Urban Growth from Patchwork to Sustainability
Case Study: Muscat

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To my family...

Abstract

Since the oil revolution, 40 years ago, Muscat, the capital of the Sultanate of Oman has been under massive waves of rural migration due to the availability of the services. Urbanization in the whole country has reached 84% in 2009 according to UN statistics.[1] However, Muscat holds more than one third of the total population of Oman. An urbanization pattern in Muscat is characterized by dispersed and patchy settlement structures as well as a car-dependent community. The overall ensuingseparation of functions is further augmenting mobility needs that are exclusively based on car-dependence. Life style patterns are oriented towards the single villa on a walled plot as the most favorite residential building type. These trends however meet limited resources mainly related to land. Due to the geophysical and climatic setting of the country 75% of the country's total surface of 212,460 square kilometers is covered by desert. Thus the remaining land has to be shared for different purposes of Omani society. While land consumption by residential use, services and transport infrastructure is increasing steadily, suitable land for agriculture is decreasing again supporting rural-to-urban migration or transition and thus creating again new demands on shrinking land resources.

Since the total area of Muscat is 2,300 square kilometers merely 330 square kilometers of land is appropriate for development, whereas the rest of the total area is dominated by Al-Hajar Mountains.[2] Meanwhile, some parts are considered as restricted areas which are occupied by governmental and institution easements. This roughly described 20th century-type of urbanization has been surpassed by the early 21st century- type that focuses on complete new cities for 200,000 to 300,000 inhabitants. In the GCC countries and in Oman a number of new cities are under construction claiming to become sustainable cities, at least from an environmental point of view.[3] While much attention is paid to this new urbanization trend, the resources consuming 20th century urbanization processes go ahead and have to be considered as an irreversible fact in Oman.

The research projects aims at detecting driving forces of the ongoing urbanization trend, and secondly at developing strategies and programs to control and guide the resulting urbanization patterns towards a resource-saving, and socially- and economically-balanced utilization of limited resources. It is assumed hereby that the way that the limited resource land is managed plays a crucial role.

[1] United Nations Population Division 2001

[2] Muscat Structure Plan, Muamir, Weidleplan, 1991

[3] www.almadinaazarqa.com ; www.thewavemuscat.com

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PART ONE: INTRODUCTION

1 PART ONE: INTRODUCION

1.1 Motivation

Although urban sprawl phenomena have influenced the daily life in Muscat as a particular place, its impacts have not been taken into consideration by the decision makers and the local inhabitants. As Buraimi[1] is my living place, every time I visit Muscat my sense of depression and frustration increases. Every time I drive on Muscat's highways I feel the number of automobiles is greater than before and the traffic jams become more critical than ever. The urban expansion is larger and larger than previously. These constant experiences have motivated me to investigate the problem in a comprehensive way. Most inhabitants relate the issue of urban sprawl in Muscat and elsewhere in Oman to the rapid growth of the population. However, I believe that the problem involves other dimensions. The patchy urban growth is seen everywhere, the scattered development and the low-density urban areas create a very rich subject to be investigated. The social segregation, fragmentation of families, increase in car accidents and increase in diabetes and heart disease are problems that have risen steadily since the early seventies. Recently, it has been a growing demand by the decision makers and local authorities to investigate these problems, which have come to be broadcast daily in local media. Consequently, the picture has become more visual since my proposal has been integrated with the research titled: '*Towards Sustainable Urbanization: Patterns in Oman'* which is sponsored by the Research Council (TRC).[2] Thus, this thesis is intended to be an influential contributor that investigates the problem in multi-dimensions to attain what might be entitled 'smart growth' development.

1.2 Problem Overview

Before the Oil Revolution started in early 1970s, more than 85% of people in Oman were living in rural areas. However, in 2009, urbanization reached 84% according to UN statistics.[3] Muscat, the capital city, holds more than one third of the total population of Oman. This trend makes the city grow both in demographic and physical dimensions. Urban growth in Muscat is characterized by the following attributes:

- Single-land use zoning;
- Strip retail shops normally built in linear character on the major streets and highways;
- Extreme land consumption;
- Low densities of buildings and population particularly on the peripheries;
- Disorientation and lack of local identity in urban form;
- Private automobile dependency with absence of viable public transport;
- Fragmented open spaces, wide gaps between developments and scattered appearance;

[1]Buraimi is 400 kilometres northwest of Muscat
[2]TRC is a governmental institution that sponsors the scientific research
[3]United Nations Population Division, 2010

- Lack of choice in housing types and prices;
- Separation of uses into distinct areas;
- One- to two-story buildings as a default form of development;
- Large lots;
- Shopping malls surrounded by acres of parking lots;
- Lack of public spaces and community centers;
- Life style patterns oriented towards the single villa on a walled plot as the most favored residential building type.

These trends, however, meet limited resources mainly related to land. The overall ensuing separation of functions increases mobility needs that are exclusively based on the car. Lifestyle patterns are oriented towards the single villa on a walled plot as the favored residential building type. The negative urban management and the lack of public awareness of the use of natural resources are major attributes of making living in Muscat a daily experience of depression and frustration. Various forces such as social, economic, political and physical factors intermingle to drive what is called "urban sprawl." 'Urban growth and sprawl is a pertinent topic for analysis and assessment towards the sustainable development of a city'.[1] Bhatta (2010) argued that 'sprawl as a process without considering the pattern cannot be characterized'.[2] According to Bhatta (2010), 'sprawl refers to: (1) certain patterns of land-use, (2) processes of land development, (3) causes of particular land-use behaviors, and (4) consequences of land-use behaviors.'[3]Therefore, the survey focuses on the key factors that are considered as primary evidence for the existing urban conditions and can then be evaluated along with the factors that cause the sprawl phenomena such as urban pattern, neighborhood conditions, quality of life, energy consumption, transport behaviors and public awareness. I believe that sprawl is the most affective phenomena that contributed to the fragmented urban fabric in Muscat. Therefore, this research focuses on urban sprawl as a dilemma that makes living in cities unbearable and what actions should be taken to combat it. Sprawl is largely a result of necessity– people immigrate from rural areas; or from other cities; to Muscat in search of better jobs and opportunities. This has resulted in an increase in the city size and created suburban development at the city periphery. The lack of good planning system management, the access to abundant cheap energy and the seducing automobile industry attract people to live on the outskirts of the city with lots of open spaces and a long distance from the city center. For example, Al Khoad has experienced rapid low-density urban growth due to the intensive demand of the vacant lands granted to the local people. These areas have been developed at random and have a patchy urban pattern with lack of basic infrastructure services and employment opportunities. A lot of environmental and social problems have emerged as a result of this kind of urban development trend.

[1]Bhatta(2010), p. vii
[2]Ibid., p16
[3]Bhatta(2010), p. 8

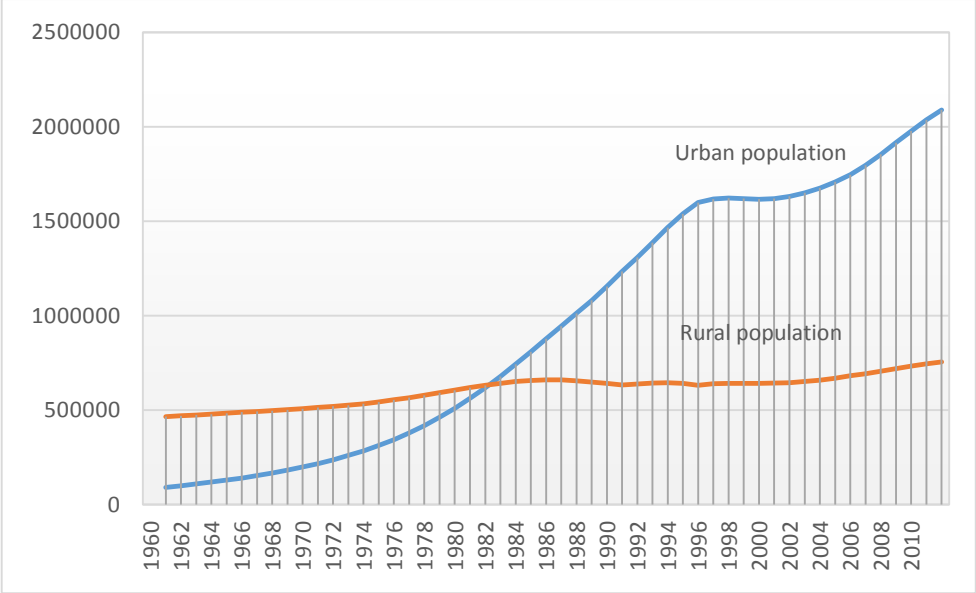


Figure 1: Urban and rural population growth in Oman

Source: World Bank Data. http://data.worldbank.org/country/oman accessed in 06/07/2013

1.3 Objectives

This PhD thesis has been prepared in parallel with a three-year Scientific Research Project conducted since May 2010 at the German University of Technology (GUTech) and Sultan Qaboos University (SQU) and is sponsored by the Technical Research Council (TRC) in Oman with the title: "Towards Sustainable Urbanization: Patterns in Oman." The PhD offers complementary studies for the TRC research focusing on Greater Muscat as an area of reference, while the TRC research integrates a deep analysis of aspects of rural-to-urban transformation. The TRC project has selected two case studies, Al Khoad in Muscat Governorate to indicate the development expansion and lifestyle pattern in urban areas, and Fanja in Dakhliyah to indicate the development expansion lifestyle pattern in rural areas. The selected case studies will be carried out in a manner that allows detailed insights and reveals specific characteristics of urban expansion. The case studies will provide a comprehensive and detailed survey on social, economic and environmental implications of land use and settlement patterns. However, this thesis embodies the urban growth in Oman in general with indication of Muscat as a particular case study. Unlike the TRC project which mostly relies on quantitative data, this thesis mostly relies on qualitative data. It not only investigates the transformation of lifestyle patterns of the society of pre-oil age and the society of oil-age, but also predicts what will happen at post-oil age based on various assumptions.

The proposed research project aims at addressing the above characterized urbanization trends in Oman with different objectives:

- to give a better understanding of the urbanization process and the mechanisms used in Oman;
- to designate the origin and evolution of the problem of rapid urban growth;
- to anticipate the future impacts according to various assumptions;
- to investigate some tools that might be used for remedy and;
- to portray the socio-economic and environmental factors that resulted from rapid urban growth.

This thesis argues what has been already done within local and international discourse regarding this issue. This thesis aims at identifying driving forces that have led to the current urban patterns in Oman.

Furthermore, the research aims to demonstrate the transformation of lifestyle in Oman since oil production. It also indicates the driving forces that have contributed to the radical change in contemporary social and environmental conditions. The proposed research aims to address aggravating problems in the country that arise through urban growth and uncontrolled consumption of limited resources, in particular land. The research program will focus on land use and land use changes, land use planning/zoning, land registration systems, land ownership, allocation and purchase, land value and land markets. The case study (Muscat) that will be carried out allows detailed insights into and reveals specific characteristics of urban growth. The primary data, which includes the interviews conducted, will be merged with secondary data, which includes the official statistics and forms a correlated subject to be deeply examined and analyzed to obtain the remedy of many socio-economic and environmental problems that are mostly associated with rapid urban development.

The final output of the research will offer a set of recommendations for revised urban development and planning strategies, physical planning standards and building codes. As well as a comprehensive land management concept adapted to the Omani context that allows a forward-looking and responsible handling of valuable and scarce resources to foster a socially, economically and environmentally sustainable and harmonious development in the country.

1.4 Significance of research

According to Clark (1996), 'the global urban pattern is changing in three different and unconnected ways: through urban growth, urbanisation, and the spread of urbanism.'[1] A Brookings Institute study defines a metropolitan area as "sprawling" if it is consuming land at a higher rate than its population is growing,'[2] Although urban sprawl is a global issue that has emerged since the industrial revolution, its impacts are varied in nations. Commonly, it is a result of the combination of multi socio-economic and environmental issues. From here, the acknowledgement of the impact of urban growth to our life is crucial. Urban growth in Oman is associated with rapid and excessive consumption of land and energy which has led to a wide range of socio-economic and environmental problems. The study of urban growth with its three pillars of economic, social and environmental factors is needed to intelligently utilize our natural resources to attain a better lifestyle and to avoid the negative impacts due to our harmful activities. Consequently, investigating the urban growth pattern and its impacts is crucial to track future planning and policies that enhance the quality of life. Oman is a significant country laid in the eastern part of the Arabian Peninsula with a beautiful meeting of three important oceans: the Arabian Sea, Oman Sea and Persian Gulf. Thesignificance of Oman resides in its cultural heritage, environmental diversity and the long history of civilization that make the country an attractive place for investments in all sectors. With these factors in consideration, this research tries to investigate the urban growth as a problematic issue that has influenced the development plans since the beginning of oil-production age forty years ago.

The urban management system, which includes the land distribution system, building codes and planning regulations, has been allocated since the early seventies and is still running up to date with some occasional provisions to some of its articles. This outdated urban management has largely impacted the profile of urban growth in Muscat in particular, and the whole of Oman in general. The output of this urban landscape becomes a considerable issue and a rich subject for study and investigation. The poor management of urban growth has been consuming the public capital as well as the natural resources. Integrating the criteria of sustainability in all development plans, policies and strategies is crucial. Therefore, this thesis is significant because it introduces some recommendations, which if intelligently applied, will ensure a secure transformation of our society to the post-oil age.

Despite the scarcity of literature on the proposed topic that focuses on Oman, the researcher found the available literature and debate quite valuable. Generally, the literature presently available that focuses on Oman's urbanization is more quantitative, such as (Al Awadi, 2008)[3] who used GIS as a tool to measure the urban expansion in Muscat, or outdated such as (Scholz, 1980) which studied the urban development up to the early

[1]Clark, D.(1996), p.40

[2]Nozzi, D.(2003), p.8

[3]Al-Awadhi T. (2008), Egypt. J. Remote Sensing & Space Sci., v.11 pp. 3-22

eighties[1], or the research based on oases settlements (Gaube, 2001) which is oriented towards historic settlement patterns and doesn't tackle ongoing urban development problems but contributes substantially to better understanding current problems. Peterson (2007)[2] focused on Muscat's historical transformation in relation of the political and cultural consequences of urban development. Al-Rawas (1989), a University of Salford PhD thesis focused on the transport context of Muscat at that time.

On a regional level, the recent Universität Stuttgart's PhD thesis publication Wiedmann (2010) focused on the post-oil urbanism in the Gulf Region mostly from a financial prospective and its impacts on decreasing the quality of the built environment in certain areas. Though Scholz and Al Awadi have partly contributed to the debate of urban growth in Oman, they have not investigated the authentic causes of urban sprawl and the current fragmentation of urban development.

All debates have not shown any scientific diagnoses to the problem. Consequently, this thesis diagnoses four main pillars: ineconomic, social, environmental and urban levels as they are crucial for the intelligent management of urban development to attain smart growthfor Oman cities. Therefore, this thesis is intended to fill the gap in relation of the scarcity of publications related to the topic. Relevant data collection on an empirical base will play a crucial role in the project. Muscat, the capital, is selected as a case study that reveals a better understanding of the characteristics of urban patterning and the major driving forces for the emergence of urban patchwork and segregation of social relations.

This thesis emerges as a response to the need for judicious and potent management of urban growth in Oman from a qualitative approach. The topic has been elaborated at a moment when Oman is at a critical period representing a turning point in development. Oil revenues are still the major source for the annual general budget. Peak oil in the country may has already been achieved while it is anticipated that oil-depletion has merely 20 years to occur according to the BP estimations. Despite all the efforts that have been made to build and develop the basic infrastructural services over the past four decades, it seems that the major natural resources have been exploited without thinking about the coming generations. During the past forty years many distinctive social norms have been swapped for irrational attitudes under the slogan of modernity. Local identity in urban and rural areas has been lost since the emergence of the 'modern' car-dependent society. Despite all attempts to preserve the traditions which define Omani society, the poor urban management system has counteracted all ways to attain this target. The lack of know-how and experience has aggravated the problem to an unbearable level. The contemporary urban management system has not only contributed the rapid consumption of natural resources but also has largely led to deterioration in the quality of life. Consequently, the existing urban management system is not able to elevate our society to the sustainable post-

[1]Scholz (1980)
[2]Peterson (2007)

oil age. Meanwhile, the existing urban planning system with its blurry and muddled profile is not suitable to guide and control the sustainable urban development.

One may ask why Muscat has been chosen as the case study for this research and what the significance of selecting Muscat over other cities is. Muscat represents the most sprawled city in Oman which houses more than 30% of the total population in Oman, while it represents merely 1.3% of the total area of the Sultanate (second smallest governorate in Oman). Muscat also hosts the most governmental headquarters and decision makers, and it is also considered the main hub of the national economy. Furthermore, Muscat has experienced various political and socio-economic transformation over its long history more than anywhere else in the Sultanate. Therefore it is evident that Muscat embodies a most suitable place for analyzing and examining the influences of rapid urban growth and sprawling development.

1.5 Limitation of study

There are seven significant limitations for the study. *Firstly*, despite sprawl and patchwork development having relatively influenced the whole country, the research focuses on Muscat, the capital city, as a case study. *Secondly,* the thesis is based on qualitative data while quantitative data is limited to previous statistics and official facts and figures that are published regularly by local authorities. *The third limitation*, the empirical data collection through interviews, represents only Omani families with civil servant backgrounds, though the Muscatpopulation includes about 48% Non-Omani residents as well in different economic sectors (important for social sustainability). *The fourth limitation*regards that although the expatriate population in Muscat represents nearly 48% in different sectors according to 2010 census, the empirical data collection through interviews represents only Omani families. The *fifth limitation*, notes that the research will not replicate the former quantitative studies such as (Awadi, 2008) but will be complementary to those studies and put forward by qualitative research. Thus the research will not include its own evaluation of aerial photos, only Google maps. *The sixth limitation*, is that this thesis focuses on United Arab Emirates and Qatar despite the fact that most of the Gulf Cooperation Council (GGC) countries have adopted various projects and schemes that are associated with sustainability. So far, those two countries have shown outstanding progress which complies with most of the criteria of sustainability which is necessary to ensure the secure transformation of the local societies to the post-oil age. *Ultimately,* due to different levels of available quantities of literature and information, some chapters have been elaborated more in depth than others.

1.6 Questions and methods

This thesis investigates the rapid urban growth phenomenon in Oman and its impact on urban form, community actions and the overall lifestyle pattern which has emerged since the late sixties. Although similar problems occur in many countries in the world, I adopted Oman as a country and Muscat as a city because I felt it is easier for me to search for the data in my home country where I have more than 17 years' experience as a town planner. Hence, the thesis essentially attempts to visualize the radical policy that has been pursued to attain the current urban form and lifestyle pattern. Consequently, this research has raised three key questions in order to investigate the answer:

1. How to describe urban growth in Oman during pre-oil and oil-age?
2. How to understand the current urban development in Oman?
3. How to guide the future urban development towards sustainability?

The first question is to investigate the substantial dimensions that cause urban sprawl phenomenon in Oman. The second question introduces Muscat as a case study to boost understanding the current urban development. The third question introduces assorted regional practices and distinctive global paradigms that are utilized to treat the problem. Meanwhile, various sub-questions have to be elaborated to broaden the sphere of understanding. They are:

- To what extent does the transformation of socio-economic dimensions affect the current lifestyle pattern?
- Why and how have the scattered and fragmented developments emerged?
- Is it a matter of rapid population growth or a matter of poor urban management or just a matter of cheap energy?
- If it is a matter of rapid population growth, what could be done when our cities are classified as mega populated cities? Can we house people in healthy urban form with the current urban management?
- If it is a matter of poor urban management, how can we deal with the urban and ecological problems that will emerge due to the increase of population and the lack of natural resources?
- If it is a matter of cheap energy, what will happen when oil is depleted? And what has been accomplished to confront this inevitable fate?
- Have our cities and societies prepared for the inevitable post-oil age? And what are the challenges that influence the achievement of this goal?
- How can local societies be safely transformed towards the post-oil age?

Methods and sources for key-question 1

In order to answer the first key question, the urban development at both pre-oil and oil ages is reviewed and analyzed in a comparative way. Economic conditions, social conditions, environmental and administrative (governance) conditions, as well as the description of urban form and their criteria Impacts have been used for review and analysis. The source of data is generally based on national statistics, literature and personal professional practice.

Methods and sources for key-question 2

In order to answer this question, various methods were pursued. Firstly, empirical research has been accomplished by conducting interviews with Muscat inhabitants.The interviews comprise multi-dimensional factors such as a neighborhood's condition, size of plot and household data, transport behaviors, energy consumption, etc. The second method was pursued by investigating the urban planning practice in Muscat. The source of data includes personal professional work experience in local planning practices, the existing planning ordinances and development policies, as well as official statistics and estimations.

Methods and sources for key-question 3

In order to answer this question, a normative approach has been utilized which is represented by the evaluation of the state of the art discourse on urban sustainability. This includes international movements and paradigms such as "compact city, urban village, smart growth and livability." The source of data includes the general literature of books and publications that contain the debate, reviews or narratives of those urban movements.

The method to answer this question also includes the evaluation of lessons learnt in neighboring GCC countries and the analysis of current urban development policies, planning programs and implementation measures.

The source of data for this method includes literature, policy papers and site visits such as those to Abu Dhabi Urban Planning Council. Another method used to answer this question includes the evaluation of (good) urban governance and urban management models. The source of data used to answer this question is the case of international best practice. The last two methods used to answer this question will be scenarios and recommendations. The source of data is based on the researcher's critical analysis and evaluation.

1.7 Evaluation of data

In order to answer the questions mentioned above, several methods of theoretical and empirical data collection are used to investigate the problem and the solution. This chapter aims at addressing the research methods that are used to examine the impact of urban management system on urban growth. It also visualizes the tools that are used to explore the lifestyle pattern in Oman and its correlation to the consumption of natural resources. An innovative multi-method approach combining qualitative and quantitative data collection techniques was developed and employed in this project.[1] Both qualitative and quantitative methods have been involved in this research.

[1]Moore et al. (2006)

1.7.1 Evaluation of primary data

Along with Devuyst (2001), 'primary data are used whenever very detailed information is required, typically in the problem identification/awareness raising phase and in the implementation phase.'[1] Measuring social conditions is mainly focused on a random sample of people who have diversity on demographic profile, housing type and tenure in Muscat, etc. This data is crucial to explore the typical urban form in Oman. The implication of primary data intends to fill the gap in the secondary data that is based on the censuses and the previous studies. According to the available literature, there is a lack of expectations or even awareness about the outcome of rapid urban growth. In contrast, low density and car-dependent development is encouraged to bear this trend. Regulations and legislations are not viable or at most times are absent in relation to standardizing the development process. If we want to defeat the sprawl which is an implication of horrific urban management, initially we have to understand the existing lifestyle pattern, the decision-making process and how to effectively change our lifestyle patterns. Consequently, primary data which is gained from field surveys, for example, is becoming crucial.

This data, which contains elements that determine the lifestyle pattern, clarifies to what extent our behaviors and attitudes are affected by the quality of urban form. For example, the survey will find out the rate of building density, rate of population density, type of housing unit, time spent on driving to and from certain destinations such as workplaces, shops, schools, places of worship, clinics, leisure places, etc. It also indicates how much time is spent in private cars per week and how much money is spent on private transportation per month. This data explores to what extent the urban form is influenced by the sprawl phenomena. Primary data has been gathered by field interviews across multiple disciplines that were conducted randomly in Muscat to observe the attitude of a certain sample of the urban population and how they acknowledge their lifestyle pattern. The interviews contain both qualitative and quantitative investigations to better understand the problem.

It has been decided to address Muscat families for interviews which will be personally conducted using a standardized questionnaire to encourage additional remarks and further comments. The traditionally accepted way of approaching families through addressing the head of the household has been followed. In order to facilitate the procedure of conducting interviews (during day time, during working hours) the heads of the households have been visited at their workplaces. Taking into consideration the high amount of employees in the civil service sector (128,805)[2], interviews have been conducted randomly with 175 Omani national employees within different ministries with the Ministries District of Khuwair, 117 of them were male and 58 were female. More than 60% (107) of the interviewees were below 35 years of age. The age ranges of the interviewees are shown in the table below.

[1] Devuyst, D. (2001), p.254

[2] Ministry of Civil Service website: http://www.mocs.gov.om/LinkClick.aspx?fileticket=8S%2fFzgUsoNI%3d&tabid=331 accessed on 9/9/2012.

