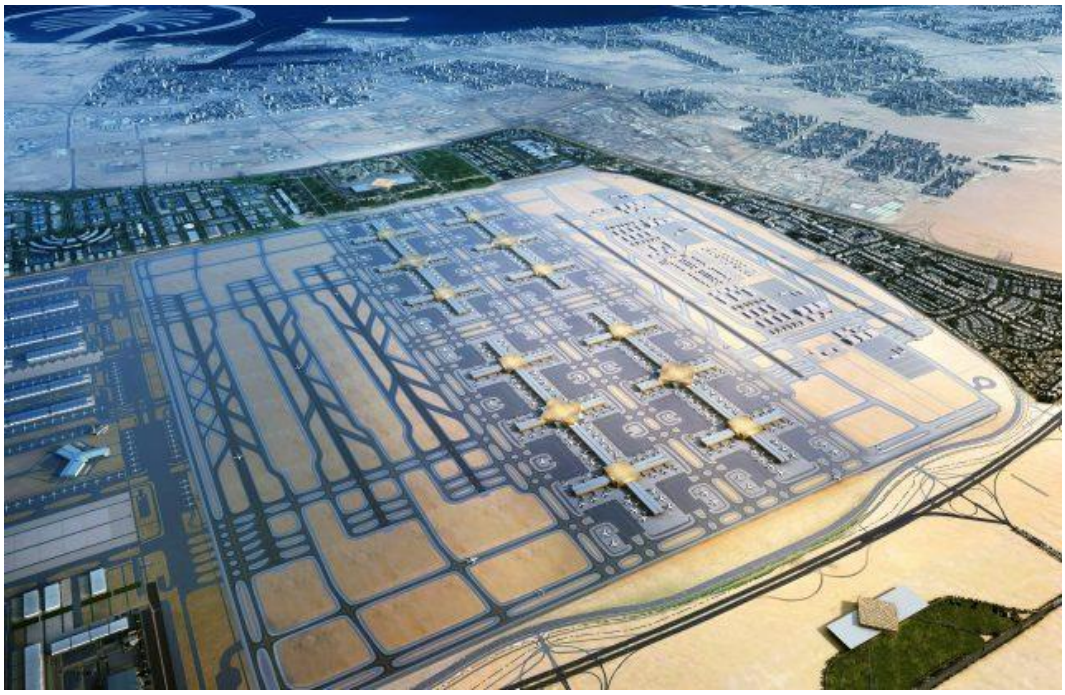

Figure 3.35: Dubai World Central. (Radoine, 2017)

In addition to the world's largest airport project, JAAC includes Jebel Ali Port, Dubai Logistics City, Dubai Aviation City, Dubai Exhibition City and numerous residential and leisure projects. Overall, the JAAC, also known as Dubai World Central, has a surface area of over 140 km² and is one of the Emirati's most ambitious projects. One plans in different stages of development until the year 2050. The infrastructure costs alone are more than 33 billion US dollars. The focus on integrated logistics promises to become one of the world's most important transshipment points (Radoine, 2017).

3.2.5. Planning development

By the year 1971, the protectorate of Britain ended, and Dubai was at the beginning of its unparalleled growth. First, with the Dubai Municipality (DM), the state administration of planning developed. She overseen the planning for decades and developed the master plans. Today it has a diminishing influence. She is responsible for the general infrastructure development and a number of urban development projects, such as the revitalization of the old city center. Important projects are the development of the metro system and the expansion of the road network. The Dubai Municipality is still the supervisor and developer of the general plan, which also concerns environmental protection. The general plan, however, only concerns the framework. This consists mainly of infrastructure planning. The development area is for the most part divided into different zones, the planning of which is taken over by state-owned development companies. The three main companies are Nakheel, Emaar and Dubai Properties (Bagaeen, 2007).

All three are in the hands of members of the tribe Al Maktoum, which has been the legal owner of the undeveloped land since the 1960s. The development companies create the master plans of the restricted zones and divide them into districts. After a topic has been found, international investors become active in carrying out individual construction projects. The companies themselves act as planners and supervisors as investors for a large proportion of the projects. For example, the company Nakheel is responsible for all artificial island projects. Emaar is an investor in the Burj Dubai and develops the entire Downtown Dubai.

The city planners employed by the development companies have to follow certain templates. The shape, the layout and the density must meet the demands of the family Al Maktoum. Above all, what is in demand is the spectacular and world record suspect. The first underwater hotel or ski halls for a Winter Olympics in Dubai are just two examples. A commonality of all planning is the expressive design language, which seems to best meet the taste of Al Maktoum. Often the forms of the palm tree and the crescent are used, as found for example in the waterfront projects of Nakheel. Both the palm and the crescent are typical symbols of the Arabic-Islamic culture. The rational planning is subordinated to this form game (Bagaeen, 2007).

Day and night work on the huge construction sites. It is estimated that about 25% of the world's 125,000 tower cranes are used in Dubai. The construction boom will continue in the next few years. With an expected doubling of the population by 2011, the construction of new housing is the prime objective. But even the Emir Sheikh Mohammed Al Maktoum recently demanded a breathing space in the development of new projects. Much of the planning is too hasty in his view. Due to the speed of development there is too little integration of the individual projects (Bagaeen, 2007).

One of the reasons for the current boom in the real estate industry is the clarification of the law in April 2006 concerning the right of real estate acquisition by foreigners. The legislative process has dragged on for years, because the acquisition of real estate also has a civic status. However, land acquisition by foreigners is still not possible. With the purchase of a property, the buyer receives a lease on the property for 99 years. The rights of landowners are based on a combination of European laws and Islamic jurisprudence, the so-called Sharia law. In the eyes of Western investors, this is not in line with international law and proves to be an obstacle to real estate development.

Another problem is unpredictable turning points in the planning. Thus, just two years after the development of the "Emirate Hills" residential project, the RTA decided to lay two multi-lane parallel roads through the "green paradise" marketed project. Despite complaints from the buyers, the project was enforced. This example also illustrates the limited cooperation and coordination of the various planning bodies (Bagaeen, 2007).

The many vacant lots and abrupt demolitions of new settlement areas testify to the special nature of the planning. Real master plans exist only within the mega-projects. At their borders, where either another investor group or the Dubai Municipality takes over, there is often a break within the development. Typologies do not converge, and often it's just larger brownfields whose development has not started. The general plan hardly coordinates the individual projects, and so creates a carpet of urban structures, which are put together by chance rather than planned. In addition, different corners of the city are being developed simultaneously. The main basic problem is the lack of coordination between the lobby responsible for the infrastructure and those who have taken over the remaining development of the zones. Even building laws such as the support for installing thermal insulation are not

uniformly applied. So the big investors like Nakheel or Emaar have the right to circumvent them (Bagaeen, 2007).

The current planning seems not to be able to treat all problems adequately, especially because of the pressure of speed. Especially the question of sustainability remains unanswered in most cases. Environmental protection is still ignored. The existing regulations concern, for example, road construction, but not new ecological construction methods. In general, many building laws are bypassed, as there are many exceptions.

By international standards, Dubai's planning management is considered centralized. But most of the planning is done by investors. The big development companies are the actual planners of the city. They are considered private but are under the control of the emir, who usually gives them plenty of room. They are the ones who define urban heights and typologies and finally divide the areas into lots for sale to investors. The main problem with this development is the lack of coordination, which in turn is mainly due to the speed of the projects. There has been a race between the investor groups, which has a negative impact on a harmonious cityscape. While the highest tower is being built at one corner, a higher tower is already being planned elsewhere. It remains unclear whether investors will continue to be involved in all spectacular plans (Bagaeen, 2007).

3.2.6. Summary

Due to its geographical location, Dubai developed into an important part of the region at the beginning of the 20th century. For a long time, besides the port and its settlement, the Emirate consisted almost entirely of desert. The 70s oil boom gave Dubai the opportunity to build a modern infrastructure. This big investment was one of the keys to later development. The economic rise is not only due to oil, but also due to the political prudence of the Emir Al Maktoum, who had early expand Dubai as a huge hub. This was confirmed again in the 1980s, when free trade zones were set up and hundreds of companies settled in Dubai. From now on, business has become the big engine of the economy. In the 90s, tourism was recognized as an important economic factor. As a result, Dubai established itself as a leisure center of the region, especially from the Gulf States, millions of guests visited the shopping

paradise Dubai. After the turn of the millennium, the real estate market for foreigners was opened, and a huge construction boom began.

The emirate was built from the beginning by foreign guest workers. In the 1990s, the majority ratio tipped and guest workers formed the majority of the population. Today it is about 85% with an upward trend. Most of them are from South Asia and work in the service sector. By contrast, the indigenous population works predominantly in the public sector and is strongly favored by the state. Since the 60s, all undeveloped land belongs to the ruler. At the same time a land allocation policy was introduced, which granted each native man from a certain age a vacant property. Even costs such as electricity and water were subsidized by the state.

Three main factors decisively shaped the city structure. The economic potential, the planning management of the political leadership and finally the population explosion due to the influx of millions.

The economic potential made it possible to make the desert habitable on a large scale with the help of modern infrastructure and to bear the large repair costs. In order to build the city in the desert, planning experts were needed alongside thousands of workers. These in turn came in the case of Dubai mainly from Great Britain, which was a longtime protectorate power. The time of the 60s and 70s was marked in Europe by planners like C. Buchanan. They pursued the idea to open the city to individual traffic and functionally allocate land uses. In Dubai, based on this planning idea, arose Traffic network of higher-level streets, which divided the growing city into zones.

The process of suburbanization has been promoted more strongly through the land allocation policy. Another factor in the city's rapid expansion was the typology of the two-story villa. This is due to politics and culture. Homes were foreign to the indigenous people living in large families, and politically they wanted to win them over. By proceeding to parcel out newly developed areas into uniform sizes and then either to sell them to locals or to sell them to the private sector, a standardization of planning emerged. This corresponded to the requirements of that time and could be carried out quickly.

The development of the inner city was thickened by the construction of high apartment buildings, where mostly guest workers lived. Most of the native population left the center and moved to the suburbs. Due to the expanding city area and the increasing building density, the center was no longer sufficient for traffic engineering reasons as a CBD. The result was a new linear CBD with a striking high-rise typology, along the main growth axis to the southwest. The sparsely populated sprawling suburbs, dense inner city and linear CBD are the three main elements of Dubai, which has almost completely surmounted its historical roots.

The main problem of the city is the high degree of sprawl, which a variety of Resulting in follow-up problems. The focus on the car and the one-sided division of land use led to an overload of the road system. This, in turn, has environmental and economic problems that adversely affect quality of life. Furthermore, a sprawl in the desert leads to increased energy and water consumption. Water consumption is in the case of Dubai energy consumption, since the water demand is covered by desalinated sea water. The city does not fulfill the requirements of sustainability in any way today.

The previous city structure threatened to slow down economic growth. Today, Dubai is undergoing a process of transformation into a city that consists of a multitude of "cities in the city". The planning and execution of these new "cities" are taken over by investor groups. Only a general plan serves as a basis. The infrastructure is still largely planned by state institutions and pursues the new goal of expanding public transport. A 70 km long metro system should help to solve the traffic problems. Three investment companies take over most of the development of the rest of the city. They are all subordinate to the ruler Al Maktoum, who will continue to shape the face of Dubai in the future.