Age (years)	>25	25-34	35-44	45-54	55-64	65+	TOTAL
Number of interviewees	34	73	57	10	1	0	175

Table 1: The age ranges of the interviewees

Source: The author based on a field survey

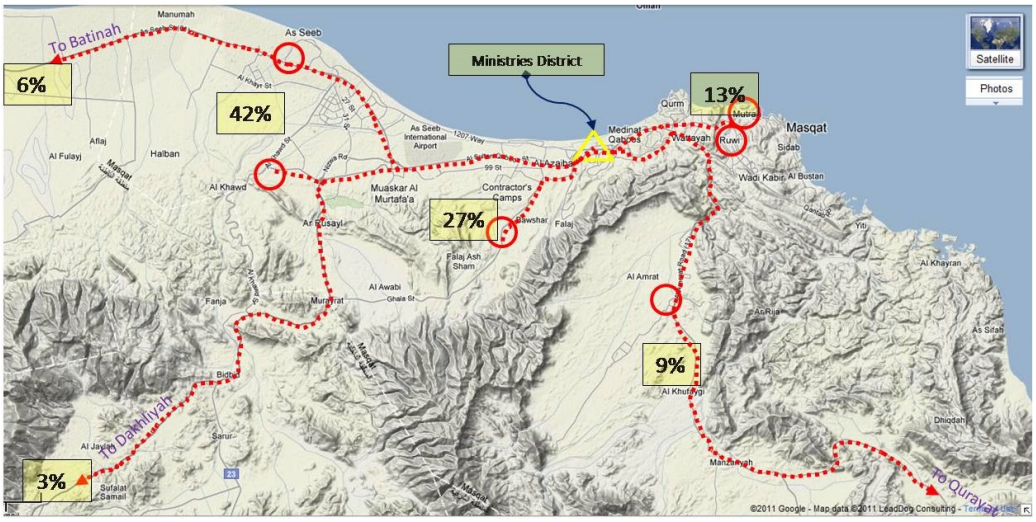


Figure 2: Percentage of interviewees and their daily transit distances to their workplace

Source: The author based on a field survey

Being aware of a limited representativeness (covering only a certain social strata of population; covering only Omani Nationals), the survey reveals nevertheless a valuable picture about lifestyle patterns, as a kind of "snapshot" of a typical Omani family as seen by males and females, by young and elderly people, by people from different professional backgrounds, and by people living in different areas of Greater Muscat. The survey has about 40 questions which are subdivided into six categories. The first category includes **general data** about the interviewee such as gender, nationality, working hours, etc. The second category is related to the plot and **household data** such as type of dwelling, type of ownership, the age of the dwelling, the reason for choosing the location of the dwelling, size of the plot, the built-up area, the number of bedrooms, value of the property, the number of cars at the household, etc. The third category explores the **transport behaviors** such as the transportation mode used and the time taken to get to common destinations such as workplace, school, places of worship, shops, etc. The fourth category attempts to visualize the **neighborhoods' conditions** such as the availability of services and outdoor spaces. The fifth category verifies the **energy consumption** at every household and the availability of thermal insulation within the house's external envelope. The final category investigates the interviewee's **awareness** about the consumption of energy and the attitudes and behaviors when certain future assumptions emerge due to energy depletion. The final part of the questionnaire tried to involve the interviewees' visions about the future of our cities and neighborhoods as we approach the post-oil age. The survey focuses on the key factors that are considered primary evidence for the existing urban conditions and that can then be evaluated along with the factors that cause the sprawl phenomena such as urban pattern, neighborhood conditions, quality of life, energy consumption, transport behaviors and public awareness.

1.7.2 Evaluation of secondary data

Secondary data is obtained from multiple sources such as census data, previous studies, maps, aerial photos, literature reviews and interviews. The secondary data also includes the history of urban growth and development progress, urban governors and real estate markets. Most of this data is found in reports, annual books that are published by various institutions, such as the Ministry of National Economy, that have been accessed either by logging into official websites or by hard copies. Data can also be gained from magazines, newspapers and websites. The most common online resource has been the World Bank website (www.worldbank.org). The demographic studies were normally obtained in detail from the Ministry of National Economy official censuses, particularly the three official census reports in1993, 2003 and 2010. The aerial photos are generally acquired using Google Pro. Software; some aerial photos were sourced from previous studies such as "*Analysis, Assessment and Modeling of the Urban Growth in Grater Muscat, Sultanate of Oman, Using Geographical Information Systems & Remote Sensing"*

1.7.2.1 Scenarios

'Scenarios can be defined as 'a tool [for] ordering one's perceptions about alternative future environments in which one's decision might be played out right'[1]Mats Lindgren and Hans Bandhold (2003) visualized scenario as follow: 'techniques are usually qualitative, based on reasoning and intuitive pattern recognition, although thorough analysis is often part of the process.'[2]

Urban future growth might further aggravate this condition, and therefore it is crucial to understand the effect of new urban development on the overall city pattern and the correlated management options. To assist the local authorities manage the ambiguity of the future urban pattern, potential consequences of an action will be examined using certain variables. Hence local authorities, decision makers and other parties related to urban development can use the advantages of these scenarios to manipulate the future trend of urban growth. It is important to consider the impact of urban growth on ecological, social, urban and overall lifestyle factors. Hence, scenario-building is a tool used to analyze the current situation and future projection with various assumptions and variables.

While cities in Oman have experienced rapid urban growth since the late sixties, a *'what if'* model of scenarios is the best tool that can be utilized to examine this issue. It has been argued that 'what if' scenarios area model that links with GIS to examine urban change scenarios, especially in cities experiencing rapid growth.'[3]From the researcher's perspective, in addition to its contribution of boosting the understanding of contemporary urban patterns, *'what if'* scenarios can be used to envisage the future of urban growth and contribute to making the local environment more sustainable.

[1]Lindgren, M. & Bandhold, H., (2003), p.21
[2]Ibid, p.30
[3]Bhatta, B. (2010), p.116

1.7.2.2 Aerial photographs

'Aerial photographs identify natural and human-made features for the interpretation, evaluation, and analysis of land resources'(Kenneth B. Hall, Jr. Gerald A. Porterfield, 2001).[1] Aerial photos taken from various platforms, mainly airplanes, have been interpreted to describe the structure of the urban physical environment as well as to predict socio-economic variables (Estes, 1966; Lillesand and Kiefer, 1994).[2]

Only aerial photographs can reveal the qualities of settlement forms and patterns, yet these add an element of distance which often reduces the subject to a map-like structure or even an abstract design[3] (Roberts, 1996). Aerial photos can be used as tools to trace the urban growth in urban and rural areas. In this research, it is used to outline the change in land use and transport infrastructure.

NASA (2001) reported that 'the advances in satellite-based land surface mapping are contributing to the creation of considerably more detailed urban maps, offering planners a much deeper understanding of the dynamics of urban growth and urban sprawl, as well as associated matters relating to territorial management.'[4]

The majority of the aerial photos used in this research are gained either from Google Earth or from the GIS Department in the Ministry of Housing. Some aerial photos have been provided by Dr. Talal Al-Awadhi from Sultan Qaboos University; they are partly used in his research '*Analysis, Assessment and Modeling of the Urban Growth in Greater Muscat, Sultanate of Oman, Using Geographical Information Systems & Remote Sensing',* particularly the photos that indicate the sequences of land use acquisition from 1980-2003. Another source of aerial photos is from the book Historical Muscat: *An Illustrated Guide and Gazetteer edited by J. E. Peterson.*

The aerial images can clearly demonstrate the existing urban layout as the public and private spaces are clearly defined. Therefore, they provide visual evidence about the degree of neighborhood quality and the public realm. The aerial photos used in this research indicate the areas that are consumed by the transport infrastructures such as the highways and parking lots. These areas can be compared with high density areas such as ancient Omani traditional settlements or Old Muttrah.

[1]Kenneth B. Hall, Jr. Gerald A. Porterfield, (2001)
[2]Lillesand, T. M. and Kiefer, R. W., (1994)
[3]Roberts B., (1996)
[4]NASA (2001)

1.7.2.3 Literature

Literature review represents the backbone for any research**.** Mauch, J. and Park, N. (2003) argued *that* 'the term *literature* is employed to include anything appropriate to the topic, such as theories, letters, documents, historical records, photos and other images or objects, government reports, newspaper accounts, empirical studies.'[1] The literature reviewed in this research addresses four common issues that are associated with the research topic. They are as follows*: firstly*, the literature that investigates and visualizes the sprawl phenomenon and its impact on urban growth. *Secondly,* the literature that offers various notions and paradigms that are commonly used as solutions for the urban sprawling and the poor urban management. Garden City, Compact City, Smart Growth and Urban Village are prominent paradigms and movements that are widely used in studies and research as imperative solutions for the urban growth associated with fragmentation and sprawl. *Thirdly,* it visualizes what has been known and unknown about the research topic. *Lastly*, it indicates the research's contribution to the available literature.

1.7.3 Normative approaches

The trends in global normative approach, such as urban growth, footprint and urban population, are crucial in studying urbanization. Since most data related to urbanization is under the publication of United Nations Statistics Division, this thesis relies on data that can be used as normative data for Oman. A good example of this is, a book such as "*Demographic Yearbook"* which contains statistic tables and graphs based on national census and estimations for urban and rural population and density which are varied in every country and continents. This data could be useful in tracing these trends and correlating them to Oman's national data. This thesis also addresses various international design solutions which are considered normative approaches for sustainable development such as the Garden City Paradigm, the Urban Village Movement, the Compact City Notion, and Smart Growth Initiative.

1.7.3.1 Comparative approach

McDonnell, M. *et al*. (2009) argued 'comparative studies are a valued and well tested method of developing new understandings in a diversity of subjects.'[2] 'Comparative studies are an important tool for scientists and can reveal general principles, identify system properties, aid the formation of new hypotheses, uncover potential causal factors and reveal undiscovered public knowledge.'[3]

To better understand the issue, comparative discussions of three cities with similar conditions to Oman are chosen as case studies. The three regional cities are Dubai, Abu Dhabi and Doha. The reason for selecting these cities is because they are located in the same region as Oman with similar climates and socio-economic conditions. However, they have

[1]Mauch, J. & Park, N. (2003), p.117
[2]McDonnell.M. et *al*,(2009), p.5
[3]Ibid,p.73

explicitly outstanding progress in relation to the transformation towards the post-oil city and they have achieved a step forward in sustainable communities. The research visualizes the lifestyle pattern prior to the oil-age in comparison with the lifestyle pattern prior to the oil-age. Many parameters have been used in weighing the differences between the two eras. For instance, the socio-economic parameters are widely used in this part as they are considered the most constitutive elements in any urban society. The comparative approach also includes weighting the local indicators of sustainable communities with the international codes and other developed societies. It also comprises the trend of certain activities which are considered the main factors of urban sprawl phenomena and patchwork development.

1.8 Structure of the thesis

The thesis is subdivided into six parts. ***Part one*** is an *'introduction'* of the dissertation which is initiated with the author's motivation. It highlights the problem, the objectives of the study, the significance of the research, and the limitations of the study. In order to investigate the rapid urban growth and its impact on the existing urban form, this part raises three key *questions* to be investigated and analyzed. The three questions focused on why urban growth in Oman is characterized by patchwork and sprawl and how urban pattern can be transformed towards the post-oil era. In order to enlarge the argument, various sub-questions are posed. This part also indicates the methodology that will be utilized to investigate and analyze the problem and the tools that are used to find the solutions. It includes analysis of the primary and secondary data as well as introducing comparative and normative approaches, which are crucial to investigating the issue and therefore obtaining the answer. It also offers "scenarios" as another method, which includes assumptions and parameters that are investigated and analyzed regarding the current and the future projection of urban lifestyle in Oman. Ultimately, this part is concluded with an indication of how this thesis is structured.

Part two *entitled 'Urban Growth at International Discourse'* includes the literature reviews associated with the topic. Chapter one discusses the emergence of 'sprawl' phenomena and 'urban growth' in the international debates. Chapter two highlights the main *factors that cause sprawl* according to many scholars and book authors. Chapter three indicates the 'impact of sprawl' according to the international discourse. Chapter four includes the major *international paradigms* and movements that have been largely utilized to limit or combat urban sprawl. Chapter five includes prominent policies and strategies that are considered as '*potent remedy*' to limit and guide urban growth, as well as sustainable urban management. This chapter also focuses on planning for a future transport system and the land management system.

Part three called *'Urban Growth in Oman, Origins and Evolution'* analyses the historical urban growth in Oman and includes three chapters. Chapter one introduces the urban growth pattern in Oman as a problematic issue which has influenced the community's life style. It also visualizes the significance and objectives of the research and the limitations of the research. Chapter two records the historical transformation of urban patterns in Oman up to the oil production in the 1960s.

It indicates the socio-economic conditions which contributed to forming the ancient cooperative society in Oman. It also indicates the characteristics of urban governance in that age including the responsibilities, power and the community that control the overall life pattern. This chapter also indicates the characteristics of urban form for old Omani settlements which were unique in the region despite the harsh environment and hard climate. It illustrates the 'Oasis settlement' as an intelligent and eco-friendly model and its strategic urban management. Chapter three indicates the characteristic of urban growth at oil-age. It analyses the transformation of socio-economic conditions that have accompanied the urban growth since the production of oil. It also visualizes the impact of urban growth on natural resources.

Part four includes the *"Challenges and Potentials to Sustainability"* which is subtitled into three main chapters. The first chapter in this part includes the main *challenges* that might counteract the transformation process towards the post-oil age. Those challenges are also classified into economic, social, urban and ecological challenges. The economic challenges mainly include the potential of oil depletion and climate change as very critical challenges that influence the current and future urban pattern. It also indicates the social challenges which represent the rapid population growth, fragmented family structure and public health conditions. The "urban challenges" include the emergence of new urban governors, the characteristics of urban form at the border of consumption of natural resources, the emergence of patchwork growth and sprawled development. These are definitely results of the high rates of private car ownership, the change of plot size and the overall built form. This chapter also includes the "ecological challenges" which investigates the rise of footprint factor which leads to many environmental problems such as droughts and floods. The second chapter in this part includes the *potentials* which highlight the major sustainable indicators that might help our society in the transformation to the post-oil age. These indicators include socio-economic indicators and ecological indicators. The third chapter illustrates various effective actions that have been applied by other GCC countries as *regional references* in relation to dealing with those challenges. The investigation is limited to Abu Dhabi and Dubai in UAE and Qatar which are considered as the most pioneering countries in the region through their attempts to deal with the issue in various dimensions. ***Part five*** includes *"Muscat as a case study"* for investigating urban growth. Firstly, it illustrates the historical urban growth in Muscat up to just before the oil production era. It also shows the current urban growth and the characteristics of lifestyle at oil-age. ***Part six*** focuses on *"the upcoming interventions and conclusions."* It includes how urban pattern should be managed towards the post-oil era. The investigation proposes five important parameters which are governance, social, economic, ecological and urban patterns. This part also includes three assuming *"scenarios"* in relation to urban patterns in Oman. These scenarios are the urban patterns of rapid urban growth with current urban management, the projection of urban patterns at the age of oil-depletion and the future model of urban patterns at the post-oil age. At the end of this part the thesis concludes with a summary of what is found and a set of multi-dimensional recommendations.

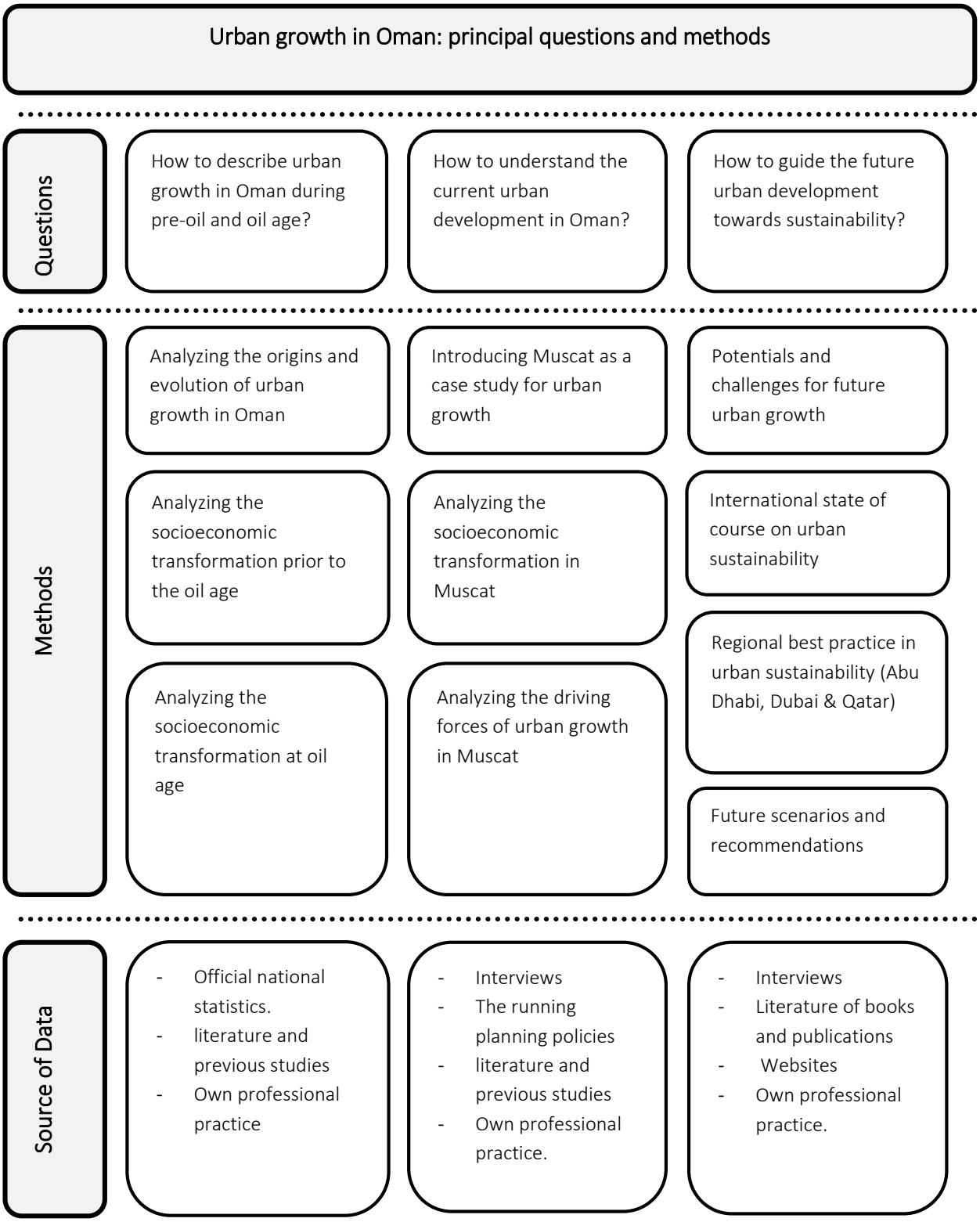
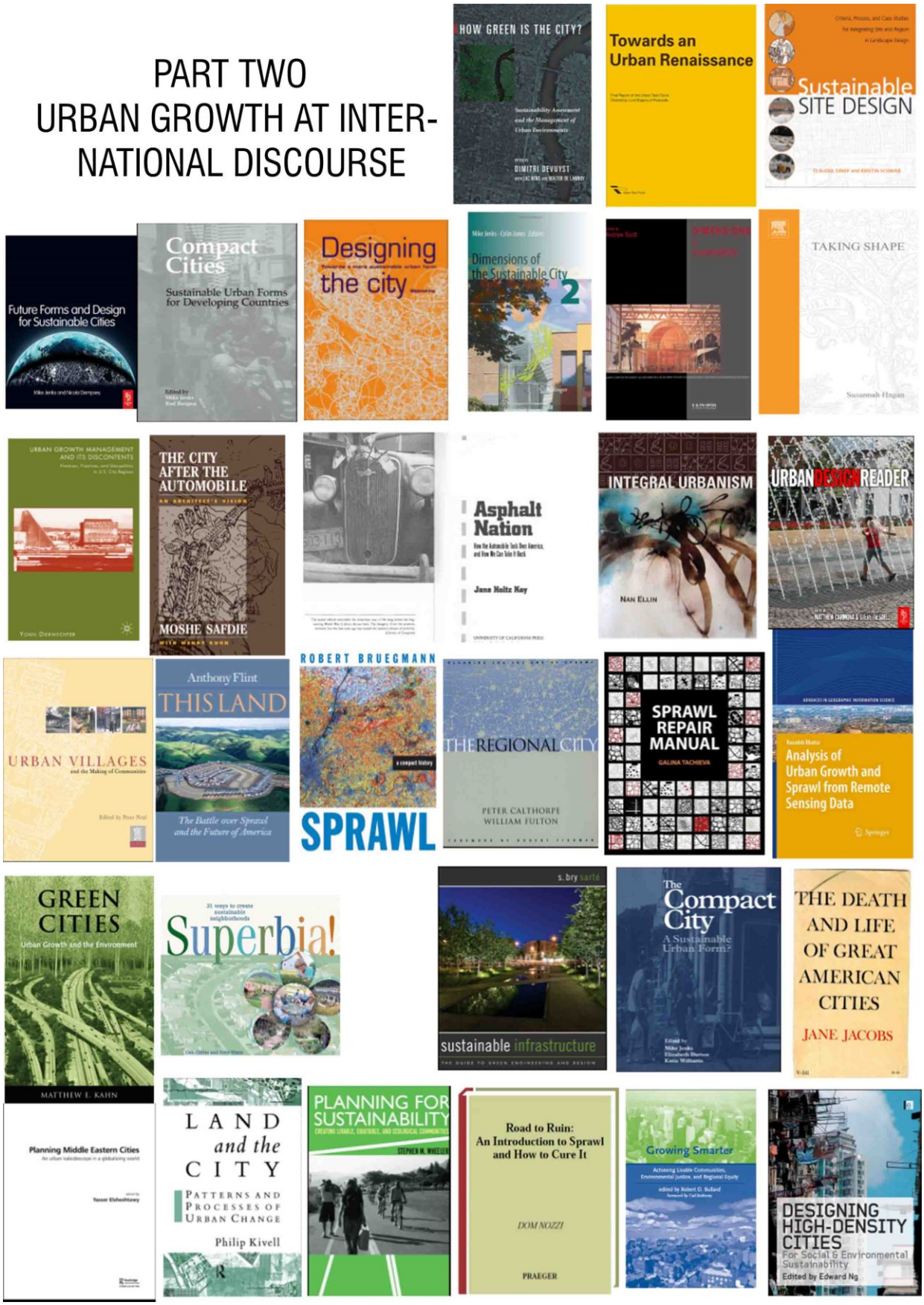


Figure 3: Urban growth in Oman: principal questions and methods

Source: The author

PART TWO
URBAN GROWTH AT INTER-NATIONAL DISCOURSE



2. PART TWO: URBAN GROWTH AT INTERNATIONAL DISCOURSE

2.1 Sprawl phenomenon vs. urban growth

Urban sprawl emerged as a main debate to many scholars, urban planners, economists, environmentalists, sociologists, transportation professionals, policymakers, public officials and academics during the past two decades. It has become a phenomenon phrase that is considered responsible for many urban problems occurring in many countries. Since the invention of the car, plenty of debates have been argued about urban sprawl as the most striking factor that has caused many socio-economic and environmental problems in contemporary urban areas. For instance 'A Brookings Institute study defines a metropolitan area as "sprawling" if it is consuming land at a higher rate than its population is growing.'[1] Schmid et *al* (2011), in *Cities and Fascination,* argued that 'perhaps the most pressing categorical revision in a revised city dictionary relates to the term 'sprawl'. For some, this much-maligned appellation invokes all that is bad about uncontrolled urban growth'[2] Ståhle (2008), in the book *Compact Sprawl* argued that 'the dominating manner in which cities grow is what is called "urban sprawl", commonly understood as "the spreading out of a city and its suburbs over more and more rural land at the periphery of an urban area.'[3]

It is obvious that sprawl has taken a wide area of critic at most recent debates associated with urban studies. Even its definitions involve censure terms. For example, Johnson & Klemens (2005) define sprawl as 'poorly planned, land-consumptive development, regardless of where it is located. It occurs at the edges of cities or in rural fringes within commuting distance of metropolitan centres.'[4] According to Dannenberg et *al*. (2011), 'sprawl is a term often used to describe low-walkable communities with low density, disconnected streets, and separate land uses. Sprawl as a type of urban design accelerated during the mid-twentieth century, made possible by large numbers of people having automobiles and being able to drive long distances to destinations.'[5]

Obviously, there are many debates that have distinguished definitions of the three urban trends: urbanisation, urban growth, and urban sprawl. United Nation (2005) defines urbanisation as 'movement of people from rural to urban areas with population growth equating to urban migration'[6] According to Bhatta (2010) 'urbanisation refers to the complex change of life styles which follow from the impact of cities on society. However, nowadays it refers to the physical growth of urban areas from rural areas as a result of population immigration to an existing urban area. Effects of urbanisation include change in urban density and administration services.'[7] Clark (1996) argued that 'urbanisation is

[1]Nozzi, D., p.8
[2]Schmid, H. et *al* (2011), p.23
[3]Ståhle, A. (2008), p.17
[4]Johnson, E. & Klemens, M.(2005), p. viii
[5]Dannenberg, A. et *al*. (2011), p.36
[6]United Nations (2005). URL:http://www.un.org/esa/population/publications/WUP2005/2005wup.htm. accessed on 9/9/2012
[7]Bhatta, B. (2010), p.3

presently a developing world phenomenon. The highest rates are to be found in the less developed countries. While little urbanisation is occurring in the already highly urbanised developed world.'[1] According to Clark (1982), 'urban growth is a spatial and demographic process and refers to the increased importance of towns and cities as a concentration of population within a particular economy and society.'[2] Sudhira and Ramachandra (2007) argued that 'urban sprawl refers to the outgrowth of urban areas caused by uncontrolled, uncoordinated and unplanned growth. This outgrowth seen along the periphery of cities, along highways, and along roads connecting a city, lacks basic amenities like sanitation, treated water supply, primary health centre, etc. as planners were unable to visualise such growth during planning, policy and decision-making.'[3]

According to Bhatta (2010), 'urban sprawl, an undesirable type of urban growth' [4] He also indicate it as 'the less compact outgrowth of a core urban area exceeding the population growth rate and having a refusal character or impact on sustainability of environment and human.'[5] Gillham (2002) defines sprawl as 'a form of urbanization distinguished by leapfrog patterns of development, commercial strips, low density, separated land uses, automobile dominance, and a minimum of public open space.'[6] Connerly et *al.*(2007) in his book *Growth management in Florida : planning for paradise* indicates that 'urban sprawl was defined as one or more of the following developments: (1) leapfrog development; (2) ribbon or strip development; and (3) large expanse of low-density, single dimensional development'[7]Bullard (2007) argued that 'sprawl is frequently defined as poorly planned, land-consumptive development at the edges of cities, surrounding suburbs, or in rural fringes within commuting distance of metropolitan centres.'[8] Barnett (2001) noted that 'sprawl was originally coined as a pejorative term for seemingly unplanned new development spreading outward from older cities and suburbs, but sprawl also turns out to be the product of a complex interaction among government programs and private enterprise.'[9]

The Oxford Dictionary (2000) defines the sprawl as 'a large area covered with buildings, which spreads from the city into the countryside in an ugly way.'[10] Ottensmann (1977) has identified urban sprawl as 'the scattering of new development on isolated tracts, separated from other areas by vacant land.'[11] Zhang (2004) defines urban sprawl as 'the pattern of urban development out of control has been regarded as urban sprawl.'[12] 'Sprawl is a term often used to describe low-walkable communities with low density, disconnected streets, and separate land uses. Sprawl as a type of urban design accelerated during the mid-twentieth century, made possible by large numbers of people having automobiles and being

[1]Clark, D.(1996), p.49
[2]Clark, D. (1982), p.231
[3]Sudhira, H. & Ramachandra, T. (2007). URL: http://eprints.iisc.ernet.in/11834/
[4]Bhatta, B. (2010), p.1
[5]Bhatta, B. (2010). p.9
[6]Gillham, O. (2002), p.8
[7]Connerly, C. et al. (2007), p.38
[8]Bullard, R (2007), p. ix
[9]Barnett, J. (2001), p.2
[10]Oxford Dictionary (2000)
[11]Ottensmann, J.R. (1977) (quoted by Bhatta, B (2010), p.8)
[12]Zhang, B. (2004).

able to drive long distances to destinations.'[1] According to Foran (2009), urban sprawl refers to 'scattered development that increases traffic, saps local resources and destroys open space'[2] whereas Maciocco (2008) argued that, 'sprawl appears as a city adrift above all because it presents itself as urban growth without shape.'[3] Among various manifestos which tried to define the term sprawl, I found the most appropriate scripts that sum up the definition as follows: 'sprawl is the spreading out of a city and its suburbs over more and more rural land at the periphery of an urban area. This involves the conversion of open space (rural land) into built-up, developed land over time.'[4] All the above debates collectively describe urban sprawl as a major contributor of many socio-economic problems as well as environmental deterioration that is seen nowadays in urban and suburban areas alike.