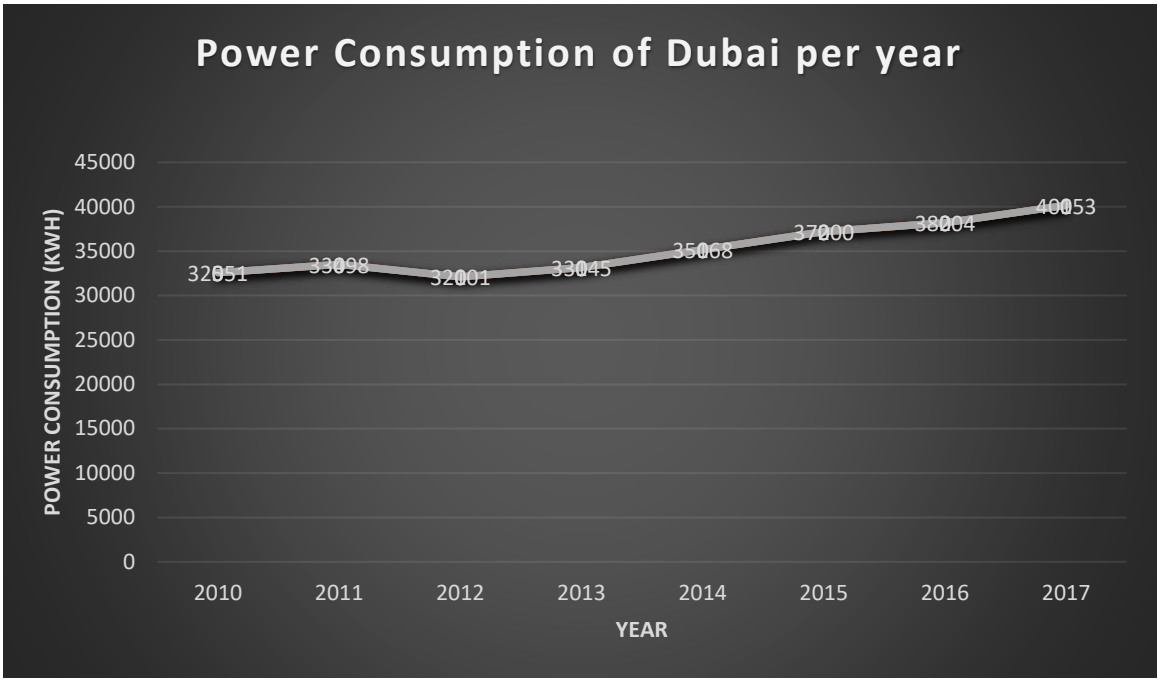

Figure 3.36: Showing the power consumption of Dubai per year (MOCCAE, 2017)

The future of the emirate depends above all on whether economic growth will continue and whether a society will emerge that lives and works for the most part in Dubai.

CHAPTER 4
COMPARISON OF RIYADH AND DUBAI

4.1 Riyadh and Dubai for Oasis Development

A large majority of individuals are have picked certain interest in a greener, eco-friendly and sustainable citiy development worldwide. The ultimate goal is to create a sustainable, evergreen architectural building condition that supports carbon neutrality, great life cycle and economical building materials. Cities such as Masdar City in Abu Dhabi, the capital city of United Arab Emirates (UAE) have begun advancement of full technological advancement towards the building of an oasis sustainable city. Other cities such as Riyadh and Dubai still in the UAE are following the trend. The dimensions and indicators of the sustainable building requires a focus on both the economic and social view to sustain oasis development.

The Saudi capital, Riyadh, has little in common with the small emirate Dubai. While Riyadh is as of now, relatively unknown in the West, Dubai is fast gaining worldwide recognition. A systematic comparison of the common elements of both cities will help to define the general city type of the Oil City. For this comparison, the Local Agenda 21 general framework is used in comparing the two cities. Since the Local Agenda 21 focuses on the application of the global action plan on sustainable development to local districts, it therefore provides a framework that measures sustainability as close to the people as possible.

Since the use of public transport and environmental friendly transport systems was long ignored, both cities have problems to regulate the traffic; the development of ring roads could not solve the traffic problems permanently, because the traffic congestion increased with increasing urban growth. In addition to the economic problem of loss of time, the living conditions in the cities are also worsening. Furthermore, there are a number of traffic-related ecological problems. Both cities are considered highly uneconomical. Expensive seawater desalination, high gas mileage and the necessary air conditioning systems contribute to the fact that both cities outperform North American cities in terms of energy consumption.

The evaluation for a proper oasis developmental building construction therefore is focused on the reviewed literature from the author to understand the implicit requirement of a sustainable oasis city transformation. The highlighted sub category of the dimensions, indicators are thus vividly outline to support a greener oasis development.

4.1.1 Environmental dimension

- ***Air Quality:*** Due to the low public transport coverage, widespread use of private cars and unavailability of green transports in Riyadh, there is a high amount of particulate matter in the air. A relatively high dependence on the use of private automobiles (cars) is one of the major sources of air pollution through the release of CO2 and other greenhouse gases into the atmosphere. The presence of dust particles in the air has been reduced through sustainable architectural designs and landscaping, yet the use of automobiles has been responsible for particulate presence in the air. Due to the low public transport coverage, widespread use of private cars and unavailability of green transports in Riyadh, there is high amount of particulate matters in the air. Dubai on the other hand has vested high resources in mitigating the release of particulate matters into the atmosphere through the introduction of hybrid and electric cars, and efficient public transport. The city is constantly running environmental impact assessments of its economic projects to monitor its performances environmentally.

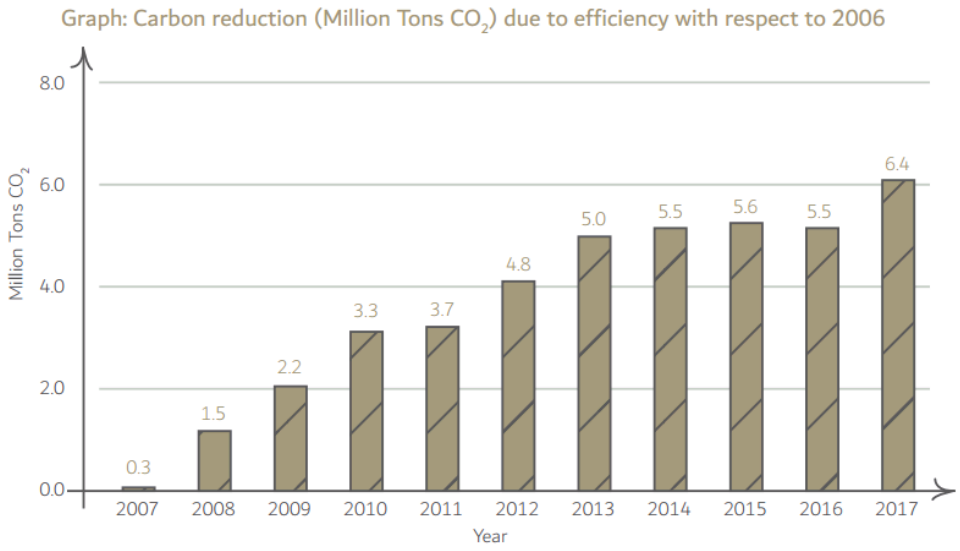

Figure 4.1: Carbon presence in Dubai Atmosphere (DEWA, 2017)

- ***Energy Efficiency:*** Energy efficiency in recent times is discussed in the premises of renewable, conservative energy that has been described as eco-friendly with no emission, radioactive or particulate pollution of any sort. Riyadh in terms of

environmental sustainability is adjudged slow and largely ineffective, due to the absence of green energy services and renewable energy technology in the city. Meanwhile, the explosive population growth has led to higher consumption of fossil fuel and waste production (UN-HABITAT 2016). Dubai on the other hand has initiated several green energy initiatives to reduce the reliance on fossil fuel consumption. Dubai encourages and improves on its green housing not just to reduce reliance on fossil energy consumption but to also make a housing unit an energy generating unit. Solar energy initiatives are very common in Dubai such as the Al Khazzan solar-powered park, Mohammed bin Rashid Solar Park and Shams Dubai initiative for distributing rooftop solar energy (MOCCAE, 2017).

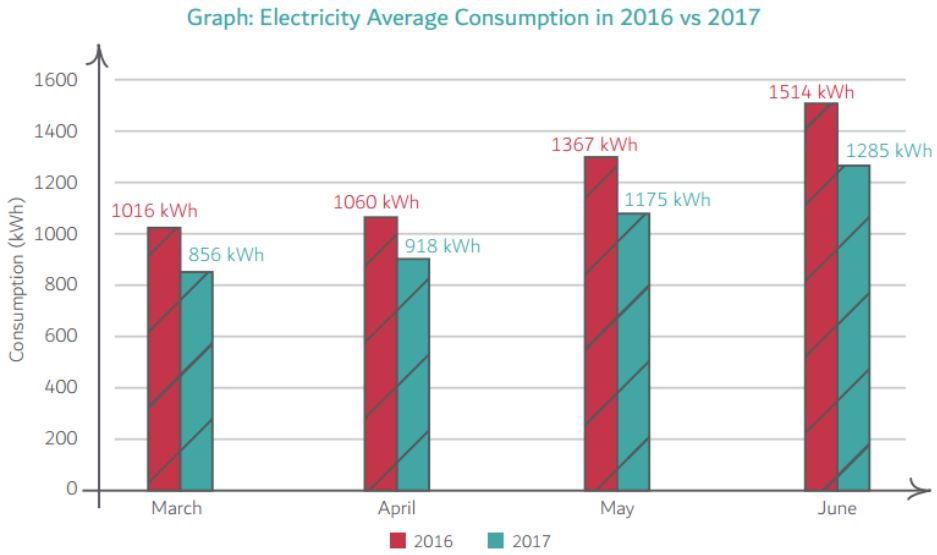

Figure 4.2: Two years comparison of Dubai Electricity consumption (DEWA 2017)

- ***Green Spaces:***The availability of land spaces for habitation and agricultural cultivation is also a subject for comparison. While in Riyadh approximately 4.3 million inhabitants live on 1600 km², there are about 1.5 million on more than 600 km² in Dubai. Both cities thus have a similar relationship between population and settlement area. The spread of Riyadh is extensive and extends in almost all directions. Only the Wadi in the west and the industrial area in the southeast limit growth. The most important growth axes are the north, as the master plan envisaged, and the east, where the connection to the Arabian Gulf runs.

Table 4.1: Riyadh Land Use details (UN-HABITAT, 2016)

The main use	Area km²	Percentage%
Residential	256.4	8.23%
Commercial & Business Services	43.2	1.39%
Industrial	25	0.80%
Warehouses	48.8	1.57%
Health	6.9	0.22%
Education	30.9	0.99%
Cultural	1.5	0.05%
Recreation and parks	46.9	1.51%
Agricultural, mining	64.42	2.07%
Transport services	19.8	0.64%
Communications and utilities	17	0.55%
Government	60.7	1.95%
Other uses	27.4	0.88%
Roads	471	15.12%
Vacant land	1995	64.04%
Total	3114.92	100.00%

In Dubai, the sea limits the spread of the city. But even here the city grows in the form of artificial peninsulas and islands. Main growth axis is still southwest along the coast. Increasingly, the city is also expanding towards the interior of the country. Both cities have the development system of a typical car city. Multi-lane city highways form the first order of a hierarchical road system. In Riyadh the superordinate street grid is characterized by the 2x 2 km "Supergrid" of Doxiadis. In both cities, linear multi-lane axes connect the city center with the suburbs. To relieve these, a ring of city highways was laid around the central city area (Al-Hathloul, 2017).