The book, *The Rise of Sprawl and the Decline of the American Dream,* Duany et *al.* (2000) has depicted the distinction amongst sprawl and the traditional neighborhood in a critical way. The authors portrayed the urban sprawl as 'an idealized' and 'not healthy growth' and 'essentially self-destructive.' while the traditional neighborhood 'evolved organically as a response to human needs'.[5] According to Pitz (2004), 'if the sprawl cannot be stopped, then planning must be invoked to determine how best to manage the expanded area. Urban sprawl is the unplanned expansion of urban and suburban development (structures and activities) onto adjacent rural land. The expansion may be in the form of residential developments, office complexes, business parks, or industrial centres. Regardless of the form of expansion, urban sprawl implies minimal control over growth and the absence of viable urban planning. Urban sprawl occurs in three basic forms: ribbon development, low-density housing development, and leapfrog growth.'[6]

Urban Sprawl: A Comprehensive Reference Guide is one of the latest books which addresses sprawl phenomena in a comprehensive way. The book, which was edited by Soule (2006) initiated that 'definition and management' of sprawl, passing through the sprawl's 'spatial dynamics', the sprawl's cost and 'impact on environment and human health', 'measuring and analyzing' the sprawl reaching the sprawl's proposed remedies.[7] Jenks & Dempsey (2005) portrayed the sprawl as a blurry pattern when he argued that 'suburban sprawl has meant that the edge of cities is often blurred with miles of semi-suburban semi-rural hinterland of shopping malls, office parks and housing developments that constitutes neither city nor countryside.'

In the book 'Images of the Future City', Hojer et al (2011) expressed that nowadays the context of cities are hostages for urban sprawl in using the following expression: 'tendencies to sprawl, functional separation, segregation, thinning and population growth have led to comprehensive suburbanization' [8] while at the ultimate part of the book, they described the future images of sustainable cities. Girardetp (2007) argued that 'the spatial

[1]Dannenberg, A. et al. (2011), p.36
[2]Foran, M. (2009), p.4
[3]Maciocco, G (2008),p.7
[4]http://www.sprawlcity.org/defining.html
[5]Duany A. et al (2000), p.25
[6]Pitz, G. (2004), pp.267-268
[7]Soule, D (2006)
[8]Hojer, G et al (2011), p.101

expansion of cities often dramatically exceeds their population growth. Metropolitan New York's population, for instance, has grown only 5 per cent in the last 25 years, yet its surface area has grown by 61 per cent. Over 50 per cent of the fuel that is used to power this city region is required for motorcars.'[1]

It has been argued that 'urban growth is a result of a combination of factors: geographical location, natural population growth, rural-to-urban migration, infrastructure development, government policies, corporate strategies, and other major political and economic forces, including globalization.'[2]

2.2 Causes of sprawl

Since the industrial revolution, the invention of cars and the broadening of globalization, lifestyles have changed dramatically leading to an excessive use of natural resources. In the introduction of the final Report of Urban Task Force, Lord Rogers indicated that, 'the beginning of the 21st century is a moment of change. There are three main drivers:

- The technical revolution—centred on information technology and exchange;
- The ecological threat—based on greater understanding of the implications of our rapid consumption of natural resources and the importance of sustainable development;
- The social transformation—flowing from increased life-expectancy and new lifestyle choices.'[3]

The Gillham's (2002) *Limitless City* is considered one the most recently published books which investigates the sprawl in a comprehensive way. Although the debate was focused on the American sprawl, most of its content is comparable to most other countries that suffer from sprawl phenomena. Gillham introduced four main ingredients that cause sprawl, they are: 'landownership and use; transportation patterns; telecommunications technology; and regulations and standards.'[4] In relation to the first category, Gillham argued that 'as long as land remains privately owned and its rights remains unencumbered. It is susceptible to being subdivided and built upon.'[5] He added that 'without a highly developed system of private land ownership and a viable market for land, sprawl as we know it would be virtually impossible.'[6] Gillham indicates that 'concept of private land ownership is the foundation upon which the private home is built'. Gillham also indicates 'the private ownership of land and the huge, almost liquid, market for it are vital to the very survival of suburban sprawl.'[7] Gillham noted that 'the unique pattern of sprawl can be partly attributed to the abundance and relatively low cost of land, which is necessary to allow dispersed, low-rise development to occur.'[8] In relation to transportation patterns, Gillham argued that 'when trip origins and destinations are highly dispersed over a wide area (the result of a

[1]Girardetp, H (2007), p.109
[2]Bhatta, B. (2010), , pp.18-19
[3]Urban task Force Towards an Urban Renaissance Final Report, UK, (1999), p.viii
[4]Gillham, O. (2002), p.8
[5]Ibid
[6]Ibid
[7]Gillham (2002), p.9
[8]Ibid

continuum of low-density development), the private automobiles is often the only adequate mode of transport.'[1] Gillham indicated that 'as suburban patterns develop further and further from major urban centers, the car becomes the only real mode choice for most commuting trips. The car usually the only choice for suburban network trips because of the low density and horizontal separation of uses.'[2]

The third factor that influences sprawl according to Gillham is the telecommunications technology. Gillham argued that 'this technology revolution has made suburban sprawl possible on scale that could never have been envisioned in the early twentieth century. He indicated that 'together with roadways, cars and airports, advances in telecommunications and computer technology have substantially changed how these forces work, allowing many companies to abandon older models and to decentralize, relocating major portions of their business to suburban locations or wherever land and labor or both cost less.'[3] In my point of view, telecommunication has also contributed to spatial and social segregation as a person no longer has to live with or close to parents or relatives because phones- as common beliefs- can replace the social interactions. The fourth factor is the 'regulations and standards' that contribute to the final urban pattern as Gillham's debate. Gillham argued that 'how lands developed, where and for what use and even density and form'[4] are mainly determined by real estate markets. But once the market development has been established, publicity regulated land use control, or zoning, also can become a critical determinant in how land can be developed.'[5]

According to Ots et *al.* (2011), 'sprawl, characterized by an uncontrolled and disorderly spread of containers devoid of identity and of unifying elements such as car parks and shopping centres or open spaces, is to be considered as qualitative emptiness.'[6] While Root (2003) noted that 'the subsidisation of the auto owners, and particularly the auto owners in low-density areas, becomes a reinforcing pattern for continually extending the region of urban sprawl.'[7] The lack of mixed use development is considered as a significant driver for urban sprawl. In his description of sprawled development, Condon (2008) indicates that 'most residential areas have little or no commercial space within or near them. Conversely, commercial space is most often oversupplied within some drivable distance. This distribution eventually creates landscapes that are entirely auto dependent because any purchase will involve a car trip to a sprawling and often congested commercial zone.'[8]

[1]Ibid, p. 11
[2]Ibid
[3]Ibid
[4]Ibid, p.15
[5]Ibid
[6]Ots, E. et *al.* (2011), p.87
[7]Ibid
[8]Condon, P. (2008), p.45

Bekele (2005) argued that "sprawl in developed countries is usually a matter of *preference.* In the developed world, the movement of people from rural area of the country to more heavily populated cities and towns has been reversed. In contrast, for developing countries sprawl is largely a result of *necessity*.'[1]

Some debates designate *industrialization* as a major contributor of sprawl. For instance, Cawood et *al* (2006) argued that, 'a major cause of urban and regional expansion (as well as the growth of smaller towns and cities) is the ongoing competition to attract new business and industry by lowering costs, thereby creating economic growth and jobs.'[2] While Talen (2008) indicated that 'industrialization brought rising affluence, the growth of the middle class, cheap cars, cheap oil, highways and government subsidies, which, combined with racial and class intolerance, created a toxic mixture that sparked the most extraordinary sprawling out and spatial sorting of cities the world had ever seen,'[3]

Léautier (2006) indicated that, '... urban sprawl affects the time involved, and on the types of transportation services available.'[4] According to Banfield (1974) 'the *expressway* and (with minor exceptions) the housing program in effect pay the middle-class person to leave the central city for the suburbs. At the same time the urban renewal and mass transit programs pay him to stay in central city or to move back to it, have contributed to rapid, suburbanization and unplanned urban sprawl.'[5]

Meanwhile, some debates indicate technology as a significant reason for urban segregation as Shearer & Mouat, Chapter in Shearer et *al* (2009) noted that 'today opportunities afforded by advances in telecommunications continue to extend the range of physical distance between the home and the main office.'[6]

2.2.1 Low Density

Edward (2010) focused on density as a significant factor that reduces or boosts sprawl, 'any so-called 'sprawl' surrounding the city centre will mean that some land is available to support these urban refugees. In a post-oil world, everything still needs to be brought in and out of the high-density city and the energy to do this may not be there and will definitely be more expensive.'[7] Calthorpe & Fulton (2001) identified sprawl as 'a post-war strategy to house a growing middle class in low-density places knitted together by the car. This pattern once delivered affordable single-family homes, low crime, open space, and free access for the car. Now homes are distant and more expensive, crime spreads, open space recedes, and cars are stuck in traffic.'[8]

[1]Bekele, H.(2005), p.8
[2]Cawood, P. et al (2006), p.165
[3]Talen E. (2008), p.2
[4]Léautier, F. (2006), p.73
[5]Banfield, E (1974), p.17
[6]Chapter in: Shearer, A. et al (2009), p.17
[7]Edward Ng. (2010), p.20
[8]Calthorpe, P. & Fulton, W. (2001), p.2

According to Devuyst (2001) observation, 'low-density neighborhoods require more water and sewer pipes, power lines, roads, and building materials. Economic benefits from compact growth have been calculated. For example, the State of New Jersey would save 1.3 billion (U.S.) dollars if a compact growth development option was followed instead of the sprawl-as-usual.'[1] Additionally, Davoudi et *al.* (2009) indicated that, 'different densities in a built-up area will affect the local climate differently in different parts of that urban area. Overall density also affects how urbanization modifies the regional climate (wind conditions, air temperature near ground level, radiation balance, natural lighting, and the duration of fog and cloudiness)'[2]

The book *Urban Meltdown* by Doucet (2007) is a critical debate about 'poor city management 'on dealing with sprawl and climate change. The author argued that, 'urban densities are the result not of a city's total population, but of how people travel. If you move people around by car, urban densities will be slight because cars require so much space. On average, single occupant vehicles need four private and another four, on street, shared parking pads or stalls. Not surprisingly, every person in a single occupancy vehicle (SOV) takes eight times as much road space as eight people in a bus and 16 times as many people in a tram or a train.'[3]

2.2.2 Car dependency

As has been indicated already through this thesis, cars represent the most driving forces for sprawl. Most cities now are primarily designed for car utilities not for people as Cullingworth & Caves (2003) argue 'a common theme among critics of our development patterns is that our cities have been designed for cars, not for people. The automobile has given individuals the ability to live increasing distances away from their work. It has contributed to a type of isolationism among individuals. Individuals have turned to living in suburban tract developments. These sterile developments have led to the separation of neighbours. Neighbours do not know each other. In essence, there is no sense of 'community or neighborhood'.'[4]Schiller P, et al (2010): 'the patterns of transportation and urban land use associated with high levels of automobile dependence present an array of environmental, economic and social problems for the sustainability of cities, as summarized in table [2]'[5]

[1]Devuyst, D.(2001), p.29
[2]Davoudi, S. et *al.* (2009), p.37
[3]Doucet, C. (2007), p.49
[4] Cullingworth, B. & Caves, R. (2003), p.179
[5] Schiller P, Bruun E. and Kenworthy J. (2010), P.7

	Economic problems	Social problems
Oil vulnerability	Congestion costs	Loss of street life
Urban sprawl	High urban infrastructure costs for sewers, water mains, roads, etc.	Loss of community in neighborhoods
Photochemical smog	Loss of productive rural land	Loss of public safety
Acid rain	Loss of urban land to pavement	Isolation in remote suburbs with few amenities
High greenhouse gases – global warming	Poor transit cost recovery	Access problems for those without cars or access to cars and those with disabilities
Greater storm water runoff problems	Economic and human costs of transportation accident trauma and death	Road rage
Traffic problems: noise, neighborhood severance, visual intrusion, physical danger	High proportion of city wealth spent on passenger transportation	Anti-social behaviour due to boredom in car-dependent suburbs
Decimated transit systems	Public health costs from air and other pollution	Enforced car ownership for lower income households
	Health costs from growing obesity due to sedentary auto lifestyles	Physical and mental health problems related to lack of physical activity in isolated suburbs

Table 2: Problem associated with automobile dependence.

Source: Schiller P, et al (2010), p.7

According to Alexander (1977), 'a neighborhood can only have a strong identity if it is protected from heavy traffic.'[1] Regarding the enhancement of neighborhood's identity, Alexander argued that 'people need an identifiable spatial unit to belong to'[2]. He suggested of 'helping people to define the neighborhoods they live in, not more than 300 yards across, with no more than 400 or 500 inhabitants. In existing cities, encourage local groups to organize themselves to form such neighborhoods. Give the neighborhoods some degree of autonomy as far as taxes and land controls are concerned. Keep major roads outside these neighborhoods.'[3]

According to Kemp & Stephani (2011), 'today, most local governments have neighborhoods that are friendlier to cars and trucks than people. The sizes and configurations of streets, garages, cul- de- sacs, driveways, and other neighborhood and property elements were designed to accommodate automobiles and fire trucks rather than people.'[4] Nozzi (2003) argued that 'as we enter a new century, our vaunted mobility is, in fact, obstructed by a car culture in which every attempt to move is fraught with wasted motion, wasted time, wasted surroundings, wasted money.'[5]In his book *Urban Design Reader*, Carmona & Tiesdell (2007)

[1] Alexander, C. (1977), *A Pattern Language ,* Oxford University Press: New York, p.82
[2] Ibid, p.81
[3]Alexander, C. (1977), p.84
[4]Kemp, R. & Stephani, C. (2011), p.20
[5]Nozzi ,D (2003), p.8

indicated that 'the increase of car dependency comes at forefront of factors that contribute of creating 'lost space' in cities.'[1] It is obvious that cars have largely contributed to the deterioration of space. Nozzi (2003)) indicated that 'the higher the number of exits to a place, the less likely a true place would be there. It wasn't accidental. The high ratio of highway and ramps to a centre inevitably made for centreless sprawl.'[2]

A wide range of debates have focused on the contribution of cars to land consumption and air toxic waste. For instance, Jenks & Dempsey (2005) argued that 'if rural dwellers are oriented to a city lifestyle based on car commuting, the land becomes merely an object of consumption and the attractive nature of the land is compromised with traffic, pollution and increased road infrastructure.'[3] The book *Road to Ruin* by Nozzi (2003)is considered as 'full of empirical data, and this distinguishes it from the earlier polemical critiques of car culture. The book explains what every commuter ponders while stuck in traffic: how did cars take over our towns and our lives, what has it cost us, and what happens next?'[4] Nozzi argued that 'population growth is less to blame for sprawl than our car-centered lifestyle. When we widen streets and lay down huge asphalt parking lots, we make car travel cheaper, make it easier for people to drive longer distances to their jobs, and thus encourage more of us to live in remote, dispersed areas.'[5]

The book *Urban Structure Matters* by Næss (2006) envisages 'the influence of urban structure on travel behaviour'. The research is based on 'how spatial planning can be used to influence the amount of travel and the proportions carried out by different modes of conveyance, and thereby also energy use for transport. For example, the relationships between residential location and travel. The more transport requiring the spatial structure of the city, the higher losses of welfare will be the consequences of such changes in travel behaviour. The higher dependence on (car) travel is built-in in the location of urban facilities. At economic level, the more transport-requiring the urban structure, the higher taxes will be necessary in order to change travel behaviour among the households causing the heaviest environmental load through their daily travelling.[6] The urban

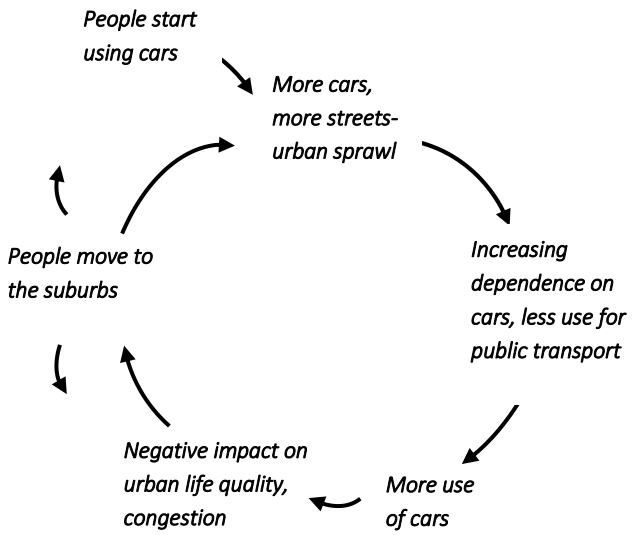


Diagram 1: Use of Automobile and Sprawl

Bekele H. (2005), p.9

[1]Carmona, M. & Tiesdell, S.(2007)
[2]Nozzi ,D (2003), p.78
[3]Jenks, M.. & and Dempsey, N. (2005), p.26
[4]Nozzi, D. (2003), pp. xiii-xv
[5]Nozzi, D. (2003), p.10
[6]Næss, P. (2006), pp.1-6

structural characteristics of residential areas could influence people's social pattern of contact. For instance, negative impacts of urban sprawl on the social interaction.[1]

2.3 Impacts of sprawl

Alexander (1977) argued that 'continuous sprawling urbanization destroys life, and makes cities unbearable'[2]'As sprawl continues, we consume more and more land per person, more infrastructure per person, and have a greater environmental impact as well.'[3] Downton (2009) describes sprawl as an aggressive tendency when he argued that 'sprawl kills in more ways than one. Spread out, pancake-shaped cities consume the landscape, ousting and destroying patterns of living material in places that had evolved over millennia. Sprawling cities and the automobile culture go hand-in-hand, they are integral to each other.'[4] According to Martine, G. et *al*. (2008), 'growing spatial mobility, especially an increase in daily commuting, is closely related to urban sprawl. The relative dependence on individual transportation is a key feature of the lifestyles associated with sprawl. The intense use of cars after World War II considerably increased the living spaces of daily life, separating place of residence from place of work and from access to services. Smaller families and the increase of women's participation in the labour force often meant different daily destinations for commuters from the same household. New phenomena, such as the environmental movement, communication technology, globalized economic production and consumption expectations, can all impact quickly on residential preferences and, thus, on urban form.'[5] Flint, A. (2006) demonstrated that, 'when we spend so much time in cars, it erodes quality of life and community. Try as we might to foster community, it's difficult to feel a sense of place. And there's the impact on the environment. Year after year, sprawl shows itself to be hugely inefficient and a money-loser for local governments.'[6]

One of the most significant impacts of sprawl is the loss of land. Steef Buijs in *Volume Magazine* indicates that 'sometimes up to ten times as much land went to waste as was directly used for urban expansion.'[7] Sieverts (2003) argued that 'it goes back to the discussions on urban sprawl, the large scale consumption of land and to the old debate on the optimal utilisation of the infrastructure. It is also a consequence of rising land prices.'[8] According to Preston et *al* (2010), 'the pattern of transportation and urban land use associated with high levels of automobile dependence present an array of environmental, economic and social problems for the sustainability of cities.'[9] Beigel & Christou (2010) also demonstrated that 'urban Sprawl is destroying landscapes and cities in many places of the world.'[10] They added 'it is a good tool in a situation where there is a risk of urban sprawl,

[1]Ibid, p.25
[2]Alexander ,C. (1977), p.22
[3] Russ, T. (2009), p.20
[4]Downton P. (2009), pp.399-400
[5]Martine, G. et al. (2008), pp.204-205
[6]Flint, A. (2006), p.16
[7]Steef Buijs in Volume Magazine issue no. 18, p.138
[8]Sieverts, T. (2003), p.30
[9]Preston et *al* (2010), p.7
[10]Beigel, F & Christou, P. (2010), p.26

and this is everywhere now. Urban sprawl is the end of urbanism really. It is a kind of soup with no place, no identity.'[1]

At sprawl's *social impact*, Maciocco (2008) argued that, 'in the discomposed city, sprawl, which is defined as the physical manifestation of modernity, the loss is linked mainly with the crisis in the space of proximity, which in our tradition was the place of personal social relations on a local scale, but also of the ephemeral, impersonal and cosmopolitan relations that characterised the birth of the metropolis.'[2] Similarly, Morris (2005), in his book*' Sprawl World AfterAll'*, 'illustrates how suburban sprawl has fractured social relationships and hastened the disappearance of civic-mindedness and how sprawl has reduced our overall quality of life and turned neighbors into strangers.'[3] Morris identified five characteristics of sprawl: 'low density design, lack of multi-use development patterns, automobile dependence, gridlock and inadequate public transit.'[4]

Some debates have focused on the impact of sprawl and car-dependency on *public health*. For instance, Orr (2006) argued that 'sprawl brings a range of human health problems. Suburbanites living in isolation from each other and dependent on the car for transportation are more obese, suffer more often from heart disease, are more prone to asthma, and are victims of other diseases rare in more concentrated communities.'[5] According to Dannenberg, et *al*. (2011) in *Making Healthy Places,* 'the extent of the network of well-built, high-speed roads may have indirectly contributed to increased motor vehicle injuries by fuelling urban sprawl, thereby increasing commute time, vehicle miles travelled, and exposure to traffic crashes.'[6] McCann & Ewing (2003), issued a report entitled: *Measuring the Health Effects of Sprawl.* The study, which was focused on '*Relationship between Urban Sprawl and Physical Activity, Obesity, and Morbidity*, found that people living in counties marked by sprawling development are likely to walk less and weigh more than people who live in less sprawling counties. In addition, people in more sprawling counties are more likely to suffer from hypertension (high blood pressure).'[7]

Some debates have demonstrated the *economic impacts* of sprawl. For example, Sorensen & Okata (2011) pointed out that, 'urban sprawl, resulting from high land prices in the central zones and the expansion of the city's peripheral areas, increased infrastructure costs (transportation, for instance) and led to negative and perverse consequences. The high costs of services such as transportation, lighting, sewage, waste disposal, or paving meant that poor families either received very low-quality services or no services at all.'[8] According to Nelson (2007), 'the fiscal costs of serving this kind of development pattern are the highest of all alternatives studied by researchers.' [9] In the book *Metroburbia,* Knox