Figure 4.3: A solar Park in Dubai (DEWA 2017)

- ***Mobility:*** Commuting is given high priority in Riyadh. The roadways in Riyadh are in very good conditions with excellent street interconnectivity. There is however a heavy reliance on private cars and very low public transport. The street intersection also encourages walking and bicycling around the city. Dubai is particularly interested in green energy and as such has public muster points for electric cars recharge. The Dubai Road Transport Authority (RTA) is therefore testing future driverless smart cars. Based on Dubai's the Green Agenda Initiative, a Car-Free Day has been declared to encourage other means of mobility apart from cars usage (MOCCAE, 2017).

Figure 4.4: Picture of an electric cars recharge station (DEWA 2017)

- ***Waste Management:*** Municipal waste is adequately managed in Riyadh. The city's 2016 CPI profile shows that there is total collection of municipal wastes. This means that there is zero environmental pollution from municipal wastes sources. However, just 30% of the solid wastes collected make it to the recycling level while about 62% of waste water is being recycled. This shows that there is still large room for improvement in Riyadh's waste management approach. In Dubai, 25% of the waste generated is from municipal source while more than 66% of the waste is generated from demolition and construction. Dubai however, has an integrated waste management scheme that helps to ensure that waste generated is effectively management. Some of the waste management efforts include vehicle tracking

system, door-to-door waste collection, underground waste compactors, and solar powered waste containers. This efforts reveal that waste management is of topmost priority in Dubai (MOCCAE, 2017).

Table 4.2: Environmental Sub dimension indicators (UN-HABITAT, 2016)

Sub-Dimension	Indicator	Actual	Units	Standardized	Comments
Water and Energy (0%)	Share of renewable energy consumption	0.00	ug/m3	0.00	V. Weak
Waste Management (64%)	Solid Waste Collection	100.00	%	100.00	V. Strong
	Solid waste recycling share	15.00	%	30.00	V. Weak
	Waste water treatment	62.00	%	62.00	M. Strong

- ***Water Quality:*** Although desalination is far more costly that other natural sources, water has been used in unsustainable pattern in Riyadh until the intervention of the Saline Water Conversion Corporation (Choguill 2008). The oasis city could however not rely on water from such conventional sources again due to over-exploitation and increasing water need brought about by population growth. The cost of desalination however is so high that it seems unsustainable. There is also heavy desalination going on in Dubai due to the closeness to coastal regions. The Dubai Electricity and Water Authority (DEWA) are working conscientiously to provide quality portable water for the Dubai residents, UAE and the world at large. There are also several studies into managing the coastlines and ensuring sustainability (MOCCAE, 2017).

4.1.2 Social dimension

- ***Health:*** Due to the neighborliness of Riyadh, health services provided within short distances to the resident of Riyadh. The quality of health services is also high yielding a high life expectancy index.

Table 4.3: Social Sub-dimensions indicators analysis (UN-HABITAT, 2016)

Sub-Dimension	Indicator	Actual	Units	Standardized	Comments
Health (82.8%)	Life Expectancy at Birth	72.30	years	67.6%	M. Strong
	Eradicate Maternal Mortality	-	#/100,000 live births	-	-
	Eradicate Under-5 Mortality	-	#/1000 live births	-	-
	Vaccination Coverage	98.00	%	98.0%	Very Strong
Education (48.0%)	Early Childhood Education	13.00	%	13.0%	V. Weak
	Net Enrolment in Higher Education	33.99	%	34.0%	Weak
	Literacy Rate	93.38	%	92.3%	V. Strong
	Mean Years of Schooling	7.20	%	51.4%	M. Weak
Safety and Security (92.6%)	Homicide Rate	3.01	#/100,000 inhab.	85.1%	V. Strong
	Theft Rate	14.92	#/100,000 inhab.	100.0%	V. Strong
Public Space (51.7%)	Green Area per Capita	12.25	m2 / inhabitant	81.6%	V. Strong
	Accessibility to Open Public Space	21.81	%	21.8%	V. Weak

- ***Education:*** Riyadh has very low education coverage although literacy rate is rising. Higher education enrolment rate is higher than primary education enrollment. This low education coverage is responsible for the very high rate of guest workers within Riyadh.

- ***Sanitation:*** Due to the desert climate in Riyadh, considerable effort is committed into sewage infrastructure and waste water treatment. Although, there seems to be some gap in the sanitation services, as some houses lack access to sewerage facilities (UN-HABITAT 2016).

- ***Compact City:*** The Doxiadis master plan of 1971 determined the shape of the city structure. In the 70s and 80s, Riyadh expanded the strongest. Even today, the growth rate averages 8%. Since the founding of the state Riyadh has grown from an oasis city of about 2 km² to a city of more than 1600 km² (Al-Hathloul, 2017).

  In Dubai, big city growth started more than a decade ago. In the 1970s, they built a modern infrastructure and developed the industry. The master plan came from British planners. The most important growth direction was along the coast in Jumeirah. At the same time, the city grew to the borders of neighboring neighbor Sharjah and expanded towards the interior of the country. While the city in the mid-20th century only about 3.2 km² in size, it now covers a city area of more than 600 km². Both cities had comparable sizes before the mid-20th century, and due to the larger and earlier

oil boom, Riyadh grew more than twice as fast. In addition, many locals from all parts of the country moved to the capital and contributed early to the fact that Riyadh exceeded the million mark. Dubai's development began 10 to 20 years offset and one had no larger hinterland, which increased the population pressure in addition (Al-Hathloul, 2017). The inner cities remained the main economic center. In the third phase, linear CBD developed along the main growth direction. While downtown Riyadh lost importance as a result, the center in Dubai was able to retain important functions due to its location on the creek and the existing waterfront (Bagaeen, 2007).

- ***Housing**:* Typologically, both cities differ in only a few points. In the suburbs, which occupy most of the settlement area, the two-story villa with walling is the dominant typology. In the city center, the development is denser and consists of block buildings with mixed use. In the case of Dubai, an average of 5 to 10 storey higher than the development in Riyadh. While there are still old historical structures in the center of Riyadh, in the case of Dubai only parts of the Souq are preserved. The development of the center is also much more heterogeneous in Riyadh than in Dubai. In addition to two-storey housing development, there is multi-storey block development. In contrast to Dubai, in Riyadh a large part of the city center, especially in the south, consists of very dense two-storey residential buildings. This is where the lowest income bracket lives.

Table 4.4: Details of Riyadh Social development (UN-HABITAT, 2016)

Sub-Dimension	Indicator	Actual	Units	Standardized	Comments
Housing Infrastructure (85.1%)	Access to Electricity	99.93	%	99.9%	V. Strong
	Access to Improved Sanitation	86.21	%	83.8%	V. Weak
	Access to Improved Water	96.74	%	93.5%	V. Strong
	Access to Improved Shelter	97.58	%	100.0%	V. Strong
	Population Density	5,017	Inhab/Km2	33.4%	V. Weak
	Sufficient Living Area	98.98	%	100.0%	Strong
Social Infrastructure (28.0%)	Number of Public Libraries	0.03	#/100,000 inhab.	0.0%	V. Weak
	Physician Density	2.56	#/1,000 inhab.	56.0%	M. Weak
ICT (68.4%)	Average Broadband Speed	11.12	Mbps	47.9%	Weak
	Home Computer Access	73.00	%	73.0%	Strong
	Internet Access	84.47	%	84.5%	V. Strong
Urban Mobility (58.2%)	Average Daily Travel Time	23.00	minutes	100.0%	V. Weak
	Affordability of Transport	0.58	%	100.0%	V. Strong
	Length of Mass Transport Network	0.00	Km/1M Inhab.	0.0%	V. Weak
	Road Safety (traffic fatalities)	3.73	#/100,000 inhab.	90.9%	V. Strong
	Use of Public Transport	3.00	%	0.0%	V. Weak
Street Connectivity (82.5%)	Intersection Density	109.60	#/km2	100.0%	V. Strong
	Land Allocated to Streets	27.87	%	72.9%	Strong
	Street Density	15.21	Km/KM2	76.1%	Strong

In both cities, the city center is densely built and used mixed. In Riyadh, the industrial area is located in a designated area on the outskirts. In the case of Dubai, industrial areas were created mainly near the port of Jebel Ali and in the vicinity of the airport. The CBD of the cities developed along linear axes, which connect the inner cities with the new settlements and grew with the dynamic expansion of the cities. Within each residential district, both in Riyadh and in Dubai, there is a nucleus where, in addition to shops, there are also schools, mosques or kindergartens. Most of the built-up area in the suburbs consists of low residential development. Guest workers of the lower service sector live in the center or in its immediate surroundings in both cities. In the case of Riyadh, there is a rich north and a poor south. In Dubai, many guest workers live in mass housing on the outskirts or in the vicinity of industrial areas or free trade zones. There are relatively few public spaces in both cities. In addition to parks, especially the restored historical center with Souq, mosque and old ruler's seat is important public area. In Dubai, there are a variety of theme parks due to tourism, but these are usually used commercially (Al-Hathloul, 2017).

In Dubai, low-wage workers live in proprietary block buildings within the center and outside the outskirts. Skyscrapers and shopping malls were built in both cities on the

central axes of the CBD. While there are only two skyscrapers in Riyadh, Dubai has whole skyscraper agglomerations that form either a waterfront or the CBD. Riad is generally flatter and far less conspicuous in architecture. The architecture is global in both cases, but often provided with oriental face-lifting. Striking in both cities are projects that incorporate elements of the historic architectural style and convert them into modern construction methods (Ragette, 2003).

- ***Quality Public Space:*** Riyadh is repellent and characterless due to the lack of public spaces. The City of cars dominates and hardly allows any urban quality. The introversion prevails and the space between place of residence and place of work is dominated by multi-lane roads. This image can be found in a modified form in Dubai, but due to its location on the sea has other qualities. The historic center on the Creek and the beaches along the coast give Dubai striking cityscapes. In both cities, the car is the only recognized means of transportation. The pedestrian is considered a foreign body. The most important social space is the air conditioned shopping mall, which is often connected to a theme park.

  Dubai is investing in global city marketing to attract tourists and investors. Unlike Riyadh, Dubai is considered open and liberal. The new construction boom transforms the small emirate into a city of architectural world records. Dubai has become a figurehead for the economic emergence of the region. Despite its huge dimensions, Riyadh is unlikely to attract attention like Dubai. The economic direction is too one-sided and too unstable is the political situation for investors. Riyadh never sought international attention and did not become a tourist destination, mainly due to the dominant role of Wahhabism (Radoine, 2017).