[1]Ibid, p.142
[2]Maciocco, G (2008),p.96
[3]Morris D. (2005), p. iii
[4]Ibid,p.17
[5]Orr, D. (2006), p.9
[6]Dannenberg, A. et *al*. (2011), p.80
[7]McCann, B. & Ewing, R. (2003), p.1
[8]Sorensen A. & Okata J. (2011), p.347
[9]Nelson, A. (2007), p.49

(2008) argued that 'the economics of private subdivision lead to a lack of public open space, urban infrastructure, and civic amenities. The low densities inherent to single family suburban development result in increased traffic, long commutes, and a chronic dependence on automobiles. The environmental costs of automobile dependency include air pollution—and in particular the generation of millions of tons of greenhouse gases from suburban commuters—and polluted run-off from the roads and parking lots that constitute a third or more of suburban watersheds. The automobile-dependent lifestyles associated with sprawl, meanwhile, lead to increases in rates of asthma, lung cancer, and heart problems. Stress resulting from commuting leads to adverse effects on marriages and family life.'[1]

The impacts of sprawl also embrace the levels of *habitat and biodiversity*. For instance, the book *The Nature in Fragments: The Legacy of Sprawl,* focuses on the impact of sprawl into the biodiversity and 'to create a platform from which to integrate biodiversity issues, concerns, and needs into the growing number of anti-sprawl initiatives, including the "smart-growth" and "new urbanist" movements.'[2] Johnson & Klemens (2005) showed that 'sprawl plays a primary role in habitat loss, fragmentation, and degradation. Some impacts to species and ecosystems are well defined, others are more subtle, and some impacts will not become evident until many years after development of a landscape has occurred.'[3]

Dannenberg et *al*. (2011), in the book *Making Healthy Places* argued that 'criticism of sprawl has been strong in terms of both social and environmental consequences. Sprawl is associated with longer daily travel times and less family time, a health burden that includes greater stress, pollution from increased traffic, loss of green space, increased water use, and ecosystems compromised by fragmentation.'[4] 'People living in sprawling places drive 20 to 40 percent more than those living in compact places, leading to higher emissions for categorical pollutants and greenhouse gases'[5]

In the book *Philosophy and Design,* Vermaas (2008) revealed the impacts of sprawl in general way: 'Sprawling growth patterns eat land, increase travel time and cost, make walking both more difficult and dangerous, and lead to greater pollution levels. Sprawl also exacerbates social separations. Living patterns become increasingly segregated along racial lines. Sprawling development patterns are the result of the free market responding to people's true desires including the desire for a single-family residence and a patch of green.'[6] At the same level, Wheeler (2004), in the book '*Planning for Sustainability*', indicated that 'sprawl development is often fragmented (the landscape becomes a mosaic of inwardly oriented projects that don't relate to one another or are separated by oversized roads), discontinuous (developments leapfrog out into the countryside), homogeneous (each project contains only housing, offices, or stores), poorly connected (street networks are characterized by cul-de-sacs, loop roads, or other poorly connected patterns), and ecologically destructive (new development fails to take into account natural landscape

[1]Knox, P, (2008), pp. 31-32
[2]Johnson, E. & Klemens, M.(2005), p. viii
[3]Ibid, p.32
[4]Martine, G. et al. (2008), p.146
[5]Dannenberg, A. et *al*. (2011), p.156
[6]Vermaas, P.(2008), pp.330-331

features and helps generate pollution and excessive resource use). All of these characteristics undermine livability and sustainability.'[1]

According to Maciocco (2008), 'sprawl appears as a city adrift above all because it presents itself as urban growth without shape,'[2] while Tellier (2009) sees that 'urban sprawl eventually caused a decline of the population living downtown.' [3]Moor & Rowland (2006) noted that 'the landscape created by sprawl as having four dimensions: (1) a population that is widely dispersed in low-density development; (2) clearly separated homes, shops, and workplaces; (3) a network of roads marked by very large blocks and poor access; and (4) a lack of well-defined activity centers, such as downtowns and town centers. Most of the other features usually associated with sprawl – the lack of transportation choices, relative uniformity of housing options or the difficulty of walking.'[4]

2.4 International paradigms

2.4.1 Sustainability

The paradigm of *sustainability* has emerged as a significant debate that aims to enhance the quality of life as well as a judicious idiom for treating multi levels of socio-economic and ecological issues.The most common definition of sustainability emerged in 1987 in the report of World Commission on Environment and Development or Brundtland Report which defines sustainability as 'economic activity or development which meets the needs of the present without compromising the ability of future generations to meet their own needs'.[5] Cliff Moughtin and Peter Shirley (2005) indicated that 'the goal of sustainable development is to sustain human communities by development that does not destroy the fundamental environmental life support system.'[6]The majority of debates have demonstrated the rising of density, offering mixed use development and providing viable public transport systems are significant entities to attain liveable and sustainable urban patterns. These principles normally come under revolutionary paradigms such as 'compact city', 'smart growth', and 'new urbanism'.

The book, *This land: the battle over sprawl and the future of America* 'looks at the battles over growth in different communities and understand the challenges of establishing a more sustainable system.'[7] He urged that 'It's true that some sprawl is getting denser, so much so that some new homeowners are disappointed by how closely the houses are set to each other. It's also true that, technologically speaking, anything could happen—perfected hybrid or alternative fuel systems for cars or improvements in water distribution or agriculture might smooth out some inefficiencies. But counting on such advances seems a little like relying on a future lottery win to balance the household checkbook.'[8] The author is inspired by the notion *'smart growth'* as 'a call to build more compactly, to place homes and stores and workplaces closer to each other, and to take advantage of existing

[1]Wheeler, S. (2004), pp.3-4
[2]Maciocco, G (2008), p.7
[3]Tellier, L. (2009), p.529
[4]Maciocco, G (2008), p. 28
[5]World Commission on Environment and Development (1987)
[6]Moughtin, C.& Shirl, P. (2005), p.11
[7]Flint, A. (2006), p.6
[8]Ibid

infrastructure, especially trains and buses, instead of laying down so many miles of new asphalt. He also inspired by the movement of *'New Urbanism'* which is a practice that embraces compact layouts, located near means of transit, that rely on recycled building materials and alternative energy sources like solar and wind power.'[1]

The book , *the Sustainability Revolution: Portrait of a Paradigm Shift authore*d by Edwards, A., (2005) expressed the sustainability revolution as much similar to the industrial revolution as both trends have been worked to change our life in individual and communal level. The author argued that 'the Sustainability Revolution presents an alternative that supports economic viability and healthy ecosystems by modifying consumption patterns and implementing a more equitable social framework'[2]

2.4.2 Compact city

Compact city has dominated most international debates as the most powerful initiative utilized to combat urban sprawl. Several books have been published exclusively on the idea of compact city as one of the most striking practices to limit urban growth and attain sustainability (Jenks et *al*, 1996; Jenks & Burgess, 2000; Bruegmann, 2005; Ståhle, 2008). Jenkset al (1996) in the book *The Compact City: A Sustainable Urban Form* 'address some of the questions raised about the conceptions of the compact city. For example, questions are raised about the form and effectiveness of the compact city concept in achieving sustainability, and whether it means concentration and centralisation, or decentralisation with some degree of autonomy.'[3] 'Many see the high density compact city as a solution to many environmental problems, combating suburban sprawl by building at higher densities, encouraging walking, cycling and social interaction, and discouraging car use, aided by congestion charging, fewer parking facilities and the provision of reliable public transport systems, particularly light rail and trams.'[4]

In his book, *Sprawl: A Compact History,* Bruegmann (2005) 'looked at sprawl and public policy devoted to it primarily through the lens of history and at cultural issue. It examined the effects of urban decentralization on the city, the suburbs, and the exurbs. He argued that many of the problems that are usually blamed on sprawl—traffic congestion, for example—are, if anything, the result of the slowing of sprawl and increasing density in urban areas. He tried to show how cities have sprawled and how reformers have tried to stop this sprawl'[5] However, Dannenberg et *al.* (2011), in the book '*Making Healthy Places*' indicated that 'highly dense, compact cities are not necessarily the solution to the problem of urban sprawl. Because extremely dense settings may actually lead people to withdraw into their private spaces, careful consideration needs to be given to population density. On balance, mid-density designs with up to about forty dwelling units per acre appear to be optimal for interaction with neighbours and participation in groups, even though neighbourhood pride

[1]Ibid
[2]Edwards, A., (2005), p.3
[3] Jenkset al (1996), p.4
[4]Blewitt, J. (2008), p. 164
[5] Bruegmann, R.(2005), pp.8-12

and attachment may be highest at lower densities and use of neighbourhood facilities may peak at higher densities.'[1]

It's been argued that 'compact city policies may have a marginal effect on the overall level of urban land consumption.'[2] 'The compact city was the most efficient urban model that traditional communities in the hot regions of Muslim Arab countries developed in response to the harsh climatic agents. At present, compactness is becoming the central theme of sustainable development.'[3] In Australia, 'compact city policies are being developed and implemented in all capitals to deal with population pressures and urban expansion.'[4] The compact city strategy aims to intensify urban land use through a combination of higher residential densities and centralisation, mixed land uses, and development limits outside of a designated area (Churchman, 1999). 'Compact cities also typically involve concentrations of urban services and transportation options and high degrees of land-use planning controls.' Box [1].

Box 1: Compact city characteristics

[1]Dannenberg, A. et *al*. (2011), p.124
[2]Bhatta (2010), p.47
[3]Ben-Hamouche, M. (2008) in Archnet-IJAR Volume 2 - Issue 2 - July 2008, p.206
[4]Aurigi A. & De Cindio, F. (2008). p.76

- High residential and employment densities.
- Mixture of land uses.
- Fine grain of land uses (proximity of varied uses and small relative size of land parcels).
- Increased social and economic interactions.
- Contiguous development (some parcels or structures may be vacant or abandoned or surface parking).
- Contained urban development, demarcated by legible limits.
- Efficient urban infrastructure, especially sewerage and water mains.
- Multi-modal transportation.
- High degree of accessibility: local/regional.
- High degree of street connectivity (internal/external), including sidewalks and bicycle lanes.
- High degree of impervious surface coverage.
- Low open-space ratio.
- Unitary control of planning of land development, or closely co-ordinated control.
- Sufficient government fiscal capacity to finance urban facilities and infrastructure.

Source: OECD (2010), p.131

The high density involves a range of advantages. For instance, 'higher densities would mean less space is consumed per capita, and more land is saved for agriculture and for open space. Bus and rail better serve denser settlements, and there could be less reliance on the automobile. Higher densities reduce society's environmental footprint and slow the consumption of non-renewable resources.'[1]

However, compact city's criteria have to be evaluated according to our contemporary life's conditions and to gauge its liveability to the sustainable urban form. For instance density has to be measured according to many socio-economic and environmental conditions. For instance, the rate of density has to be efficiently obtained to enhance the quality of life because overrate density could boost the dilemma such as creating slums, traffic crowd, crime, poverty, etc. It was argued that 'using economic and environmental criteria, as well as social and political reactions to sustainable development ideas, it is possible to assess the compact city. This is done with reference to economic trends, resource efficiency, and its

[1]Jenks M. and Burgess R. (2000), , p.65

popularity among the people and politicians who we would expect to support and to live in it. The most obvious issues that future urban development forms will need to address are (in no particular order): accommodating growth, energy consumption, accessibility, economic viability, ecological integration and protection, political achievability, popular aspirations of quality of life and the burden of proof of success.'[1]

Alexander (1977) shows his book 'A Pattern Language' when argued about the right population for neighbourhood. According to him 'The neighbourhood inhabitants should be able to look after their own interests by organizing themselves to bring pressure on city hall or local governments. This means the families in a neighbourhood must be able to reach agreement on basic decisions about public services, community land, and so forth. Anthropological evidence suggests that a human group cannot coordinate itself to reach such decisions if its population is above 1500, and many people set the figure as low as 500.'[2]

At other position of his book, Alexander indicated that 'individuals have no effective voice in any community of more than 5000-10,000 persons.'[3] In order of investigating the solution, Alaxander suggested to 'decentralize city governments in a way that gives local control to communities of 5,000 to 10,000 persons. As nearly as possible, use natural geographic and historical boundaries to mark these communities. Give each community the power to initiate, decide, and execute the affairs that concern it closely: land use, housing, maintenance, streets, parks, police, schooling, welfare, neighbourhood services.'[4]

Gumuchdjian (1997) argued that: 'Dense cities can through integrated planning be designed to increase energy efficiency, consume fewer resources, produce less pollution and avoid sprawling over the countryside. It is for these reasons that I believe we should be investing in the idea of a 'Compact City' - a dense and socially diverse city where economic and social activities overlap and where communities are focused around neighbourhoods.'[5]

2.4.3 Smart Growth

Smart Growth is a movement which emerged in mid-1990's 'as an effort to recast the policy debate over sprawl in a way that more directly links the environment, the economy and daily life concerns. In 1996, the US Environmental Protection Agency launched ten smart growth principles:

1. Mix land uses.
2. Take advantage of compact building design.
3. Create housing opportunities and choices.
4. Create walkable communities.
5. Foster distinctive, attractive communities with a strong sense of place.
6. Preserve open space, farmland, natural beauty, and critical environmental areas.
7. Strengthen and direct development toward existing communities.
8. Provide a variety of transportation choices.

[1]Jenks, M. et.al. (2005), P.46
[2]Alexander, C. (1977), p.81
[3]Ibid, p.71
[4]Ibid, p.73
[5]Gumuchdjian, P. (1997), p. 35

9. Make development decisions predictable, fair, and cost-effective.
10. Encourage community and stakeholder collaboration in development decisions.'[1]

In his book 'Growing Smarter', Bullard (2007) indicates 'smart growth' as a movement that is not only a response to suburban sprawl along with the kaleidoscope of urban problems related to housing markets, business location, migration, land use, transportation, pollution, conservation, and environmental protection, but also as a tool to manage growth while creating healthy, livable, and sustainable communities.'[2]

Smart growth is a new term that has emerged in modern urbanism as an urban growth's discipline that is utilized to meet the targets of sustainability. It has been argued that 'smart growth is an urban planning and transportation theory that concentrates growth in the centre of a city to avoid urban sprawl; and advocates compact, transit-oriented, walkable, bicycle-friendly land-use, including neighbourhood schools, complete streets, and mixed-use development with a range of housing choices.'[3] Diagram [2] represent a conceptual model of smart growth. Smart growth paradigm has various advantages in relation of meeting the sustainable urban growth as 'it values long-range regional considerations of sustainability over a short-term focus. It balances the competing interests of the environment, the economy, and quality of life.'[4] Its objectives also include 'achieving a unique sense of community and place; expand the range of transportation, employment, and housing choices; equitably distribute the costs and benefits of development; preserve and enhance natural and cultural resources; and promote public health. Smart growth programs often involve a package of tools such as mixed-use zoning, comprehensive plans, subdivision regulations, development fees, exactions, and infrastructure investments, applied together with high-density development.'[5]

'The U.S. Environmental Protection Agency identifies the following 10 principles of smart growth:
1. Mix land uses
2. Take advantage of compact building design
3. Create a range of housing opportunities and choices
4. Create walkable neighbourhoods
5. Foster distinctive, attractive communities with a strong sense of place
6. Preserve open space, farmland, natural beauty, and critical environmental areas
7. Strengthen and direct development towards existing communities
8. Provide a variety of transportation choices
9. Make development decisions predictable, fair and cost effective
10. Encourage community and stakeholder collaboration in development decisions.'[6]

According to Kemp, R. *et. al*.(2011) argue, 'to implement smart growth, a community must decide what space needs to be protected for recreation, community character, the

[1]Moor, M. & Rowland, J. (2006), p.41
[2]Bullard, R (2007), p. 2
[3]B. Bhatta (2010), p.39
[4]Ibid, p.41
[5]Ibid, p.p.41-42
[6]Kemp, R. et al.(2011), p.226

conservation of natural resources, and open space. These decisions are unique to each community and are often controversial. Making these decisions helps shape growth appropriately and control costs.'[1]

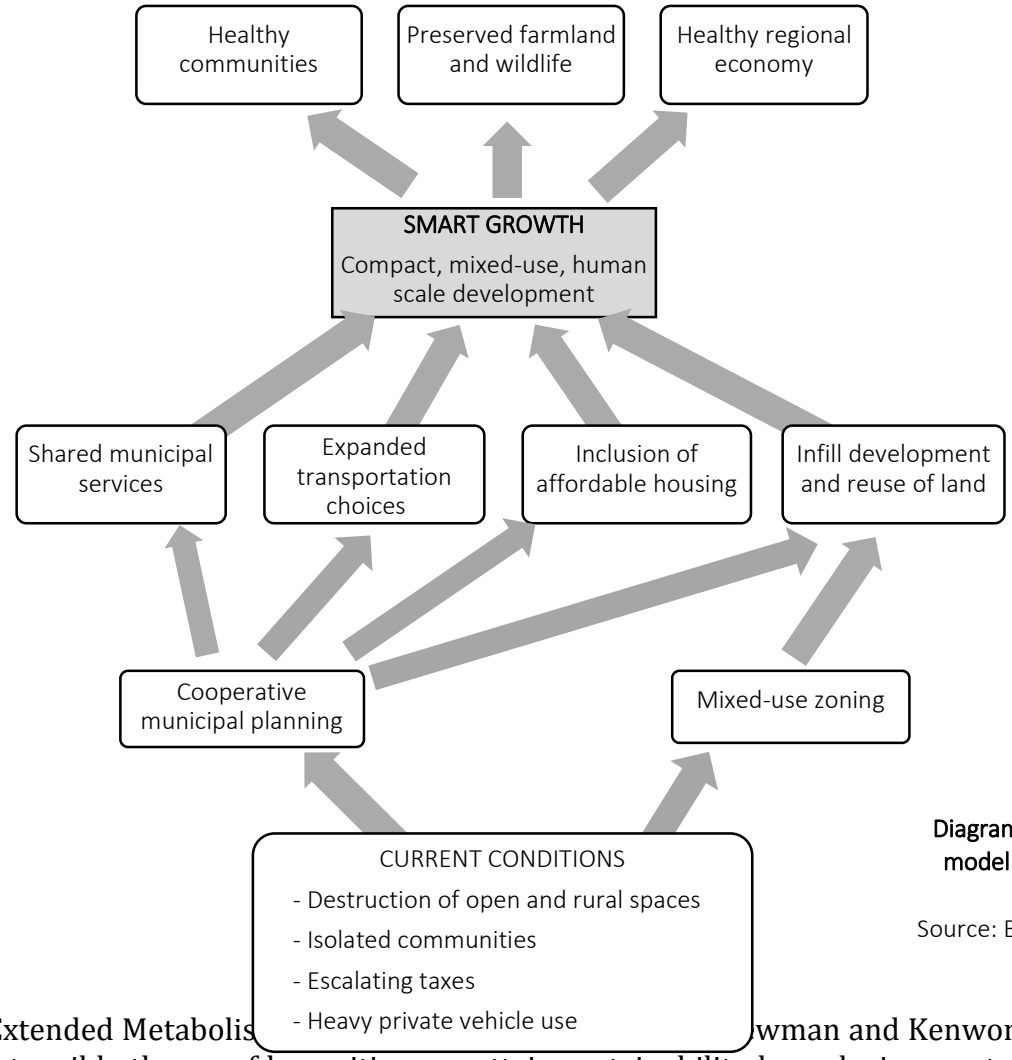


Diagram 2: A conceptual model of smart growth

Source: Bhatta (2010), p.40

Extended Metaboli wman and Kenworthy represents a tangible theory of how cities can attain sustainability by reducing waste and resources consumption while increasing the liveability. The model suggests 'how cities can become more sustainable by reducing their resources and wastes while increasing their liveability'[2], See figure (4).

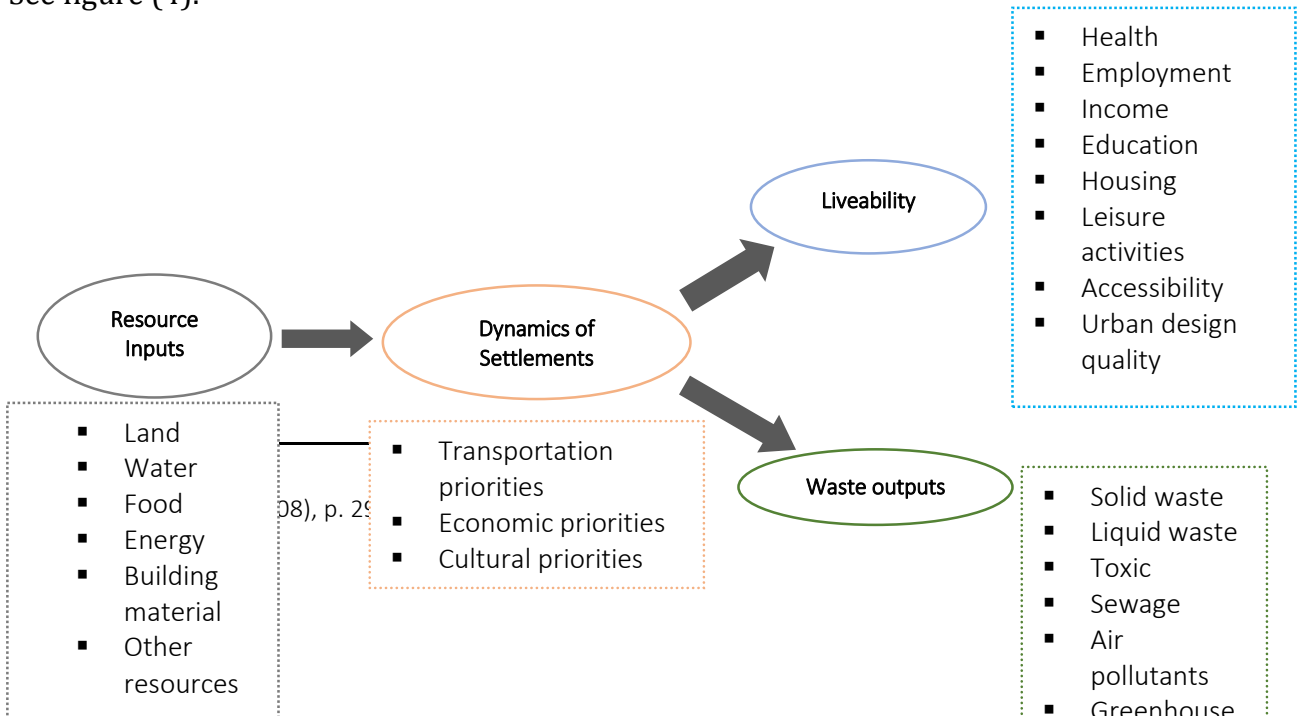


Figure 4: The Extended Metabolism Model

Source: Newman & Jennings (2008), p. 29

'One of the most intransigent problems of managing cities is to do with establishing and maintaining an optimum size to suit their function. Even if an ideal size can be ascertained, there remains the problem of how to maintain it despite pressures of growth. The first valid approach to this problem was not made till Ebenezer Howard broached it at the end of the nineteenth century in the book that became 'Garden Cities of Tomorrow.'[1]

Despite the garden city movement is mostly inapplicable in hot-dried areas like Oman, but it represents the first manifesto which has seriously attempted to manage the large-scale urban growth. 'Howard understood that it was important that the decentralization the metropolises not sprawl out over the countryside but be concentrated in carefully-planned, mixed-income and mixed-use "garden cities" which would achieve a small-scale urbanity, walkability, and economic vitality along with close contact with nature.[2] Howard's designed was based on density as an efficient parameter for 'adequate standard of living'.

[1]Downton (2009), p. 101

[2]Banerjee, T. and Sideris, A. (2011), p.37

Consequently, 'his approach to planning included the land to grow the food for the people living at higher density in the central part of the garden city. He also acknowledged the need for some people to live in agricultural areas at much lower density in order to grow food. In this way he arrived at the ideal figure of 32,000 people: 30,000 in the garden city at a density of 30 persons per acre and 2000 in the agricultural hinterland at a density of 2 persons per 5 acres.'[1] 'The Garden City embraces the concept of people creating their own built, economic and social environment.

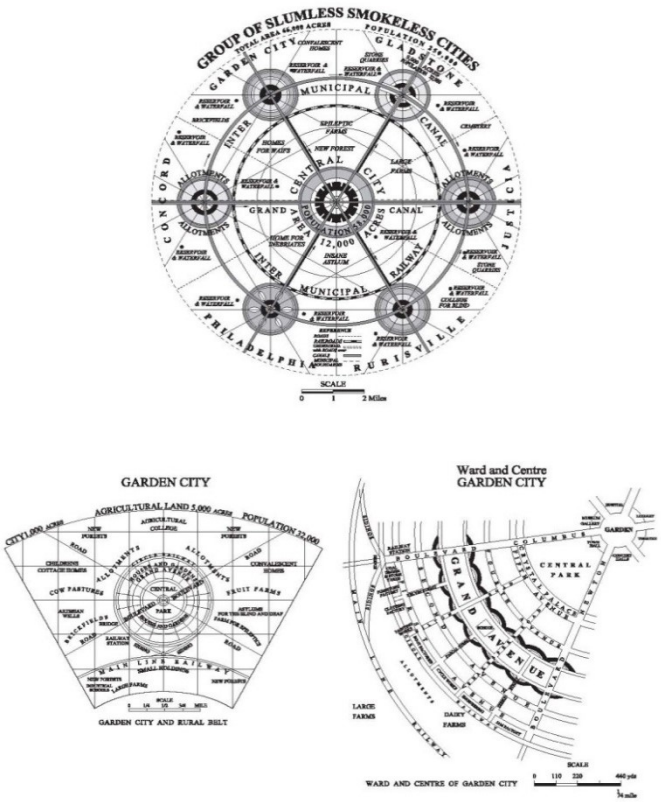


Figure 5: Structure of Howard's Garden City

Source: Pacione, M. (2009), p.169

Thus Howard's concept responds to many of the characteristics of a sustainable city: decentralisation of the core city's functions to generate all needed local services and facilities in each Garden City, and in the farmland surrounding it; decentralisation of responsibility and participation of the communities in the process of shaping and building their own cities according to their needs and aspirations; a symbiotic relationship with the countryside; a considerable degree of open-endedness and flexibility of development; and virtually limitless growth of the pattern to any metropolitan size.'[2]

Box 2: Reasons for high-density living

- Living closer together encourages more community interaction, and reduces isolation for vulnerable social groups, such as young families;
- Compact settlements require less transport and reduce car use, with health and environmental benefits;
- Higher-density development is environmentally beneficial, resulting in lower carbon emissions;
- In rural areas, more compact villages could help to stem the decline in rural services, such as shops, post offices and bus services.

Source: Edward, Ng. (2010), p.xxxiii

[1]Edward, Ng. (2010). p.24

[2]Frey, H (1999), p.p 77-78

2.4.4 Urban Village

The idea of 'urban village' which 'offers environmental benefits, high-quality and affordable neighbourhoods, and mixed-use urban space with stable and diversely populated communities',[1] has been effectively utilized to alter the sprawled urban development in many worldwide cities. The urban village paradigm is based on medium density, mixed use development integrated with viable public transport, safe and convenient pedestrian pathways as well as qualitative public spaces. In general, the notion is proposed to combat most of sprawl's characteristics such as lessening the car-dependency through encouraging walking, cycling and public transit. According to Grant (2006*),* 'urban villages seek to combine urban features (like ready access to public transportation) with village features (like daily needs ready at hand in a walkable environment).'[2]

The book, *Urban Villages and the Making of Communities by* Neal, P. (2003) is the latest book that takes the notion of urban village as a comprehensive method of research and investigation. 'The urban village paradigm first emerged in 1989 by the Urban Villages Forum which was formed on the initiative of the Prince of Wales whose concern over the quality of urban development had long been evident. Their first report was published in 1992. It was a combination of the Prince of Wales' urban design ideas and the neighbourhood concept.' [3] 'The report identified six essential qualities for a successful urban village' as shown in box [3]

Box 3: Six essential qualities for a successful urban village

- **It should be small enough for any place to be within easy walking distance of any other**, but large enough to support a wide range of activities and facilities. The forum envisaged a combined resident and working population of 3000–5000 people and a notional area of 100 acres (40 hectares).
- **There should be mixed use providing both homes and workspaces aiming to achieve a 1: 1 ratio between jobs and residents available for work.** This would reduce, but not eliminate, the need for commuting as a degree of inward and outward travel to work would be expected.
- **Tenures should be mixed both for residential development and employment uses.** This would allow flexibility to accommodate demographic change, particularly the increasing number of elderly, and changes in work patterns, including increasing numbers working from home.
- **It should provide an admirable environment. There should be a mixture of different types and sized of buildings with a more densely built-up central area.** Main streets should have a mixture of uses within buildings, with precedence given on ground floors to shops, restaurants, pubs and other public uses.
- **There should be a pedestrian-friendly environment which caters for the car without encouraging its use.** A wide range of traffic calming measures and devices are available which civilise driving and enhance pedestrian priority.
- **There should be a mixture of different types and sizes of buildings and, in the more built-up central area, a mix of uses within buildings.** On main streets the ground floors should be given over to public facilities and services which bring life to urban spaces.

Source: Towers, G. (2005), pp. 67-68

[1]Blewitt, J. (2008), p.163
[2]Grant, J. (2006), p.125
[3]Towers, G. (2005), p.66

John Punter. (1999)[1] argued that:

> *"Urban villages are intended to have a strong core of commercial facilities, increased densities within one-quarter of a mile of the city centre, a social and economic mix, strong pedestrian orientation, a variety of house types and costs, mixed uses (vertically), appropriate community facilities, stronger transit and cycle/ pedestrian connections, reduced parking space, integrated public space and a unique identity." Punter J. (1999)*

In exploring scenarios for urban village development options, there are 'three identical approaches which effectively illustrate the difference between 'medium density' Australian models of urban form and European models:

- Scenario I 'Liveable Neighbourhood' supposes compact layouts so that people are within 5 minutes' walk of local centres, simply connected streets where people can walk, cycle or take public transport.
- Scenario II proposes more community space, car-free housing and upgraded public transport along with rainwater capture, grey water recycling and community gardens.
- Scenario III applies 'some of European best practice of sustainability-oriented urban planning' to the mobility management and ecological components of Scenario II.'[2]

2.4.5 New Urbanism

New Urbanism is an urban design movement that has emerged in the USA in early 1980s. The movement suggested neighbourhood which promotes walkability, range of housing types aside by job vacancies. As Joseph E. & Szold T. (2005) argue, 'it has emerged 'as a response to the broken promises of suburbia and an effort to improve the quality and diversity of the human habitat.'[3]
In relation to the 'region: metropolis, city, and town', 'the new urbanism promotes the elements of healthy metropolitan form. This includes (1) polycentric metropolises organized so as to produce a coherent whole of nature, farmland, and a hierarchy of communities: villages, towns, and cities organized along transportation routes; (2) investment in cities and their infrastructure; (3) limits to encroachment onto natural and agricultural open space; (4) jobs and correspondingly priced housing linked by a transportation network that incorporates transit; (5) regional cooperation to coordinate growth; and (6) communities composed of identifiable neighbourhoods and districts.'[4]

In relation to the 'neighbourhood, the district, and the corridor' 'characteristics include (1) compact, pedestrian-friendly, and mixed-use fabric;(2) a pedestrian shed, reflecting the distance people will willingly walk (5–10 minutes), organized so that daily destinations and transit are easy to reach on foot; (3) a continuous street grid laid out so that local traffic can avoid arterials, in a pattern that responds to local topography, climate, and history; (4) a mix of building types and uses that includes dwellings and business quarters, with sufficient

[1]Punter J.(1999), p.40
[2]Downton, P.(2009), p. 554
[3]Joseph E. & Szold T. (2005), p.294
[4]Hutchison, R. (2010), p.551

density to justify conveniences within walking distance; (5) respect for historic buildings, neighbourhoods, and landscapes; (6) environmental practices, open spaces, parks, and infrastructure that are adjusted to the intensity of the urbanism and that promote natural methods of climate control and water conservation; (7) recognizable types of civic open spaces modelled by urban buildings; and (8) urban design regulated through graphic design and/or zoning codes.'[1]

In relation to 'block, street, and building', 'guiding principles include (1) blocks that average a quarter mile or less in perimeter to provide frequent intersections and slow traffic and give pedestrians more choices; (2) streets designed and sized for the comfort of cyclists and pedestrians, with wider sidewalks, and narrow lanes to keep vehicles at safe speeds; (3) buildings with facades that align to bound public spaces physically— rather than stand as objects in the landscape; (4) building types whose proportions enable them to be organized into a harmonious ensemble—regardless of style; (5) parking on streets and behind buildings; (6) a system of familiar and appropriate public and private boundaries, such as fences, hedges, gates, porches, and doors; (7) civic buildings designed to be more prominent than ordinary buildings, by sitting if not by size; and (8) historic buildings preserved whenever feasible and emulated when they form an urban fabric.'[2]

'New Urbanism, an urbanistic trend promoted by Peter Calthorpe, tries to condense the ideals of the Garden City. For Calthorpe, the American suburbs should behave like small urban nuclei with their "pedestrian pocket" and with a centre of public transport reachable on foot in ten minutes.'[3] 'Although new urbanists dislike sprawl, they do not suggest that there should be a return to dense cities. Instead, new Urbanists planners want to improve on suburbia by introducing more variety to residential blocks, by allowing mixed land-use, and by making towns pedestrian rather than automobile friendly.'[4]'New urbanism responds to issues of sprawl and modernity in the city. It seeks to manage growth by making cities more urban/urbane, and to restore the kind of vibrant neighbourhoods experienced in the early twentieth century.'[5]

[1]Ibid, p.551
[2]Ibid
[3]Maciocco, G (2008), pp.27-28
[4]Parker, S. (2004), p.66
[5]Grant, J. (2006), p.14

2.5 Potent remedy for sprawl

The problem requires undertaking viable policies and strategies to limit the urban growth and combat the urban sprawl in a comprehensive way. For instance, 'by 2000, over 250 local authorities in the USA had held plebiscites on initiatives to begin to tackle sprawl and car-dependence.'[1] Ben-Joseph & Szold (2005) indicated that 'counteracting sprawl is possible only if one has a clearly articulated and technically elaborated proposition concerning the alternative. Environmentalism needs a theory of urban form as much as New Urbanists need a theory that enables them to understand the ecological impact of urban development.'[2]

There are many mechanisms and initiatives that have been utilized globally to limit the urban growth and restrain the phenomenon of sprawl .For instance, *Green Belt* strategy which emerged in Great Britain is one prominent technique that has been utilized to limit the urban expansion around metropolitan centres. Though it hasn't attained the promising success to stop the rapid urban growth of London, it has in fact achieved some targets to limit sprawl. Along with the success of London's Green Belt initiative, in North Korea, the government applied the *Green Belt* policy 'to prevent urban sprawl, to protect agricultural land, and to preserve the natural environment. In designating the greenbelt around Seoul, the government felt that urban sprawl would be contained as long as vacant land remained in Seoul for urban uses. However, the greenbelt resulted in the densification of the inner city and unplanned development beyond the greenbelt. Over time, the density differential inside and outside the greenbelt has equalized.'[3]

Likewise, 'the green belt policies have been applied in Adelaide, Melbourne, Ottawa, Ontario, Vancouver, Toronto, Seoul, Beijing, Hong Kong, Portland, Minneapolis, Virginia Beach, Lexington and more than 20 cities in the San Francisco Bay Area. In these examples, the green belt is a protected land aimed to reduce sprawl and to compact the city core, an approach that is often supported by an "Urban Growth Boundary" (UGB).'[4] Green belt principles can also be applied in the Arabian Peninsula. It has been argued that 'in the 7th century, Muhammad established a green belt around Medina. He did this by prohibiting any further removal of trees in a 12-mile long strip around the city.'[5] One of the highly prominent practices used to limit urban growth is *Urban Growth Boundaries* (UGBs). UGBs 'curb sprawl by targeting growth into pre-existing cities and immediately adjacent areas. A UGB is essentially a line on the map within which development is encouraged and outside of which development is prohibited or strongly discouraged.'[6] One of the potent tools of increasing the density is adopting the programs of '*multiple-family buildings*'. These programs tend to 'conserve land and thereby prevent urban sprawl; local stores reduce the necessity for owning automobiles or driving long distances; and light plants serve all these purposes and, most important, provide employment for local residents.'[7]

[1]Badcock, B, (2002), p.241
[2]Ben-Joseph, E. & Szold, T. (2005), p.307
[3]Sorensen A. & Okata J. (2011), p.47
[4]Ståhle, A. (2008), p.191-2
[5]http://en.wikipedia.org/wiki/Green_belt accessed on 9/9/2012 based on Iqbal, M. (2005), p. 27
[6]Perlman, D. & Milder, J. (2004), p.192
[7]Ben-Joseph, E. & Szold, T. (2005), p.221

Integrating *master plans* into urban development is one, option not only to channel the urban growth pattern, but also to avoid the emergence of patchwork and scattered developments. Thorns, D.(2002) indicates that 'such plans usually entailed some form of limit to the spread or 'sprawl' of the larger cities and a strategy for 'decentralistion' either through deliberate planning decisions or through putting in place a set of incentives.'[1]

According to OECD (2001), 'uncontrolled urban development, generally leading to low-density urban sprawl, consumes valuable agricultural land and effectively "locks" industries and households in energy-intensive production and consumption patterns. Strategic land-use planning — integrating industrial, residential and transport-related land use planning— entails forecasting future growth trends; identifying likely constraints and opportunities, and negotiating appropriate responses with affected communities and enterprises. Relevant measures include: reserving areas for low-income housing development, to avoid confining low-income groups to the urban periphery; encouraging a mix of residential developments, employment, leisure, health care and education; confining certain industrial activities to specially designated areas and away from vulnerable waterways; integrating transport and land use planning; using green spaces to prevent development in dangerous areas such as unstable hill slopes, and many others. Strategic urban planning can considerably lower the cost of providing public infrastructure by reducing, among other things, lengths of roads, gas and water pipes, and electricity lines.'[2]

The Newman's book *'Resilient Cities'* is proposed for 'understanding the implications of certain actions and finding hope in the steps that can be taken to create resilient cities in the face of peak oil and climate change.'[3] In his book *'Sprawl repair manual'*, Tachieva, G. (2010) introduced a very interesting piece of work which is considered as 'guidance for transforming fragmented and inefficient development into complete communities that are liveable and robust. Polemical as well as practical, the manual equips design professionals, developers, regulators, and citizens with strategies drawn from successful built projects.'[4]

In his book '*Sprawl Costs'*, Burchell, R. (2005) proposed 'to provide a reasonable amount of evidence on the costs of sprawl as well as the potential savings as a function of more compact growth. The study laid out how and why sprawling low-density development is more expensive than compact forms of development. The book visualizes the linkages among resource conservation, planned growth, economic development, and quality of life. It makes the resource, economic, fiscal, and market sense to be careful about where and how we grow.'[5]

Chiras & Wann (2003), *Suburbia: 31 Ways to Create Sustainable Neighbourhoods* is a book about 'reinventing existing neighbourhoods — both suburban and urban — to make them livelier and more productive, a goal shared by many. It offers specific ideas for social and physical changes to enrich the neighbourhoods we already live in. It's intended as a book of possibilities for reconnecting people with both neighbours and nature.'[6]

[1]Thorns, D.(2002),p.182
[2]OECD (2001),p.258
[3]Newman, P.et.*al.* (2009), p.2
[4]Tachieva, G. (2010), p.1
[5]Burchell, R. (2005), pp.7-9
[6]Chiras, D. & Wann, D. (2003),p.1

Planning for better utilization of infrastructure is a significant demand for sustainable development. The book *Sustainable Infrastructure* by Sarte, S. (2010) 'demonstrates how to create more liveable communities by blending ecologically functional and reliable design with an artistic sensibility to make infrastructure that is both green and good-looking. It shows designers how to reconnect the public to vital resources like open space, clean energy, running water, and biodiversity by creating infrastructure that is beautiful to look at as well as a source of knowledge and pride about our relationship to where we live.'[1] With regard to Brundtland's definition of sustainability, 'it is important to analyse the wider impacts of urban sprawl on today's communities, as well as how these impacts are set to develop into the future.' [2] The Millennium Village programme (2000) set out 'seven tests of sustainability' as showed in Box [4].

Box 4: Seven tests of sustainability

1. Minimising resource consumption. This means using high-density forms which consume less land and make more efficient use of other resources.
2. Protecting and enhancing environmental capital. This means that environmental value should be enhanced by development.
3. Urban design quality. There should be a coherent pattern of streets and public spaces which is permeable to pedestrians and provides access to facilities and amenities. It should aim to accommodate personalisation and respect privacy. At the same time safety and security should be a high priority.
4. High quality of life. There should be a full range of public services, local amenities and public transport and these should be provided before the new residents move in. Residents should have access to employment opportunities and training. The development of local employment improves quality of life and also reduces the extent of daily travel.
5. Increased social inclusion. The development of mixed communities depends on accommodating a range of incomes, social status and household structure. This means providing a range of different housing types and sizes.
6. Broad participation in governance. Residents should be involved in decisions about design, planning, construction and management.
7. Commercial viability. This is not to say that public funding is unnecessary. Government investment is commonly needed to kick-start major developments.

Source: Office of the Deputy Prime Minister (2000) based on Towers, G. (2005), pp.72-77

[1]Sarte, S. (2010), p.xiv
[2]Arbury, J., p.32

The book *"Sustainable Site Design"* by Dinep & Schwab (2010), 'provides criteria, a process, and case studies for looking beyond site-only solutions to integrate regional and site concerns and maximizes sustainable landscape design potentials.'[1] In the book *Sustainable Urban Planning* by Riddell (2004), amongst its contribution of providing guidance for sustainable urban planning in a comprehensive way, it 'offers up the ideal of neighbourhood-based sustainable urban planning, particularly as a social objective for middle-income households, in contrast to bluntly physical standard suburbia and urban sprawl.'[2]

Sustainable Cities for the Third Millennium by Mega (2010), 'addresses the most critical challenges for cities, humanity's collective masterpieces in danger, and analyses breakthrough responses for sustainable development, a globalisation with human face and the transition to inclusive post carbon communities.'[3] The author pointed out that 'cities now face a range of challenges, such as urban sprawl, the loss of green spaces (greenfields), the development of abandoned or contaminated land (brownfields), distressed urban areas, gridlocked traffic and overstretched infrastructures, which are not addressed by conventional policies. They result in an accumulation of problems, further aggravated by the economic crisis, which often exceed their capacity to offer the quality of life expected by citizen.'[4] The book *Sustainable Development and Planning V* by Brebbia & Beriatos (2011) considers energy conservation as a significant approach for combating urban sprawl and 'to fulfil the criteria of sustainability. The analysis uses three parameters: energy saving and conservation, energy efficiency and renewable energy sources' to obtain this target. [5] The book *The Sustainable City IV by* Mander et *al*., (2006), 'addresses the many inter-related aspects of the urban environment from transport and mobility to social exclusion and crime prevention.' It also covers 'Architectural issues; Cultural heritage; Planning issues; Planning, development and management; Strategy and development; Land use and management; Environmental management; Energy resources; Sustainable transportation and transport integration; Traffic and transportation; The community and the city; Socio-economic issues, and Public safety.'[6]

Encouragement of local food production is one way to ensure the sustainable urban development. According to Preston et *al*. (2010), 'with the peaking of world oil production, cities increasingly need to retain as much near-city agricultural production as possible to minimize the energy content of food.'[7] There were ample debates associated to the management of urban growth. For instance, Nelson & Dawkins (2004) argue that, 'growth management should meet development needs in a manner that preserves public goods, minimizes fiscal burdens, minimizes adverse interactions between land uses while maximizing positive ones, improves the equitable distribution of the benefits of growth, and enhances the quality of life.'[8]

[1]Dinep, C. & Schwab, K. (2010, p.vi
[2]Riddell, R. (2004), p.73
[3]Mega, V. (2010), p. xi
[4]Mega, V. (2010), p. 30
[5]Brebbia, A. & Beriatos, E. (2011),p.133
[6]Mander, Ü. et *al*. (2006), p. ix
[7]Preston, L. et *al*. (2010), p.8
[8]Nelson and Dawkins (2004) quoted by Connerly, C., et *al.* (2007), p.194

Environmental awareness emerges as a significant response for sustainable development. According to Richardson & Bae (2005), 'the rising environmental awareness of the public may create a call for the preservation of raw land and for high-density urban development.'[1] Ellin, N (2006) argued 'Integral Urbanism runs counter to prevailing urban development characterized by freestanding single-use buildings connected by freeways along with rampant (sub)urban sprawl and the attendant environmental, social, and aesthetic costs.'[2]

In his book *'Making Healthy Places'*, Dannenberg, A. (2011) argues about creating healthy places, ' places in which people can grow up, live, work, play, study, pray, and age in ways that allow them to be safe and healthy, to thrive, and to reach their full potential.'[3] In their book '*The Regional City: Planning for the End of Sprawl*' Calthorpe & Fulton (2001) 'describe three interrelated phenomena: the emergence of regionalism the maturation of the suburbs, and the revitalization of older urban neighborhoods to provide a manifesto for all those who see traffic jams, loss of open space, and racial divisions not as necessities to be endured but as problems to be solved.'[4] Erickson, D. (2006), argued that 'the protection of open space is a primary driver of efforts to curb sprawl.'[5]

Planning for a New Century, by Barnett (2001), introduced 'a wide range of topics, such as transportation and land-use planning, zoning and design, housing, public education, welfare reform, public safety, downtown revitalization, pollution control, and protection of open spaces and natural areas' in order to combat urban sprawl and to broaden the livability at urban areas. 'Sprawl was originally coined as a pejorative term for seemingly unplanned new development spreading outward from older cities and suburbs, but sprawl also turns out to be the product of a complex inter-action among government programs and private enterprise.'[6]

Dannenberg et *al*. (2011), in the book '*Making Healthy Places'* indicated that 'one way to create dense, mixed-use communities is to discourage the outward expansion of sprawl at the regional or metropolitan level'[7] 'Decisions about the use of land are fundamental in determining the built environment. Policies about land use can promote or impede environments that support health: for example, they can encourage compact development patterns or sprawl'[8] Porter (2008) argued in accordance to the cost-of-sprawl studies, 'capital costs of streets, sewers, water, storm drainage, and schools for a typical subdivision of three houses per acre can be reduced by at least one third by developing near basic public facilities and employment centers and at densities averaging twelve houses per acre (assuming a mix of housing types).'[9]

[1]Richardson, H. & Bae, C. (2005), p.25
[2]Ellin, N. (2006), p.135
[3]Dannenberg, A. et *al.*(2011), p.5
[4]Calthorpe, P. & Fulton, W. (2001), p. xvi
[5]Erickson, D. (2006), p.4
[6]Barnett, J. (2001), p.2
[7]Dannenberg, A. et *al*. (2011), p.164
[8]Ibid, p.274
[9]Porter, D. (2008), p.68

I feel that urban task force is the best practice that establishes a comprehensive framework to deliver a new future for urban growth. The final report which is entitled 'Towards an Urban Renaissance' established a vivid image of what our city should look like if it intends to attain sustainable growth. In his introduction of the report Lord Rogers indicates that 'it is about creating the quality of life and vitality that makes urban living desirable. The report contains over 100 recommendations for change. They cover design, transport, management, regeneration, skills, planning and investment.'[1] The Pacione (2009) book, *Urban Geography* has not only revealed the negative effects of urban sprawl but also introduced several planning policies and a wide range of development strategies with multi disciplines to combat the sprawled development and manage the urban growth.[2]

Urban Growth Management and Its Discontents by Dierwechter (2008) is one of the latest books that have taken urban growth under investigation and practice. The book has indicated multiple projects, trends, and rationalities to shape and regulate urban growth in metropolitan regions, and to maintain landscapes of economic justice and social diversity.[3]In the book, *Urban Planning Today*, Saunders (2006) argued that sprawl problem cannot be treated in isolation with single purposes policies but it has to occur 'at both regional and local levels in large-scale strategic planning connected to a new sense of urban design. It involves new codes, technical standards, policies, financing mechanisms, and land -use patterns.'[4]

In the book, *Visionaries and Planners*, Buder (1990) is inspired by the Howard's *Garden City Movement since* his 'ideas still intrigue and provoke in the ongoing debate about the problems of large cities and our more recent concerns with their suburbs.'[5] The author tried to 'trace the various influences that led to Howard's vision of the garden city. It explains the remarkable success of the Garden City movement while examining the changes brought about by the rise of the profession of city planning and the effort of building two garden cities.'[6] Finally, 'this hook ends with a consideration of the future of Howard's ideas arid their relevance to the modern community.'[7] The author has tried to prove how the Garden City movement 'was radically reshaped in our own century.'[8]

[1]Department of the Environment, Transport and the Regions (1999), p.viii
[2]Pacione, M.(2009)
[3]Dierwechter, Y. (2008)
[4]Saunders, W. (2006), p.118
[5]Ibid
[6]Ibid
[7]Ibid
[8]Ibid

2.5.1 Future transport

Most international debates consider Transport as a principal factor for forming urban patterns. It is essential contributor of creating sprawled or sustainable cities. According to Kelbaugh & McCullough (2008), 'transportation planning should begin with the premise that we must reduce travel time to work, through consolidating destinations and providing convenient access to alternate modes of travel.'[1]

The book *Transport for Suburbia* by Mees (2010) is specifically 'for people concerned about the environmental and social costs of automobile-dominated cities.'[2] The book offers 'practical suggestions about how the move can be made.'[3] As cars now dominate the suburbia mobility modes, the book indicates the urgent need for alternatives because of 'climate change and insecure of oil.'[4] The author has pointed out that 'public transport is not the only alternative to the car – indeed, walking and cycling are the only truly sustainable transport modes – but it is a necessary ingredient in a post-automobile future. Unless public transport is so convenient that it offers real competition to the car, then schemes to promote walking and cycling, and restrain car use, will founder.'[5] However, according Kelbaugh & McCullough (2008), 'public transit itself can be bad for the environment if it facilitates rather than discourages sprawl.'[6] Mees (2010) indicates that 'the way to improve public transport is through compact cities, new urbanism, smart growth and transit-oriented design.'[7]