4.1.3 Analysis of Riyadh and Dubai for oasis development

Following the understanding of several authors point of view with regarding a sustainable oasis developmental building, the author analyzed the several strengths, weakness, opportunities, weakness, and threats (SWOT) of the analyzed cities for a proper development in to an oasis developmental structure. Riyadh and Dubai may be looking like blooming cities at the moment and they could be moving at quite a fast pace too. The city married to the Thames remains truly prospective global sustainable city. The two cities are compared using SWOT Analysis. The SWOT analysis is used to understand the points on the environmental and social indicators for the potentiality of creating oasis-based city development. The oasis developmental structure should enable several highlighted factors which include but not limited to;

- Zero waste targetw
- Life cycle Impacts
- Advance green technologies
- Alternative green energy
- Reduce
- Reuse
- Recycle
- Waste to energy implementation

Table 4.5 SWOT Analysis of Dubai and Riyadh for Oasis development (Author, 2019)

CITIES	INDICATORS	STRENGTH	WEAKNESS	OPPORTUNITIES	THREATS	REMARKS
RIYADH	Environmental	Green Spaces	Reduced smart structures Reduced smart transport Less cycling Low public transport and high fossil burning Less solar structures and inefficient use of renewable energy	Expansion possibility Increased smart transport Hybrid usages Better transport Conducive environment for economic development	Congestion Difficulty accepting hybrids Green space limitation Poor breathable air Rapidly growing population not met by investment at same pace Fossil burning and high environmental degradation	Aligning the weaknesses of Riyadh as a city while juxtaposing with the strengths and opportunities of the city, Riyadh stands to improve infrastructurally, by adopting the sustainable development strategy to bolster economy and improve the overall livelihood of the people
	Social	High economic growth High Literacy rate Good healthcare services High political stability and security.	Reduced smart structures Reduced smart transport Less cycling Low public transport Less solar structures and inefficient use of renewable energy High expenses incurred on desalination of water	Expansion possibility Increased smart transport Hybrid usages Better transport Good street interconnectivity	High economic impact effect of spending on desalination Difficulty accepting hybrids Rapidly growing population not met by investment at same pace	
DUBAI	Environmental	Smart transportation Hybrid cars Green spaces	Congestion Expansion	Solar Energy Healthy population through eco-friendly initiatives	Pollution Visibility Congestion Scarce water resources	Dubai can continue on the principles of clean, efficient energy through good governance and foster ways to address the pollution and scarce water issues of her people
	Social	High Investment capital Political stability and security	Limited local market expertise.	Increased pedestrians High ICT potential Industrialization due to high energy and power efficiency for production	Compactness leading to high crime rates Sustained level of Political instability and insecurity in the Middle East.	

The prospect of the other cities is high; the funds are still available, and the investments have not ceased. They are top tourist destinations and they are only liable to keep up with expansion and aesthetics. The global acceptance is also a limiting factor for these other two cities to become more sustainable in terms of design and structure establishment. Tourists and businesses alike expect a smart city, and only that can be got in a sustainable urban city.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Human settlements in an arid desert region that provide food and constant life cycle is termed Oasis. It houses variety of plants and animal rearing ranging from barley, millet, wheat, apricots, dates, figs, olives allowing occupying farmers the opportunity of increasing vegetation. Oasis development further changes the landscape of the arid region affecting architectural and spatial characteristics of the city. The study further identified the effect of oasis urban development in two cities Riyadh and Dubai with focus on sustainability factors. To achieve this aim, understanding the sustainability index, landscape of the oasis development in the two cities was compared with cities of high sustainability index.

The opening chapter of the thesis explorers the problem of the thesis, significance of research, the limitations involved and lastly the methods of approach towards the analysis of the research. Literature reviews on sustainable urban development with regards oasis in a growing city was explored in the second chapter of the thesis where the smart development of a city with key sustainable indicators of the Arabian Peninsula were highlighted in details. The research revealed several factors responsible for the natural oasis city development in the region, these includes; the economy of the city, temperature and environmental factors of the city, and design of the city which in turn forms a developmental urban structure of the city. According to the sustainable cities international's indicators, the key comparison factors involve include can be summarized as Economy, Social and Environment with key indicators such as smart growth, jobs, health, space distribution, energy efficiency, waste production, air quality amongst others.

The analysis of the case study cites were evaluated and strategically compared in chapter three of the research. The chapter opens with the introduction of the cities, geographical comparison, city space analysis according to the map. The problem of research in each city such as transportation, open space distribution, landscape development which were fully analyzed and identified as prosperous cities according to the City Prosperity Index and as a result of economic boom that accompanied the exploration of oil. The prosperity of the two cities has therefore driven social and environmental activities that have huge anthropogenic

impacts on the ecosystem. However, having critically analyzed the development of both cities into metropolis from a sustainability point of view reveals that Riyadh and Dubai are both gradually undergoing the urban developmental transition in to a modern green sustainable city as a result of oasis development. While both cities have failed in some aspects to effectively manage their natural resources, Dubai has shown a higher potential of being a fully sustainable city and a smart city in the near future than Riyadh. Therefore, the growth rate would differ for both cities though the Saudi capital Riyadh and the small emirate Dubai have shown potential for development into big metropolis.

According to the SWOT analysis carried out in the research, the environmental sustainability of Riyadh due to its high usage of fossil fuels and poor sanitation efforts. The research further revealed that Riyadh is highly socially sustainable, it however needs to consider green alternatives to sustainably manage its economic and environmental developments hence the urbanization of Riyadh falls largely on social factors. Dubai on the other hand has taken full responsibility for the non-renewable nature of oil. The government of Dubai has taken efficient effort in diversifying the economy and drawing out course of actions for environmental sustainability. While the city has huge dependence on natural gas derived energy, it has also initiated several green alternatives to cut the down the per capita non-renewable energy consumption. From research, Dubai has its fast urbanization growing into a big metropolis owing to this increasing attention to environmental development as Dubai is analyzed to be environmentally sustainable due to their smart transportation, green spaces, and hybrid cars while it is socially unsustainable due to poor housing condition, lack of expansion and limited local market.