Another book which focuses on the future of transport is *Transport Revolutions: Moving People and Freight without Oil* by Gilbert & Perl (2008). The authors recommend the urgent transformation to transport based on 'renewably produced electricity'. As they believe, there will be a qualitative shift in relation of 'the movement of people and freight' and the variety of transport modes.[8] This book indicates 'how to be better prepared for and how to influence what happens during oil depletion. If they are prepared for them, the transport revolutions ahead could be relatively painless, and even provide for an era of peace and prosperity. At the other extreme, lack of preparation and difficulty in keeping modern mobility functioning during oil depletion could trigger massive social unrest, economic decline and international conflict. Knowing the challenges of developing transport options that can function without oil or with less oil, and initiating efforts before oil depletion becomes acute, could motivate demands for workable programmes of transport redesign from governments.'[9]

The authors went far on the description of car-dependent society and the expected change in society's life style when transport is changed for the oil-less transport modes. 'Life in a car-dependent neighbourhood could be much harder than one where most places to be reached are a walk or a bicycle ride away, or a short journey by public transport. Quality of

[1]Kelbaugh D. & McCullough K. (2008), p.149
[2]Mees, P., (2010), p. xi
[3]Ibid
[4]Ibid
[5]Ibid
[6]Kelbaugh, D. &McCullough, K. (2008), p.51
[7]Mees, P., (2010), p.5
[8]Gilbert, R. & Perl, A.(2008), p. xxi
[9]Ibid, pp.4-5

life can be vastly improved or greatly diminished by the way transport works, at local, national or global scales. Safe and welcoming communities, healthy cities and peaceful countries are all facilitated by successful transport systems. Success in achieving these ends will depend increasingly up the ability to stop using oil as a fuel.'[1] The authors are also conscious about 'comparable opportunities and risks from oil depletion await business leaders in manufacturing, trade and finance.'[2]

An additional book which is based on transport is *Travel by Design: the Influence of Urban Form on Travel* by Boarnet (2001). The main target is to find 'how the built environment influences travel.'[3] The book introduces 'the idea that neighborhoods and cities can be designed to change travel behaviour.'[4] The overall goal is 'to reduce car use and increase the quality of neighborhood's life by improving the pedestrian and transit environments.'[5] Simpson (1994) argued that 'urban rail has been developed partly to form a focus for urban growth, to act as a means whereby the land use planning system can be used to focus urban development near to the stations, thus reducing car-orientated sprawl. This is very clear in several German cities such as Hamburg and in Stockholm, for example.'[6]

John Roberts argued in *Volume* magazine: *'Good urban design should start with the notion of transport infrastructure.'* [7] According to Schiller *et al* (2010) 'sustainable transportation depends upon the provision of walking, bicycling and public transportation infrastructure.'[8] According to Næss (2006), 'In order to break the self-perpetuating interaction between increased mobility and a transport-generating land use, there will be a call for specific transport policy measures as well as a location and structuring of future urban development aiming to limit the needs for transportation. In short: coordinated land use and transport planning.'[9]

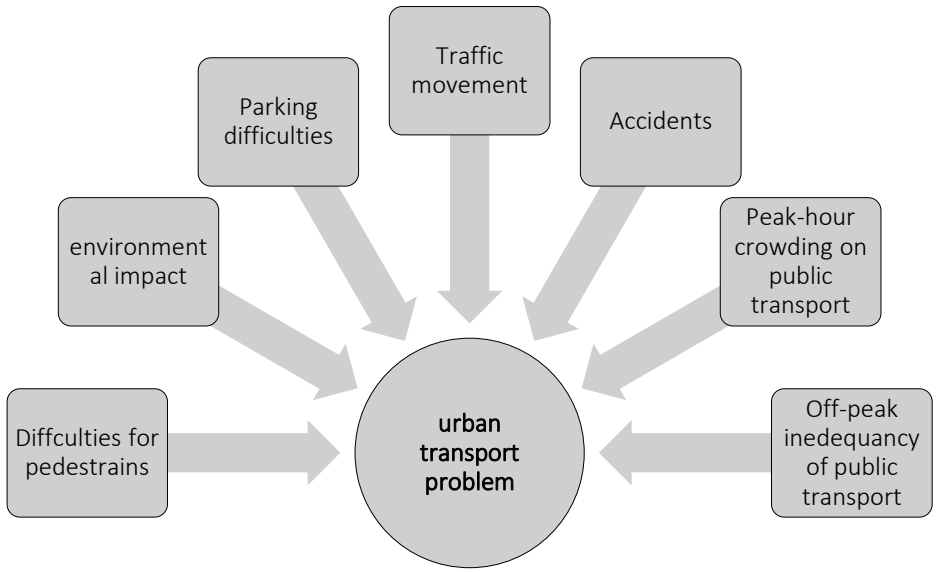


Diagram 3: Dimensions of the urban transport problem

Source: Pacione M. (2009), p.266 based on Thomson, M. (1977), (modified by the author)

[1]Gilbert, R. & Perl, A.(2008), pp.5-6
[2]Ibid, p.7
[3]Boarnet, M. (2001), p.2
[4]Ibid
[5]Ibid
[6]Simpson, B. (1994), p.37
[7]Interviewed by Piet Vollaard in Volume magazine: After Zero, vol. 18, Stichting Archis: The Netherlands, p.72
[8]Schiller et al 2010), p.232
[9]Næss, P. (2006), p.5

2.5.2 Land management

Land management system is a crucial factor which largely influences the general urban pattern. The book *Urban Regions* by Forman (2008) is one of the latest publications that deal with land management and spatial planning, particularly in the ecological prospective. Among its target, the book visualizes planning and land management through 'evaluating alternative patterns of urbanization spread (including sprawl) from the perspective of nature and people, and extracting land-use principles from landscape ecology, transportation, and hydrology are stated.'[1] 'For example, planning may focus on biodiversity, hazards/disasters, economic development, public health, water supply, energy, air pollution, climate change, and on and on. All protected lands and resources have one planning and management objective: prevention of *human overuse.* Spatial arrangements and movements of people are the main key to successful land management'[2] Regarding the enhancement of sustainability, the book *Understanding sustainable development* emerges as the most interesting book that has recently been published and covers 'theoretical discussions are interspersed with empirical case studies to demonstrate why sustainable development is such a necessity.'[3]

2.5.3 Liveability

Liveability is considered as a crucial entity that ensures the securely approach for the sustainable development. Many scholars have involved the term of liveability with the intelligently configuration of space to improve its quality. According to Knox (2011): *'Liveability is about how easy a place is to use and how safe it feels. It is about creating and maintaining a sense of place by creating an environment that is both inviting and enjoyable. The difference between liveability and sustainability is that the latter involves a longer-term perspective. Sustainability means reviving economic growth; meeting essential needs for jobs, food, energy, water and sanitation; ensuring a balance between population and resources; conserving and enhancing the resource base; and managing risk, all without compromising – if possible – the ability of future generations to meet their needs'*[4]

The liveability is always incorporated with reforming of the basic socio-economic conditions. Jenkins (2007) perceived that: 'good governance,' is characterised by *the following characteristics: 'it is participatory, consensus oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive and follows the rule of law.'*[5] The European Commission includes 'multilevel governance' framework. According to this, urban governance is characterised by three main strategies: 'decentralisation of the responsibilities and resources of local authorities, encouragement of the participation of civil society, and the creation of [public-private] partnerships with the aim of realising common objectives' (European Forum on Urban Safety, 2006)[6]

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[1]Forman, R. (2008)
[2]Ibid, pp.28-9
[3]Blewitt, J. (2008), p. xi
[4]Knox P. (2011)*, pp.240-3*
[5]United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), What is good governance? http://www.unescap.org/huset/gg/governance.htm.
[6]European Forum on Urban Safety (2006), 'The governance of security. Objectives' . Available at http://zaragoza2006.fesu.org/article.php?id_article=216&lang=en , accessed 15 February 2007.

Mander Ü., et. *al*. (2006) urged that: *'for rapidly growing cities in the developing world urban development planning towards sustainability is of top priority. These cities must orient their planning and development management towards the predictable future. In so doing, inevitable problems can be at least reduced, the management of metropolitan areas can be improved, and opportunities for more sustainable future development can be made.'*[1] Sorensen A. & Okata J. (2011) argued that: *'the challenge for urban governance is to ensure that urban policies, public investments, regulations, and plans have positive impacts on quality of life for the majority, and produce a more equitable distribution of the costs and benefits of urban life.'*[2] Cerreta M. *et. al*. (2010) argued that: 'there are many ways to support the liveability of a town. The beauty of a town, the cultural heritage, local architectural traditions and attractive public parks are key elements of liveability, as well as individual security and leisure opportunities.'[3]

The quality of space is essential factor that determines liveability either at urban or rural areas. As shown earlier in this thesis the most of urban areas in Muscat and elsewhere in Oman is normally lacking of the spatial quality due to the poor urban management system. The fragmentation of land use, the extremely low-density urban form, the poor allocating of basic services and the absence of public transport with the poor planning of pedestrian pathways are the common factors that have eliminated the quality of space in Oman.

At global level, various approaches have been introduced to enhance the quality of space. For instance, 'the UK Government introduced a strategy report for improving quality of place called 'World- class Places: The government ' s strategy for improving quality of place .the strategy identifies the 'quality of place' as 'the physical characteristics of a community – the way it is planned, designed, developed and maintained – that affect the quality of life of people living and working in it, and those visiting it, both now and into the future ' It also identifies the many different factors that contribute to quality of place and how, together with other factors, the physical characteristics of a local area can contribute to the quality of life of the people who live and work there. See figure (6).[4]

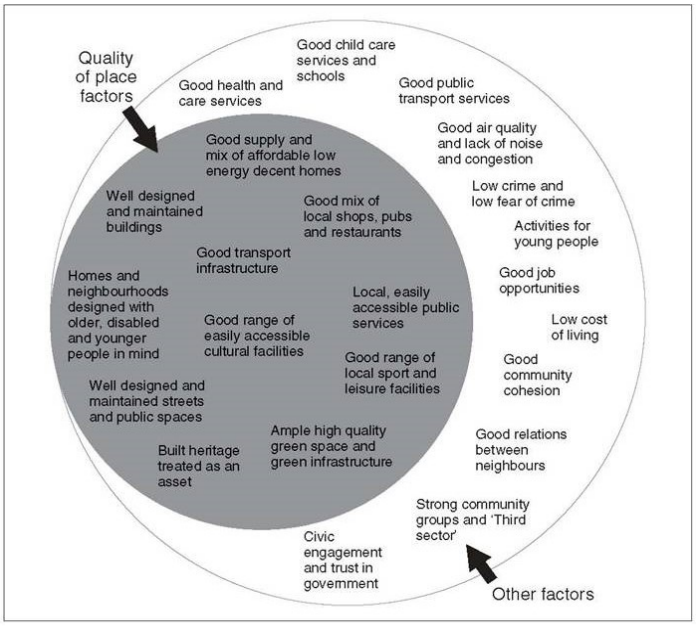


Figure 6: Factors contributing to good quality of life

Source: Syms (2010), p.236

[1]Mander Ü., al. (2006), p.175
[2]Sorensen A. & Okata J. (2011), p.410
[3]Cerreta M., Concilio, G. & Monno V. (2010), p.39
[4]Syms, P. (2010), p.235

The strategy report identifies the four 'elements' of quality of place as follows:

- A good range and mix of homes, services and amenities;
- Well - designed and - maintained buildings and spaces;
- Ample high - quality green space and green infrastructure;
- Sensitive treatment of historic buildings and places.[1]

'Together, these four elements contribute to the quality of places and to the creation of vibrant, mixed - use, attractive neighbourhoods that can be used for a wide range of activities, including walking, cycling and social interaction. They can accommodate public transport and provide ease of mobility, in places that provide a green and pleasant environment, with a sense of identity. If surrounded by user - friendly, low - energy buildings they should be capable of adapting to changing conditions.' (Syms., 2010, p.236)[2]. In short taking into consideration of the enhancement the quality of space will raise the liveable urban pattern at the post-oil age.

Sustainable urban form of a city should be observed as it was described by Frey, H. (1999): A 'good' city combines the central qualities of the traditional city—culture, exchange of ideas, a creative atmosphere, the availability of retail outlets, services and facilities—with the qualities of the suburb—privacy, solitude, freedom, quietness, good air, gardens, parks and promenades—without taking on the unsustainable characteristics of many of today's suburban and peripheral areas—single use, low density, sprawl, monotony and car dependency.'[3]

According to UN-HABITAT reports , 'cities of different sizes often struggle with issues of metropolitan governance and inter-city harmony, with some experiencing demographic or economic decline and others facing rapid growth and development. Effective metropolitan governance offers potential for urban development that manages such inequalities and creates harmonious regions.'[4] It has been argued that 'metropolitan governance arrangements affect the levels of harmony and disharmony in cities. Harmony can be enhanced through effective leadership, efficient financing, effective evaluation mechanisms and forms of citizen participation, and institutional reforms addressing multi-level and inter-jurisdictional challenges to better govern metropolitan areas.'[5]

Bogotá represents an example of how a metropolitan area is governed to obtain liveable and sustainable urban form. Sorensen A. & Okata J. (2011) noted that 'Bogotá, like many other rapidly growing megacities, has spreading informal settlements, very poor segments of the population, a crisis of congestion, environmental pollution, and major infrastructure shortages. Informal development increased rapidly after the economic crisis of the early 1980s, and the neoliberal shift towards diminished government roles and taxation. Meanwhile, the ideology of subordinating public affairs to private sector demands fostered unplanned development.'[6] In addition of improving the transportation efficiency, the

[1]Ibid
[2]Ibid
[3]Frey,H. (1999), p.29
[4]United Nations Human Settlements Programme (UN-HABITAT), (2008), p.227
[5]Ibid
[6]Sorensen A. & Okata J. (2011), p.415

solutions include the municipal governors by 'the decentralization of powers from the central government the decentralization of powers from the central government, and an increase in the tax base provided by a share of capital gains generated by urban development. Before these changes, the city was almost bankrupt, services were declining, and infrastructure was deteriorating.'[1]

According to Jenkins P. *et al* (2007), 'decentralisation is a key feature of the 'good governance' campaigns promoted by multi-lateral and bi-lateral development agencies. This normally focuses on local government development, although improved provincial/sub-regional government is also a focus.'[2] Organisation for Economic Co-operation and Development (OECD) (2009) indicated that 'economists who favour decentralisation often assume that it leads to better resource allocation and a more productive, and possibly smaller, public sector'.[3] According to OECD (2001), 'increasing decentralisation and devolution mean that territories also have more responsibility for managing their assets, and for implementing national policy objectives.[4] OECD (2009) also urged that 'decentralisation can help public administration become more efficient by making use of local knowledge in decision making and problem solving.'[5] They also indicated that 'as many urban areas are becoming *de facto* poorer, the alternative for them to rely on their own fiscal base is also diminishing. The net result is a reduction in resources available at city level for urban development. Thus, while new forms of more democratically elected governments are becoming more common in urban areas, their room for action is extremely limited. This leads to conflict over the limited resources and competition with other urban areas, when in fact collaboration might be more relevant. It also can lead to short-term horizons for decision making, such as concerning environmental impacts, as any investment is seen as better than none. The result is rapidly growing urban areas without the essential services and environmental controls which the levels of population require and hence proliferations of what are currently seen as 'slums'.

One of the most advantages of decentralization is what Booth *et al*. (2007) argued; 'decentralisation increases the competition between local authorities.'[6]The competition will positively reflect upon the local urban environment. By competition process, a wide range of goods and services will be more accessible and local economy will be enhanced. Consequently, a wide range of services and leisure activities will be offered for the local inhabitants. Schneider-Sliwa R. (2006) argued that 'the hierarchical structure of the composite city would allow the decentralisation of power and decision-making over development at town, district and neighbourhood level, with central administration providing the framework for decision-making at these different levels.'[7] For instance, Dubai has experienced a drastic transformation in relation of urban governance. 'In order to attract investor groups and cope with the large scale of many projects, urban governance has become more and more decentralized due to the decision-making authority shifting from a central administration to the decentralized planning of several master developers, who usually prepare land use and infrastructure plans in addition to general building

[1]Ibid, p.416
[2]Jenkins P., Smith H. and Wang Y, P (2007)
[3]OECD (2009), p.111
[4]Ibid, p.453
[5]Ibid
[6]Booth P, et al (2007)
[7]Schneider-Sliwa R. (2006), p.69

guidelines within their developments.' [1]. In Bahrain, 'while in previous decades most aspects of urban planning had been the responsibility of a single ministry, the decision to move the Planning Directorate from the Ministry of Housing to Ministry of Municipal Affairs (MoMA) in 2002 and an increase in master-planned projects by the private sector led to urban planning in Bahrain becoming decentralised. This in turn has led to various kinds of developments, mainly divided into urban expansion based on zoning plans by the public sector and individual master-planned projects by both the private and public sectors.'[2] According to Devas (2001) argue, 'government decentralisation in many countries has focused attention on city government, but most city governments face severe constraints and need to be strengthened, rather than assigning important functions to other agencies over which there is little or no democratic control, such as parastatals or higher-level government agencies. The personal qualities of civic leadership can also make a difference and civic education is important.'[3]

This consequence works to deliver the effective requirements to the development authorities to enhance their urban governance particularly in form of rapid urban growth. The enhancements could emphasize on shifting the centralization of government's power to local-power level. Frey, H (1999) argued that 'the Garden City embraces the concept of people creating their own built, economic and social environment. Thus Howard's concept responds to many of the characteristics of a sustainable city: decentralisation of the core city's functions to generate all needed local services and facilities in each Garden City, and in the farmland surrounding it; decentralisation of responsibility and participation of the communities in the process of shaping and building their own cities according to their needs and aspirations.'[4]

Democratization is another factor towards enhancing the urban governance. It can be achieved by 'increasing the participation of civil society in decision making and service delivery'[5]. Involving local society in urban development is becoming crucial aspect in sustainable communities. This prototype allows the local societies or their representatives to directly involve in making decision. According to Hulsbergen et.*al*. (2005), 'much attention has been given to democratic policy-making in the context of urban governance. Though democratic policy-making has been a topic for decades, what is new is that local democratisation is supposed to be a prerequisite for sustainable urban development.'[6] For example, 'the European Commission states that one of the challenges faced by cities in formulating and implementing strategies for more sustainable urban development today, is extending democracy and local empowerment and involving all stakeholders - including citizens'.[7] Pacione (2009) argued that 'local governments develop an enhanced ability to perceive and understand the interrelated and changing nature of problems in a community. In relation to this concept, the neighbourhood area approach has the twin aims of (1) bringing local government closer to the people, and (2) tuning actions to the needs of particular areas within a city.'[8]

[1]Wiedmann, F. (2010), p.110
[2]Ibid, p.153
[3]Devas, N. (2001) in Jenkins P., Smith H. and Wang Y, P (2007), p.194
[4]Frey, H (1999), p.p.77-78
[5]Jenkins P., Smith H. and Wang Y, P (2007), p. 260
[6]Hulsbergen E.D., Klaasen I.T, Kriens I. (2005), p.333
[7]European Commission (1998) in Hulsbergen E.D., Klaasen I.T, Kriens I. (2005), p.333
[8]Pacione M. (2009), p.439

Sorensen & Okata (2011) argued that 'the close link between local democratic processes and spatial planning was one key to democratic renewal. The recovery and strengthening of the public sphere was another essential part of the success of the program, along with developing planning capacity, fiscal capacity, and civic pride in quality public services and spaces.'[1]

'Pieterse's (2008) claim that for cities and citizens, the link between planning and democratic decision-making is crucial, because plans (master plans, strategic plans, regional development plans, etc.) express the ways in which broad normative principles are applied to specific territories. They create an opening for citizens and social movements to offer their perspectives on how to address problems in the city. This is not easy, but it offers opportunities to build an alternative way to imagine and talk about issues like integration, sustainability, or livelihoods, and link them to actual changes on the ground and everyday issues. The improvement of both governance processes as well as the fine-grained physical spaces of everyday life provides the links between micro-local issues and the bigger pictures of social and environmental sustainability for the future.'[2]

Wong T. &Yuen B. (2011) argued that: 'a city that leads and designs holistically, that implements change harmoniously, and where decision-making and responsibility is shared with the empowered citizenry, is a city on the road to sustainable practices. In balancing community needs with development, public consultation exercises and grassroots participation are essential to ensuring people-sensitive urban design and to encouraging community participation. Enabling local residents to be actively involved in shaping their community and urban environment is one of the hallmarks of a democracy.'[3] Ames (1997) argued that: 'Encouraging local communities to dream is the beginning of building a better world.'[4] US Environmental Protection Agency recognizes: *Community participation is key. Bringing people together, including business, industry, and education, along with children, planners, civic leaders, environmental groups and community associations, allows the vision to capture the values and interests of a broad constituency.*[5]

According to OECD (2009), 'multi-level governance is always required for managing public policies in a decentralised context ... managing relations between central and sub-national governments is necessary for two main reasons: i) wherever they are located, citizens should be able to enjoy equal access to a basic set of public goods and services; and ii) regional policy should also enhance the growth prospects of regions by raising their competitiveness. As such, *the equity objective in regional policy* attempts to reduce disparities between people living in different places, while *the growth objectives in regional policy* might widen disparities.'[6] Decentralization might be achieved by 'delivering power to regional government'[7] to enable the participation of local society in decision making.

[1]Sorensen A. & Okata J. (2011), p.416
[2]Pieterse EA (2008) in Sorensen A. & Okata J. (2011), p.416
[3]Wong T. &Yuen B.(2011), p.157
[4]Ames, S. (1997) in Newman, P. and Jennings, I. (2008), p.10
[5]Where do we want to be?, Green Communities program, US Environmental Protection Agency, http://www.epa.gov/greenkit/intro3.htm.
[6]OECD (2009), p.110

2.5.4 Environmental awareness

Environmental awareness becomes a practical entity to attain livable urban pattern at the post-oil age. According to Wong & Yuen (2011), 'large cities as nodal points are where consumption of materials and energy is very high on per capita basis. Poor environmental management is bound to lead to a degrading urban environment harmful to different habitats in the urban ecological system including definitely humans.'[1] Consequently, during the last two decades, prominent actions have emerged globally regarding the environmental awareness. Many legislations and regulations have declared which demand for the efficiently handling of natural resources and utilizing the eco-friendly products. OECD (2010) indicated that 'raising the environmental awareness of urban residents will be critical to generate sufficient demand for green products and services'[2] According to Næss (2006), 'reducing the consumption of fossil fuels (oil, coal and gas) is a key issue in the efforts to promote a sustainable development'.[3]

Towers, (2005) argued that: 'reducing the amount of energy used in housing would make a considerable contribution to cutting carbon dioxide emissions. But if nothing else were done most of the remaining energy required would still need to be provided by burning fossil fuels. There is a need to invest in alternative systems which will provide energy from natural or 'renewable. Most alternative energy sources require considerable investment and it may take a long time to gain a significant return.'[4]

White (2002) argued about 'the reason why these energy sources are not more widely used is that they are rarely price competitive with conventional fossil and nuclear fuels. They are close but they cannot compete against the subsidies the conventional fuels receive in the form of tax breaks for exploration and capital costs, plus the fact that the externalities involved in the use of fossil fuels and nuclear power are absorbed by other sectors of the economy. If the existing subsidies were removed the market would reshape itself to allow renewable energy in slowly. If a carbon tax were imposed - and if the present subsidies were removed - then this shift would be much more rapid.'[5]

Renewable energy is considered the most promising technology that can alter the fossil-oil energy. In addition of its economic benefits of providing endless energy, renewable energies such solar and wind turbines also help of creating healthy communities. The Utilization of renewable energy has emerged as a competitive attitude in the global cities since the past decade. For example 'the City of Seoul, Korea, aims in its new climate change master plan to expand its renewable energy share from 1.5% in 2007 to 20% by 2030, with nearly half of this share to come from hydrogen energy, while Los Angeles intends to attain 35% by 2020.'[6] The role of renewable energy is not merely the generation of clean energy but also contributes of the creation of new jobs. For example, 'the renewable energy industry has provided about 200 000 jobs in the EU in 2003'[7] in Germany, renewable energy

[1]Wong, T. & Yuen, B. (2011), p.140

[2]OECD (2010), p.147 http://dx.doi.org/10.1787/9789264091375-en

[3]Næss, P. (2006), p. 2

[4]Towers, G. (2005), pp. 116 -117

[5]White R.(2002), p.159

[6]OECD (2010), p.124 http://dx.doi.org/10.1787/9789264091375-en

[7] Ibid, p.155

becomes the primary job creator with 100,000 new jobs expected by 2020.[1] Edward Mazria argued that: '*Designing and constructing energy efficient buildings, combined with a massive harnessing of renewable energy, make it not only possible but also profitable for buildings to operate without fossil fuels*'.[2] According to Joseph E.& Szold T.(2005) , 'the search for a more equitable planning process and a more just urban environment could greatly benefit from a better understanding of the impact of standards on our built and natural environment. For example, how do standards and codes affect housing affordability, infrastructure provisions, and environmental conditions?'[3]

2.6 Conclusion

It is wise to verify the known and unknown literature on the topic and the contribution of this research to existing literature. Obviously, the international discourse literature indicates the causes, the impacts and the potent remedy of urban sprawl. Some literature looks into urban sprawl in general, while other literature focus on case studies mostly in American and European cities. However, most debates have not taken any Middle Eastern country as a case study for urban sprawl despite the fact that the impact of sprawl in some of these countries has reached a critical stage. One of these countries is Oman where the impacts of sprawl have reached an unbearable level though the population remains below 3 million.

Although Oman is one of the countries whose oil revenues remain the primary resource for its national GDP, lifestyle pattern is based on the excessive consumption of natural resources. The land distribution system has encouraged the scattering of urban development with very low density. Unfortunately, this patchy urban pattern has not only encouraged the social segregation but has largely contributed to the environmental deterioration. It is obvious, this urban pattern is more critical than the ones that are discussed through the international discourse. In Oman, the land use segregation contributes to the long-distance commute with the private automobile. Bicycles are still not a favorite commuting means for the Omani society for cultural reasons. Some people relate using a bicycle as embarrassing behavior or an indicator of poverty, while driving a car is a source of pride and an indicator of wealth. In Oman, building standards have extensively contributed to the horizontal low-density urban pattern. These codes, which encourage spatial segregation, are based on vehicular corridors rather than pedestrian pathways. That is why you feel all land uses are largely separated as they cannot be reached without cars.

Obviously, there some disparities between the characteristics of sprawl that have been discussed in the international discourse and the characteristics of sprawl in Oman. Though density in the case studies throughout international discourse was normally 20-30 people/acre and characterized as low, density in Oman is extremely low because it does not exceed 5 persons/acre, see pictures [1 and 2]. The literature associated with the international discourse normally talks about the fragmentation of land use. In Oman, in addition to the high rate of private land ownership -- close to 100% -- there is no law that forces owners to develop land at a certain time. Therefore, land might remain vacant for ages. It remains transferable from one owner to another. Despite the fact that the land remains the an individual dream for Omanis for building and owning a home, vast

[1] Wong T. &Yuen B.(2011), p.25
[2] Ots E., (2011), p.211
[3] Joseph E. & Szold T. (2005). p.2

proportions of land owners might sell this land once drawn on to fulfill other life priorities such as buying a private car or marriage.

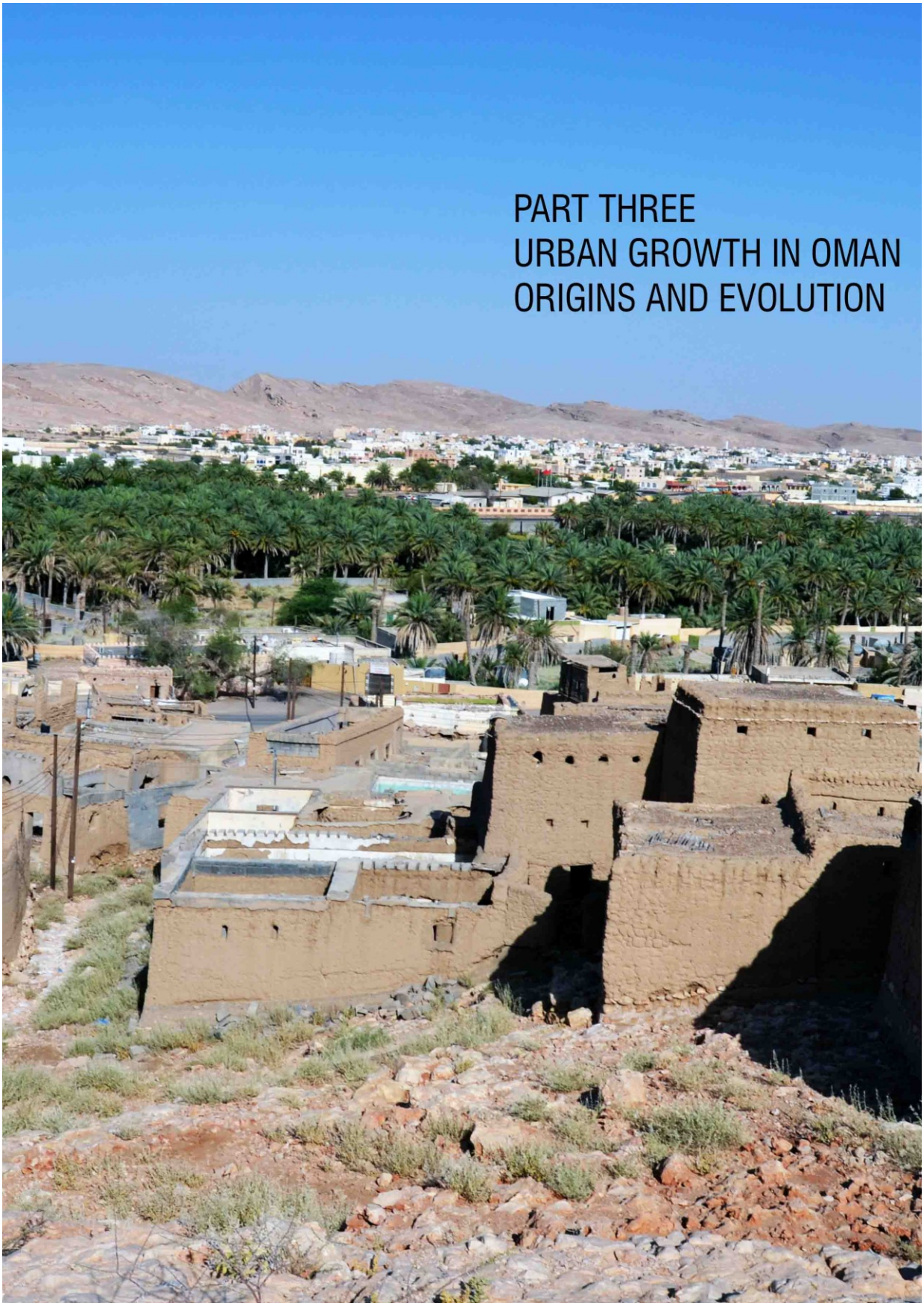
The research is unique because it examines the influence of this poor urban policy/management on urban patterns. This research shows the impact of economic prosperity on the urban pattern in the absence of sustainable urban management. Hence, in the absence of sustainable urban management, the economic wealth that was a result of oil production in Oman has led to a plentitude of social and environmental problems. These problems, which will be discussed in detail in this thesis, have formed a contemporary society based on rapid consumption of limited natural resources. The thesis uses a number of mechanisms in order to find effective and practical solutions to the problem, for instance, by comparing the prevailing urban pattern in the Omani traditional settlements and the contemporary urban pattern. Also it illustrates the sustainable policies and programs that are successfully applied in the neighboring countries that share similarity to Oman's economic and climatic conditions.

Picture 1: Urban sprawl in Florida is characterized by low-density[1]

Picture 2: Urban sprawl in Oman is characterized by extremely low-density.[2]

[1] Picture source: http://whyamericanssuck.blogspot.com/2010/07/3-sprawl.html accessed on 9/9/2012

[2] Picture source: www.googleearth.com



PART THREE
URBAN GROWTH IN OMAN
ORIGINS AND EVOLUTION

PART THREE: URBAN GROWTH IN OMAN: ORIGINS AND EVOLUTION

3.1 Introduction

Urban growth in Oman has passed through a long history of political and socio-economic variables. Obviously, these variables have largely affected the urban pattern in every period of time. Consequently, the investigation of the huge transformation of urban pattern in Oman in merely four decades of time has become an imperative demand.

3.2 The economic conditions

3.2.1 Economic conditions prior to oil-age

Until the oil boom in the late sixties, 'oasis agriculture has been the cultural and economic backbone of the Sultanate of Oman for thousands of years.'[1]In that time 'Oman's exports were largely composed of dates, wet and dry limes, fish, tobacco, fresh vegetables and fruits, cow skin and henna'. [2] Oasis settlements have largely contributed of the conservation of local food security. 'For millennia and irrespective of the changing political settings, irrigated oasis agriculture provided the major staples to the large majority of Oman's human population through date palms.'[3] Water was the most significant factor that largely influenced the amount of crops of cultivation and herds of cattle. Despite the scarcity of water, a consequence of the limited precipitation at that time, local inhabitants had sustained themselves and defeated these harsh climatic conditions. The oasis settlement arises as an alive and ideal illustration which demonstrates how successful the old Oman was. It was a model that had combined economic and social norms in a very limited spatial area. The model is so precise in relation to the way of managing the natural resources and controlling time. As water and land are the most considerable resources in oasis settlements, the local inhabitants spent a lot of effort in utilizing them according to their needs. For instance, land cannot be utilized for building if it is fertile for cultivation because buildings can be constructed on infertile, coarse, rocky or wild lands. See picture [3].

Picture 3: In Al Raybah in Ibri, old houses were built directly onto the rock's surface.

Source: The author

[1]Chapter 3 in Buerkert, A. & Schlecht, E. (2010), p.84
[2]Ministry of National Economy, (2008), p.15
[3]Ribbeck, E. et al, (2001), p.59

Likewise, water, which is represented by the '*aflaj*'[1], is precisely distributed amongst farmers according to well-known and inheritable water-shares. The water-shares are determined using a bit of sophisticated calculations. Every water-share is time-based; a standardized technique used to protect the farmers' rights to utilize water from a falaj according to many locally well-known aspects. The time span might be a quarter of an hour a day or the whole day or even two days.

'The irrigation cycle commonly ranges from seven to fifteen days and the water is shared among the users on a time basis.'[2] Table [3] indicates time division for water distribution for aflaj. The water-shares also varied from one falaj to another, from one territory to another, depending on size of the falaj itself, the amount of water available, the amount of cultivation it irrigates, etc. These shares can be also sold or leased. This intelligent water distribution system has largely contributed to preserving the socio-economic sustainability in Oman for centuries. Al Sulaimani *et al.* (2007) highlighted six major socio-economic benefits that *aflaj* offer to the local societies. See box [5]

The workforces in the past were distributed amongst agro-pastoral activities in the interior areas and agro-fishing jobs in the coastal cities. Meanwhile, major parts of the Omani population were working in neighboring GCC countries until Sultan Qaboos took control of the country in July 1970. Some GCC countries such as Saudi Arabia, Kuwait and Bahrain have preceded Oman in the oil-production sector. Thus, the prosperity of these countries in the fifties and sixties has led to the immigration of a large part of Omani the population for the purpose of upgrading their lifestyle. This was the initial spark that predicted the decline of the era of the oases settlements in Oman. Since then, the oases settlements have gradually fallen into economic recession and environmental deterioration.

Box 5: Major socio-economic benefits that *aflaj* offer to the local societies

- Maintaining mutual cooperation among those individual who use the *falaj* water for domestic and agricultural purposes.
- Providing a relatively flexible source of family income by allowing shareholders to put their water shares up for public auction or by leasing those shares for specific periods when they are not needed.
- Providing a constant source of water for a variety of crops, especially date palms.
- Encouraging the development of traditional crafts in the towns and villages through which the *aflāj* pass and thereby creating employment.
- Strengthening a sense of community and strengthening social relationships between all those benefiting from the supply of water; which traditionally would have been almost everyone in the community.
- Establishing procedures for settling disputes relating to water shares or maintenance obligations in the form of an autonomous administration responsible for the management of each *falaj.*

Source: Al Sulaimani, Z. et al (2007), p.283

[1] *Aflāj* are conduits dug in the ground to convey water by gravity from one place to another; there are more than 4,000 *aflāj* in the Sultanate of Oman, of which 3,017 are active. Many *aflāj* in Oman were built over 1,500 years ago and some of them may date back over 2,500 years. Source: Al Sulaimani, Z. et *al* (2007), p.277

[2] Al Sulaimani, Z. et *al* (2007), pp.283-4

Division	Period of time	Equivalent in *athars*	Division	Period of time	Equivalent in *athars*
Badda	12 hours	24 *athar*	*Rubaca*	7.5 minutes	1/4 *athar*
Kathba	1 ½ hours	3 *athar*	*Thāmin*	3.75 minutes	1/8 *athar*
Athar	30 minutes		*Qiyās*	1.25 minutes	1/24 *athar*

Table 3: Time division for water distribution for *aflaj*

Source: Al Sulaimani, Z., et al (2007), p. 284

3.2.2 Economic transformation at oil-age

'With the onset of the petroleum industry in the 1970s, the role of agriculture in Oman has undergone major changes. As most of the major staples can be produced much cheaper in other regions of an increasingly global economy with more favourable climatic conditions and in large scale settings, food imports eroded the economic basis of traditional oasis farmers which also were confronted with new opportunities to earn their living outside agriculture. In contrast to intensive and economically competitive irrigated cultivation in the Batinah, the traditional oasis-based agricultural production has nowadays lost much of its economic role even for those 3% of the population who are still involved in it.'[1]The majority of lifestyle patterns have changed considerably since His Majesty Sultan Qaboos bin Said took power on July 23, 1970. The economic transformations as a result of the oil boom have triggered the local inhabitants to leave most of the agricultural oases. Since the early seventies, the civil and military jobs have encouraged people to leave the inherited agro-fishing jobs for higher-waged, effortless jobs. In addition, the increase of population and the scarcity of water have also contributed to the abandoning of most oases.

The land granting system, which enables a citizen to have a granted residential plot at the area of one's workplace, has also largely encouraged families to leave these oases and go to the workplace areas. Urban growth in Oman has significantly risen since the late 1960s. The first exporting oil freighter in 1967 paved the way for the drastic change from an agricultural-based economy to the present-day economy based on the oil sector. The oil-production era, accompanied with advanced technology, is characterized by a remarkable change of urban life which encouraged people to leave their former jobs in rural areas to find better jobs in urban areas. The coastal cities, where they had better technology and basic infrastructure, received the most massive influx of local immigrants. The rapid immigration occurred in the 1980s and 1990s to these cities and incorporated with them a lot of urban and environmental problems.

[1] Source: Ribbeck, E. et al (2001), p.59

Low interest mortgages and loans that had been provided to citizens since early 1970s have led to a tremendous transformation of the overall local lifestyle. The oil wealth has contributed to taking the national economy to a higher level of prosperity and boosting the per-capita Gross Domestic Product. The oil revenues have been utilized to build the basic infrastructural services and enhance the national living standards. The government has spent much money in developing the transport infrastructure, health care, education, etc. Although the Gross Domestic Product (GDP) has been rising gradually since the beginning of the 1970s, the economy remains at risk as it still depends on oil revenues. The unstable oil prices and the decrease in gross oil production since reaching oil-peak have led the country to search for alternative income sources. GDP has expanded continuously in the past half century. It grew '339% in the Sixties reaching a peak growth of 1370% in the Seventies scaling back to modest 12% growth in the turbulent Eighties and rising again to 34% in the Nineties.'[1]The graph below indicates the change in performance of Oman's economy.

Road infrastructure in Oman is considered the major consumer of public spending. According to official statistics, asphalted roads in the Sultanate were less than 1000 kilometers 40 years ago had and just 6591 kilometers in 1996. However this amount has quadrupled in 15 years. The length of asphalt roads has leaped from 8477 kilometers in the year 2000 to 28,903 kilometers in 2011.[2]

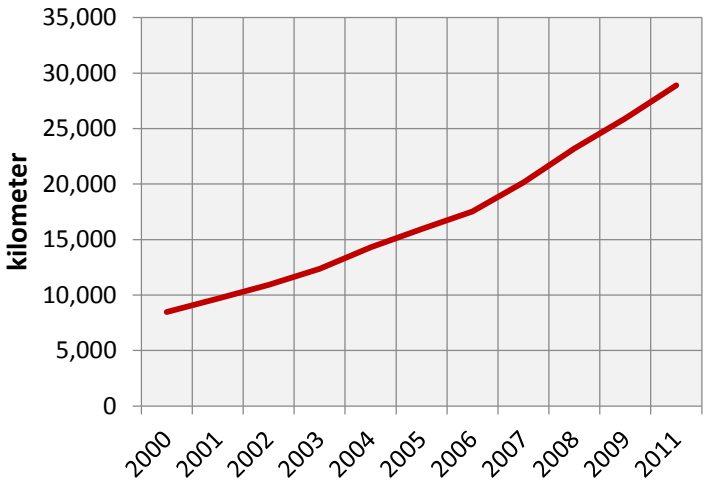


Figure 7: Asphalted road upto end 2009

Source: Statistical Year Book 2009, MNE

According to the second annual summit associated with transport infrastructure in Oman, 'the road infrastructure sector will continue to play an important role in the construction sector in 2012 with US$1.1 billion worth of contracts awarded and over US$600 million worth of bids submitted in 2011. This, along with the increasing demand in 2011 (not only in the last quarter of 2011) for quality transport infrastructure in Oman and the need to facilitate closer integration of regional economies, is why the Omani authorities are committed to an investment of US$14.8 billion, almost half of the country's 8th five-year development plan for 2011-2015 to develop roads, ports and airports infrastructure.'[3]

[1]http://en.wikipedia.org/wiki/Economy_of_Oman Accessed on 26-06-2013
[2]Statistical Year Book 2009, Ministry of National Economy and
ROP, Facts and Figures 2011, found in
http://www.traffic.gov.om/files.php?force&file=pdf/Facts%20and%20figures%20ROP%202011.pdf downloaded in 23/5/2012
[3]http://www.omantransportinfrastructure.com/uploadedFiles/EventRedesign/Dubai/2012/September/20310002/Oman-Transport-Sponsosrship-prospectus-HR.pdf downloaded 1/6/2012

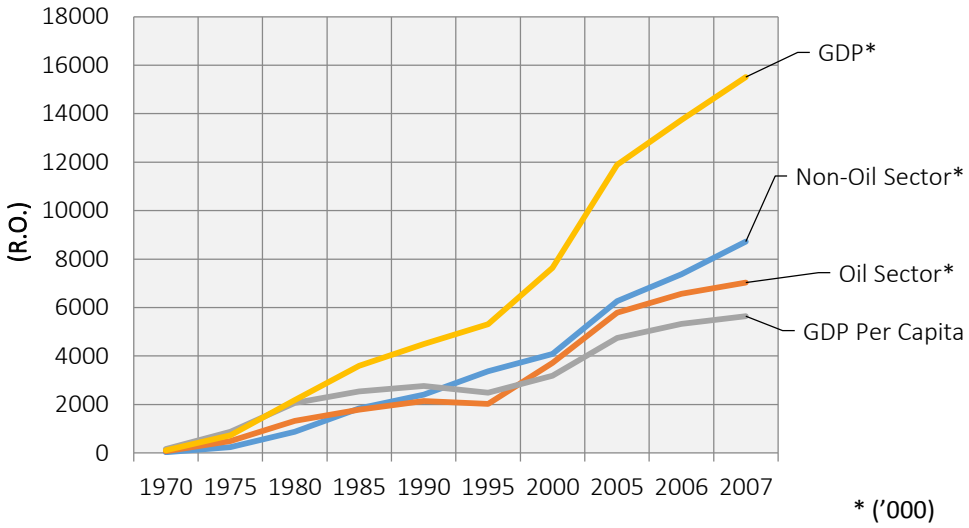


Figure 8: The change performance of Oma economy in (1970-20

Source: The author based on: Ministry of National Economy (2008), *Oman Development and Investment*, 6th ed. p.119

Meanwhile, 'Oman's government is planning to spend about RO3 billion (US$7.8 billion) on road projects through the end of 2013 alone. A big part of that money will be dedicated to the project to build the 165-mile, eight-lane Batinah expressway, which when finished will be the widest highway in the country. Another huge project is the widening and lengthening of the currently 444-mile road linking Oman's capital city of Muscat and the southern city of Salalah. The road will go from being an undivided, one lane road to a highway with two lanes in each direction. The government also plans to spend about RO500 million on projects to ease traffic problems within the city of Muscat.'[1] As in many of the world's countries, since 1970 Oman pursued the economic five-year plan as a strategic tool for organizing the long-term financial resources and as a proper technique for the extensive development. The table (4) highlights the main objectives of the seven five-year plans of Oman's economy. The increase of labor forces, particularly in civil services and military enterprises, has boosted the demand for housing spaces. Meanwhile, this trend has pushed land owners to rapidly develop new housing units. At the time lacking the sustainable urban management systems, this rapid urban growth became fragmented and scattered.

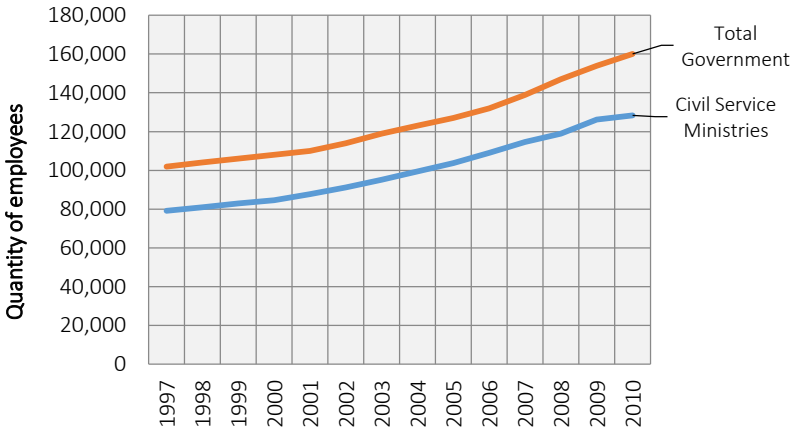


Figure 9: The trend of employees in the sector of civil service.

Source: The author based on the statistics of MNE and Ministry of Civil Service

[1] http://www.worldfolio.co.uk/region/middle-east/oman/ahmed-mohammed-al-futaisi-minister-transport-communications-oman-n1842

Five-Year Plan	Objectives
(1st) 1976-1980	▪ Establishing the country's infrastructure. ▪ increasing the absorptive capacity of the economy and to lay down the foundation for a competitive private-sector-led economy
(2nd) 1981-1985	▪ The completion of the infrastructure ▪ To raise the standards of living. ▪ The scope of building the infrastructure was broadened to include projects to develop natural water resources and to include regional development.
(3rd) 1986-1990	▪ To augment the achievements of the previous plans and further improve the provision of health, education, and other social services. ▪ Maintaining the standard of living.
(4th) 1991-1995	▪ Channeling investments to productive projects, ▪ Broadening and diversifying the production base of the economy, and private sector development. ▪ Special attention was given to the regional and sectoral dimensions. ▪ Development of human resources and the expansion of Omani participation in the development process.
(5th) 1996-2000	▪ to maintain, at the minimum, the current level of per capita income in real terms and will strive to double it by 2020, while maintaining Omani values and traditions
(6th) 2001-2005	▪ Economic balance and sustainable growth ▪ Targeting annual GDP growth rate of not less than 3% at constant rate. ▪ Increasing the Government revenue, particularly the non-oil revenue. ▪ Maintaining the current low levels of inflation (Less than 1% since 1992). ▪ Realizing comparable levels of development in the different regions of the Sultanate. ▪ Human resources development ▪ Economic Diversification, through upgrading gas and tourism ▪ Private sector development and Privatization
(7th) 2006-2010	▪ Achieving an average annual growth rate, during the plan period, of not less than 3%, to raise the citizen's standard of living and maintain the current low levels of living and maintain the current low levels of inflation. ▪ Improving general and higher education. ▪ Provide programs for the employment of the citizens ▪ To enhancing the non-oil revenue. ▪ To enhance sustainable human development, social care, and women's participation in society. ▪ Promoting and conserving the water resources. ▪ Incorporating environmental criteria in the development policies programs and projects of the plan particularly that relate to provision of appropriate housing and basic services in remote areas. ▪ Conservation of the national heritage. ▪ Special attention should be given to the development of tourism, fisheries and manufacturing sectors. ▪ Encouragement of the domestic and foreign private sector investments.

Table 4: Summary of the Five-Year Plans for Oman's national economy in 1976-2010

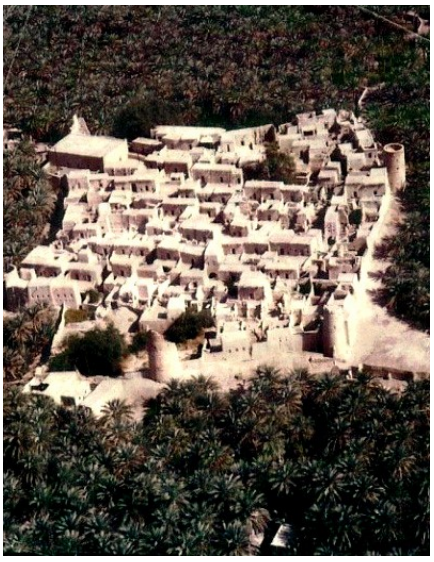
Source: The author based on: MNE (2008), *Oman Development and Investment*, 6th ed. pp.16-4

3.3 Social conditions

3.3.1 Social conditions prior to oil-age

The past period, just before 1970 when Sultan Qaboos took power, Omani society was scattered and fragmented into tribes. The local societies were ruled by the power and rigidity of each tribe. The interior parts of Oman were ruled by *Imams*[1] and *Sheikhs*[2] of tribes. However, fear and unsafe environments forced local people to gather together to protect themselves from the raids and burglary of other tribes.

Consequently, the traditional settlement in Oman was built densely with surrounding walls. For security purposes, turrets were significant structures which were used as panoramic monitors built at various points on these walls particularly at corners, Pictures [4 and 5]. Because of the lack of income and the financial resources, people were forced to search for food rather than focusing on education.