In addition, the chapter four of the thesis compared the two cities for Oasis development of the city. Environmental dimension shows that the air quality in both cities is low as a result of reduced public transport coverage. In both cities, air quality is reduced by pollution emission of carbon dioxide and other greenhouse gasses in to the atmosphere mostly initialed by private cars. The energy efficiency describes the eco-friendly nature of the environment. Riyadh slowly adjusted to the environmental sustainability over time while Dubai initialed its green energy usage earlier. Such examples include fossil energy, usage of solar energy etc.

5.2 Critical Evaluation

Both cities have an area of undeveloped desert areas and were therefore able to spread almost without restriction.. The land allocation policy was characterized by a distribution of large areas of land to the local population in order to counteract the acute housing shortage. In addition, this type of distribution of wealth was expected to win over the population and prevent attempts to overthrow it. Due to the rapid growth, the planning was standardized. The land was divided into equal parcels and cultivated with a uniform typology. The type of the maximum two-storied villa with walling became in both cities the successors of the traditional yard house. This type of building was an import and did not meet cultural needs. The Islamic tradition prevented a greater mix of typologies of different sizes, since looking into the neighboring property would have disturbed the sensitive privacy.

The land allocation policy and typology led to a rapid expansion of the suburbs. The petrodollars covered the higher costs of infrastructure and rising energy consumption. Due to the high population growth, the land take of both cities was correspondingly high. In both cities, the wealthy population left the city center and settled in the suburbs. In the following period, the development in the city centers condensed. A large part of the guest workers settled in the city center, where rents were much cheaper. At the beginning of urban development, the city center was the actual CBD of the cities.

In both Dubai and Riyadh, street axes have become linear centers of specific city functions. In the 1970s, for example, the banking center along Baniyas Road in the direction of the new airport was built. And in Riyadh, as early as the 1950s and 1960s, the administrative center along the former airport road developed. For traffic reasons, the city lost its function as the actual economic center. This was newly created along multi-lane road axes that lead from the inner cities into the suburbs. In the case of Dubai, this epitomizes Sheikh Zayed Road, which heads southwest along the coast since the 1980s. Its counterpart in Riyadh is the King Fahd Road, which has been the city's north-south axis since the 1970s. Today's city center is used mixed in both cities. Only the restored center with the Friday Mosque, the old ruler's palace and the Souq still reminds of the history before the oil boom. The condensed downtown, the linear CBD and the sprawling sub-urbanity characterize both cities.

The consequence of the one-sided orientation as car cities was a multiplicity of problems. The high degree of urbanization led to a city type that leads the world in terms of highest energy consumption. The separation of place of work and place of residence led to an overload of the road system. The further expansion of city freeways split the city into zones and could not solve the traffic problem in a sustainable way. Today, the system is so overloaded that daily traffic jams cost the economy millions. Living conditions are falling in both cities due to high air and noise pollution. Another problem is the increased water demand, which increased exponentially with the expansion of the cities. The lack of sustainability leads to increasing economic and ecological problems.

Today's basic problem is the low density of the buildings and the one-sided distribution of city functions. In the future, the master plans of both cities intend to develop sub-centers in order to integrate work and living better and to create new urban qualities. This decentralization of the city structure marks a turning point in the urban development of both cities.

The two emerging cities have been able to come out of the rubles of ancient deserts and climbed up the ladder of global relevance in terms of infrastructure, systems, and sustainability. Yet there is still more to learn from a city that has been able to achieve better sustainable structure. These cities are yet to reach their maximum infrastructural growth in terms of building new ones to complement existing ones, without having to go through the intricacies of planning with so many factors to be considered.

Dubai for example has its agglomeration within the central business district close to the coast. This strategic insistence will only amount to congestion. This congestion can be avoided in the long term if much attention is paid to a spread out of investments and movement away from the central district. Dubai seems fast to adopt high rise structures and Riyadh seem to struggle more but these high rise buildings should be more sustainable, it will reduce fossil fuel consumption, a direct effect on CO_2 emission.

The infrastructural revolution and modernization of both towns in recent years have has a significant effect on the socio-economic landscape of the cities, bringing investments in hospitality, logistics and travels as part of the trade dictates of tourist attractions all over the world. This in a way has led to a rapid urbanization of these cities, Dubai especially, as

compared favorably to other metropolitan cities in the world because of the environmental and social developments. The effects of this population growth, industrialization and economic expansion if managed well, could place the cities on the global radar as not just tourist cities, but as economic and investment hubs of the world, thereby increasing the socio-economic welfare of the cities, the country and the continent as a whole.

5.3 Recommendations

By recommendation, Oasis and its implementation in the discussed cities should allow more shaded side walkways, "oasis-like garden development in the cities, palm tree plantation to reduce the urban city heat which would not only beautify the landscape of the city, but also would reduce the heat island as well.

Several attempts should also be made to provide energy efficiency increment, awareness for water saving and waste management disposal through recycling to provide a stable ecosystem with significant green life cycle.

Furthermore, it is recommended that Dubai should focus on more social sustainability strategies such as health, education, sanitation, housing as well as public spaces in order to become a full sustainable metropolis regarding both environmental and social development. Riyadh on the other hand should focus on energy efficiency and air quality in order to develop into a sustainable metropolis as Riyadh has shown possibilities of improvement in its infrastructure by adopting a number of strategies for sustainable development in order to improve the standard of living of people and foster economic growth.

Implementation of several law and enforcement to ensure the green transformation which aim to improve life quality at the long term end

Lastly, a project of new modern housing development with cool roof structure and thermal conditions taking advantage of solar powered panels for sustainable green energy should be implemented in the cities. However as much as modern taste is desired in the in the urban development through the sustainability of oasis, care should be taken to avoid loss of cultural heritage to the modern lifestyle.

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