Picture 4: Harat Al Jam'e, Adam, an ancient neighbourhood.
Source: SCTP

Islam does not determine the type of family household, but encourages an extended family that forms a very strong relationship among its members. 'There is an incident that occurred during the lifetime of Prophet Mohammed in Madina when he was asked about his house which has become too small to accommodate his growing family. However, instead of moving to another house or to split his family between several houses, the Prophet decided to raise his dwelling or build on the top of it.'[3] Meanwhile, the old Omani family was not much different from the typical Islamic family.

Picture 5: Oasis settlement in Adam, Dakhliyah Governorate in Oman

Picture source: www.googleearth.com

[1]The traditional secular and Ibadi religious head of the Omani community; the last imam was in the 1950s; imamate = the territory controlled by an imam

[2]The head of a tribe mainly is inherited personal

[3]Mortada, H. (2003), p.34

3.3.2 Social transformation at oil-age

3.3.2.1 Rapid population growth

The first and foremost reason of urban growth is an increase in urban population. Rapid growth of urban areas is the result of two population growth factors: (1) natural increase in population, and (2) migration to urban areas.[1] The combined effect of population growth and urbanization is placing a tremendous strain on resources and the environment.[2] The natural increase of population in Oman has rapidly occurred since the early Seventies. The improvement of health care has contributed to boosting procreation and fertility rates. Also, the optimization of local economy allowed many Omani expatriates, who were mostly working and inhabiting the Gulf States and the eastern coast of Africa, to return to the country.

The central cities are characterized as attractive areas for population because they accommodate the basics of infrastructural services such as schools, hospitals, universities, water, public parks and so on. Consequently, the populous has been oriented to the major cities because these cities work as hubs for most of the economic, social, cultural and political activities along with the hosting of most investments. The rapid socio-economic change and rapid urban development that took place in Oman from subsistence to a highly commercialized economy over the last four decades has inevitably led to the creation of increased pressure on both the land and limited water resources.

The population growth at a high net annual rate of 3.5% has, along with the improvement of the Omani standard of living, further amplified the burden on those resources. Census 2010 witnessed seven cities exceed the 100,000 mark; they are Seeb, Baushar, Salalah, Muttrah, Sohar, Ibri and Suwaiq comparing with merely four cities in 2003 Census. Note that three of them are from Muscat Governorate. Seeb is considered the most populated city in Oman and is home to about 11% of total population of Oman, followed by Baushar (7%) and Salalah (6%). This is an indication of how these places have become major urban centers in a very limited time. The population pyramid is considered an essential component for socio-economic sustainability. Nearly 60% of the Omani population is at work-production age (15-64). About 35% are under 14 years of age. This indicates that most of the Omani population is at an age that requires jobs and shares in governmental services, such as residential and recreational spaces.

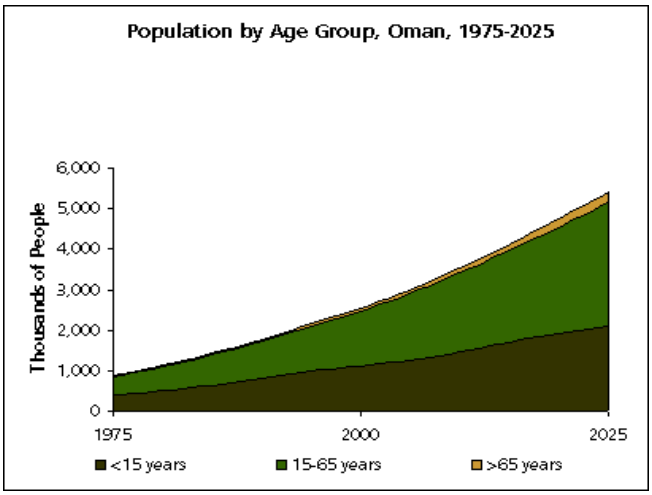


Figure 10: Projected population trend in Oman by Age Group 1975-2025.

Source: MNE

[1] Bhatta, B. (2010), p.18

[2] 'An Urbanising World'; UNHCS (1996) quoted by Department of the Environment, Transport and the Regions (1999), p.4

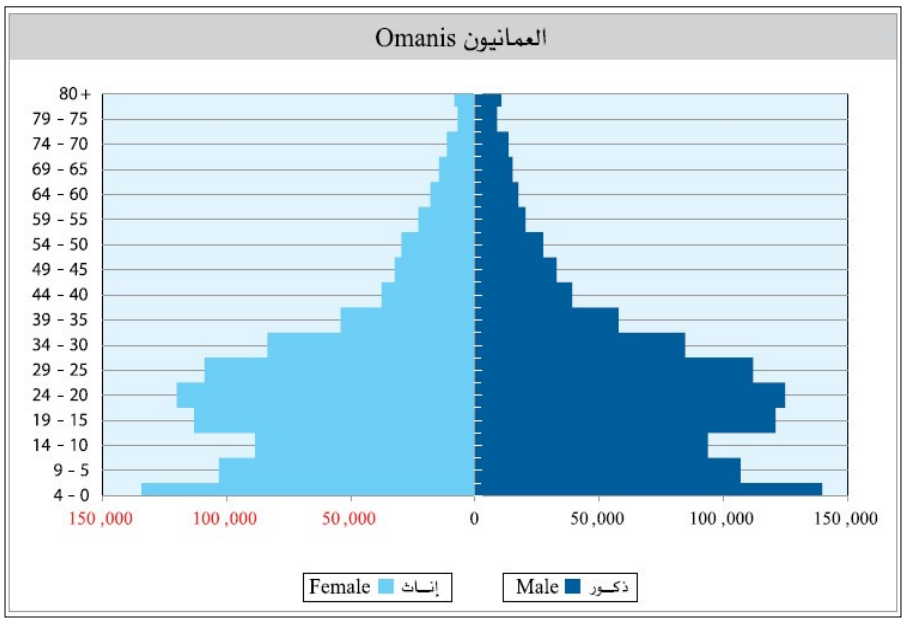


Figure 11: Omani Population Pyramid, 2011.

Source: MNE

	1985-1990	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
Male	66.2	67.7	68.9	70.1	71.1	72.1	73.1	73.9
Female	69.8	71.8	73.3	74.5	75.7	76.7	77.7	78.5

Table 5: Life expectancy at birth in years, male & female

Source: MNE. Final Result Report. Census 2010

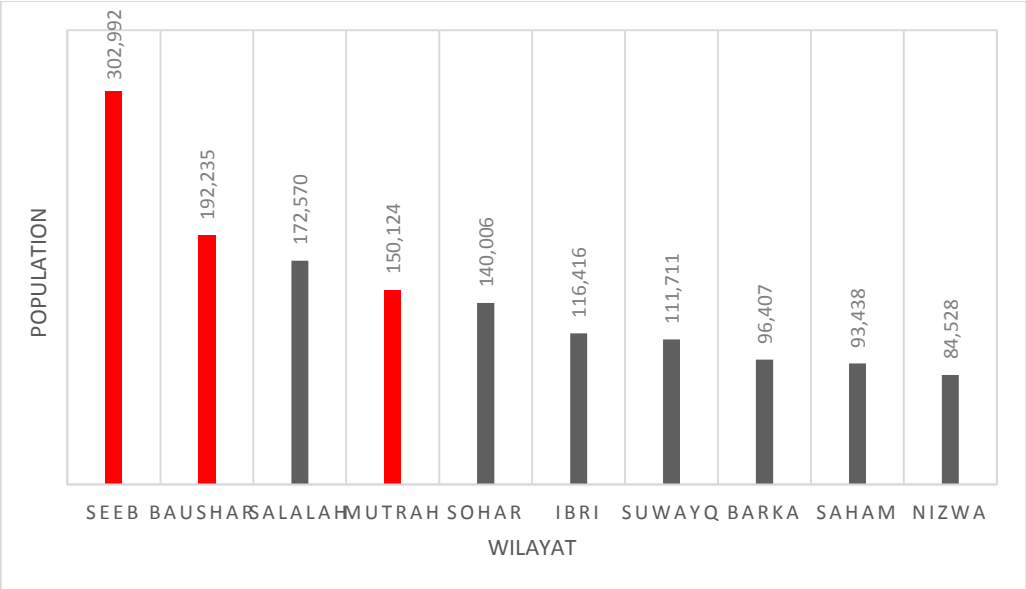


Figure 12: Ten Most Populated Wilayat

Source: MNE, Final Result Report, Census 2010

Optimizing health care since the early Seventies has led to a notable reduction in illness rates whilst boosting the life expectation in the country. This gradual increase of life expectation is considered one factor that contributes to population growth. Figure [13] indicates the change in life expectancy in the Sultanate from 1960 to 2011.

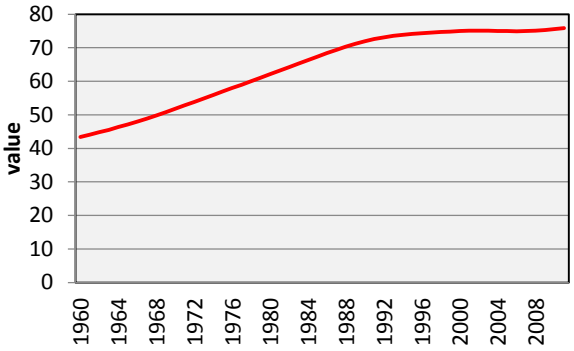


Figure 13: Life expectancy in Oman (1960 to 2011)

Source: http://www.indexmundi.com/facts/oman/life-expectancy-at-birth retrieved on 19-06-2013 based on United Nations Population Division

3.3.2.2 Change in family structure

The change in family structure is also considered one reason of rapid urban sprawl. Until just before the emergence of the oil-age, most families including cousins, aunts and uncles lived together, as well as parents with their children forming an "extended family". They were all living in one house sharing all its utilities. They were also sharing their work, and their production formed a very strong cooperative society. Every family now has its own life and lives in a single detached home. This new trend has led to the emergence of patchy urban pattern and an overload on the use of natural resources. The dramatic change in family structure increased the demand for larger plot size. Figure [14] indicates the transformation of the plot size prior to 1970 up to the present day.

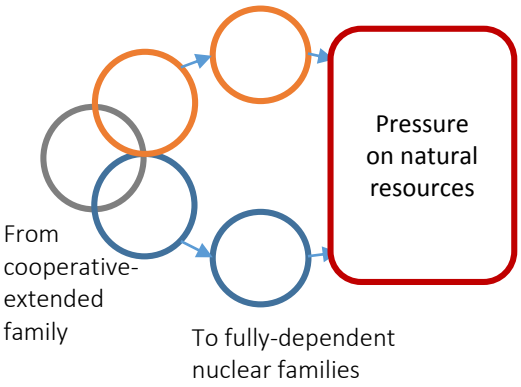
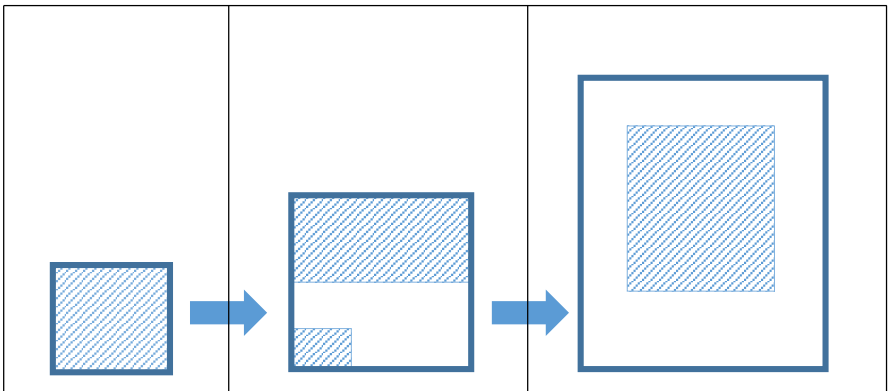


Diagram 4: Transformation of family structure in Oman

Source: The author



Period	Before 1970s	1970s & 1980s	1990s - Now
Plot area	90-240 m^2	220-400 m^2	600-1200 m^2
Built-up area	80-100%	60-80%	30-40%

Figure 14: The transformation of the plot size. Source: The author

The Income and Expenses Survey of Omani Family which was conducted by the Ministry of National Economy between the period of (May 20, 2007 and May 19, 2008 provided crucial data for future strategic planning. It was found that the average Omani-family included 8.2 household members. This rate is considerably higher than the average global figures (4 people per household).[1] Average households in urban areas in Oman were 8 persons while in rural areas it reached about 8.8 individuals. The average family-household members (Omani-expatriate) were 5.6 persons; 5.4 persons in urban areas and 6.3 persons in rural areas.

However, the recent population census in 2010 indicates a decrease in the average Omani household size from 9 people in 2003 Census to 7.5 people in 2010 Census. Table [6] indicates the Population, Households and Housing Units (2003-2010). According to the State Administrative Subdivision before the year 2006, population is distributed into eight administrative units, three Governorate and five Regions. The data in the two censuses of 1993 and 2003 showed the annual growth rate of the Omani population by 1.8%, where the Omani population was 1,483,226 in 1993 and has grown to 1,781,558 in 2003as shown in the table below.

Unit	2003	2010
Total Population ▪ Omani ▪ Expatriate	**2,340,815** 1,781,558 559,257	**2,773,479** 1,957,336 816,143
Population Density: (Person/Km^2)	**7.6**	**9.0**
Total Households ▪ Omani ▪ Expatriate ▪ Collective	**343,377** 225,564 112,015 5,798	**402,286** 260,120 139,154 3,012
Average Omani Households Size Average Expatriate Households Size	9.0 4.2	7.5 4.1
Total Housing Units ▪ Occupied Housing Units	**430,996** 338,946	**551,058** 396,421

Table 6: Population, Households and Housing Units (2003 - 2010).

Source: MNE, Census 2010

[1] Based on 2002 estimations found in http://www.worldmapper.org/ 22/4/2013

3.3.2.3 Migration

Migration is a demographic phenomenon which leads to a direct and indirect impact on the economic and social developments for any society. Oman has experienced a rapid increase in urban population during the past four decades due to three types of demographic factors. They include *natural population growth* due to the increase in birth rate over the death rate; *internal immigration* due to the rapid immigration from rural to urban areas and *international migration* as a consequence of receiving expatriates for work, study, etc.

The internal migration: Internal migration is considered one of the most prominent factors that form the demographic composition of any society. Based on the available censuses data of 1993 and 2003, the volume of internal migration for Omanis remains tight between the two censuses about 73-74,000inhabitants. In 2003, more than half of the Omani population (53%) occupied Muscat and *Batinah,* whereas (43%) of the Omani population is distributed among four regions: *Dakhliyah, Dhahira, Sharqiyyah and Dofar*, Table [7]. In 2003, the highest rate of population growth of Omani-nationals is recorded in *Wusta* with 2.6% whereas *Muscat* took the second with 2.5% growth.

Governorate/ Region	1993		2003		2010	
	Number	%	Number	%	Number	%
Muscat	295.764	19.94	381.612	21.42	407,006	21.4
Batinah	472.065	31.83	564.407	31.68	620,950	31.7
Musandam	22.461	1.51	20.324	1.14	21,898	1.1
Dhahirah	135.140	9.11	147.689	8.29	118,877	6.1
Dakhliyah	199.401	13.44	235.337	13.21	269,069	13.7
Sharqiyyah	219.568	14.80	264.064	14.82	293,394	15.0
Wusta	13.218	0.89	17.166	0.96	19,043	1.0
Dofar	125.613	8.47	150.959	8.47	164,073	8.4
Buraimi					43,026	2.2
Total	1.483.226	100.00	1.781.558	100.00	1,957,336	100.00

Table 7: Distribution of Omani Population by Regions in 1993, 2003 and 2010 census

Source: Family's Income and Expenditure, MNE, 2008

The growth rate for children under five years of age has deceased to reach about (- 0.56%) because fertility rate has declined from 6.9 births per woman in 1993 to 3.65 in 2003.

The amount of internal migration: The size of internal migration prior 1993 was estimated at 74,000 which represented nearly 6% of the total Omani population. However, the number had dropped by 0.1% in 2003 to about 73,400 which represents nearly 4% of the total Omani population. Table [8] shows the internal migration between years of 1993 and 2003.

Governorate/ Region	1993			2003		
	In-migration	Out-migration	Net migration	In-migration	Out-migration	Net migration
Muscat	44.072	10.384	33.688	37.818	15.397	22.421
Batinah	6.801	20.997	-14.196	9.248	9.248	-10.048
Musandam	0.638	0.883	-0.245	0.656	0.499	+ 0.157
Dhahirah	7.092	7.410	-318	7.209	5.748	+ 1.461
Dakhliyah	5.246	14.948	-9.702	6.834	13.292	- 6.458
Sharqiyyah	5.310	13.815	-8.505	5.020	15.292	- 10.272
Wusta	0.893	0.278	0.615	1.288	0.219	+ 1.069
Dofar	3.366	4.703	-1.337	5.968	4.298	+ 1.670
Total	73.418	73.418	-	74.041	74.041	-

Table 8: In-migration, Out and Net-migration in Regions in Oman (1993-2003)

Source: Family's Income and Expenditure, Ministry of National Economy, 2008

The major of migration flows: According to data from the 1993census, Muscat Governorate received about 51% of the total immigrants and Batinah Region received about 12.5%, followed by Dhahira Region with 9.7%.However, Batinah leads the list of top immigrants-sender by 26.1%, followed by Muscat Governorate and Sharqiyyah Region by 20.8% and 20.6% respectively. By calculating the net total migration, Muscat, Dofar and Dhahira are considered the most immigrants-receivers while Sharqiyyah and Batinah are the most immigrants-senders. The net internal migration in Muscat was 22,000 inhabitants while in Batinah was -10,400 inhabitants. Whereas, according to the 2003 census, Muscat Governorate received about 60% of the total Omanis who have changed their residence from other regions. The work and educational opportunities on one hand and the rapid change towards civic life pattern on the other hand have led to receiving large amounts of citizens from other regions.

Census 2003 also indicates that *Batinah* is the leader of top immigrant-senders by 29% followed by *Dakhliyah* and *Sharqiyyah* Regions by 20.8% and 19% respectively. By calculating the net total migration in the 2003 census, the net internal migration in Muscat was 33,700 inhabitants followed by *Wusta* Region by 7,000 inhabitants while in *Batinah* was -14,100 inhabitants followed by *Dakhliyah* Region by -9,700 inhabitants.

Period of residence: Census 2003 also indicates about 87% of the total Omani population are currently residing in the Wilayats where they were born in. However, about 13% (232,000) are considered as immigrants to the places where they are currently staying. Muscat Governorate occupies the most proportion of internal immigrants because about 31.5% of its total population were not born there, followed by Dhahira Region at 14.2%.

The two censuses data indicate that about half of internal Omani immigrants were moving to their new areas of residence in less than a year after the census. Furthermore, about a quarter of migrants move to their current residence in five to nine years as shown in Figure (15)

The characteristics of migrants: The two censuses indicate that the internal migration in Oman is commonly characterized as *family-migration*; all members of a family normally accompany the family's lord (head of household) to the new place of residence.

In the 1993 census, family- the total migration represented nearly 69.6% of types of immigration. While this figure has dropped to 52.3% in 2003, the proportion of immigrants who share housing rose from nearly 16.1% in 1993 to 33.4% in 2003.[1] This authenticates the correlation of the demand for single family housings and the rapid consumption of land. The available data indicates that about 70% of internal migrations in the Sultanate happened five years prior to both censuses. Although the internal migration in the Sultanate was mostly family migration, the single immigrants in 2003 have become greater than 1993. It was obvious that the number of male migrants exceeded females, though the proportions of female migrants have risen in 2003 compared to 1993.

Region	Time since reside			
	Since birth	> 10 years	10+ years	Total
Muscat	68.5	12.9	18.6	100
Batinah	93.9	3.2	2.8	100
Musandam	93.4	4.4	2.2	100
Dhahirah	85.8	8.4	5.8	100
Dakhliyah	92.5	4	3.5	100
Sharqiyyah	92.3	4.8	2.9	100
Wusta	91.2	6.1	2.7	100
Dofar	90.2	5.3	4.5	100
Oman	87.0	6.3	6.7	100

Table 9: Omani internal immigrants (%) according to time's length since migration by regions (2003).

Source; MNE, Census 2003 Result Report vol.1

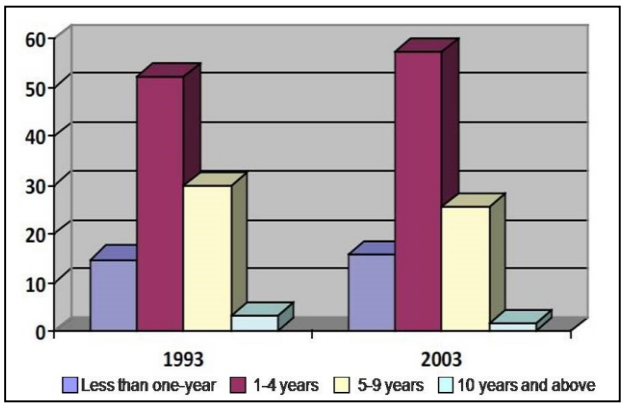


Figure 15: internal immigrants by the time's length since migration (1993-2003) %.

Source: MNE, Family's Income and Expenditure, 2008

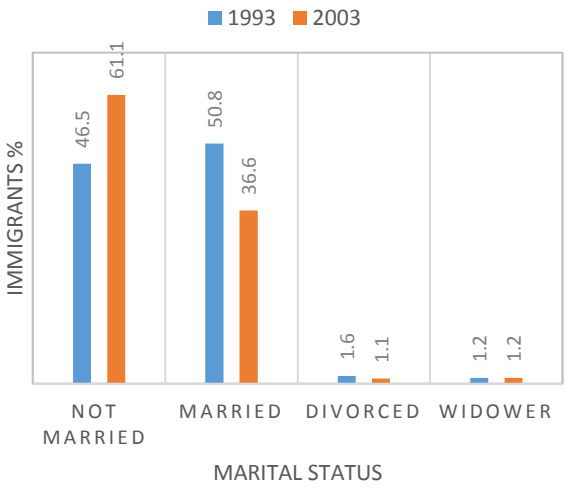


Figure 16: Internal immigrants according to marital status in 1993 and 2003 censuses (%).

Source: MNE, Family's Income and Expenditure, 2008

[1]Sharing residence is normally for employees or students who stay the weekdays together and travel back home at the weekends. Sharing here means for a limited time, some moves to another place as get married, other goes back home as accomplish the study, etc. Sharing is not also exclusive for relatives or for who are in the same tribe.

Table [10] indicates that the majority of migrants in the Sultanate were males with a percentage of 61.5% of the total immigrants in 1993 and this declined slightly in 2003 to 56.5%.

Age class	1993			2003		
	Male	Female	Total	Male	Female	Total
00 - 04	1.0	1.0	2.0	1.3	1.2	2.5
05 - 09	2.7	2.6	5.3	3.5	3.0	6.5
10 - 14	3.8	3.5	7.3	4.0	3.8	7.8
15 - 19	7.1	5.2	12.3	8.7	6.8	15.5
20 - 24	11.1	5.9	17.0	17.8	15.4	33.3
25 - 29	8.2	4.6	12.8	9.4	6.7	16.1
30 - 34	6.5	3.7	10.2	4.4	2.6	7.0
35 - 39	5.6	3.2	8,8	2.9	1.4	4.3
40 - 44	4.2	2.1	6.3	1.9	0.7	2.6
45 - 49	3.4	1.8	5.2	1.0	0.4	1.4
50 - 54	2.8	1.6	4,4	0.7	0.4	1.0
55 - 59	1.7	0.9	2.6	0.3	0.2	0.6
60+	3.4	2.4	5.8	0.7	0.7	1.4
Total	61.5	38.5	100,0	56.5	43.5	100.0

Table 10: Internal immigrants (%) according to sex and age class in 1993 and 2003 Censuses.

Source: MNE, Family's Income and Expenditure, 2008

The economic activity of internal immigrants: The available data about the economic activity of internal immigrants in the Sultanate confirms that migration is normally for work and resuming study. Since about 39% of immigrants in 2003 were students and 38% were employees, it means that more than 70% of internal migrations are either for business or study. This figure was about 80% in 1993, in the case that employees formed about 54% of immigrants and students about 27%. In 2003, about 58% of them were employed in the public sector and 38% were employed in private sector, while the corresponding percentages in 1993 were 82% and 17% respectively. In both censuses, Muscat Governorate is considered as the most essential area that attracts population from other regions, while the Batinah Region is considered as the area for the most population-expulsion.

Immigrant Activity	1993	2003
Employed	54.2	38.0
Unemployed	2.1	6.0
Work at Home	14.3	13.4
Student	26.6	39.0
Other	3.4	3.7
Total	100	100
Work Sector		
Public Sector	82.3	58.3
Private Sector	17.3	38.2
Family		3.2
Other	0.2	0.3
Total	100	100
Work Status		
Employer	0.4	0.4
Own Business	1.0	2.1
Payee Labour	98.6	96.8
Unpaid Labour	0.0	0.1
Total	100	100

Table 11: Percentage distribution of internal immigrants according to economic activity, work sector and education status in 1993 and 2003 censuses.

Source: MNE, Family's Income and Expenditure, 2008

International migration

In addition to internal migration and the natural population growth, international migration is another factor that has largely contributed to the rapid urban growth in Oman. Since the beginning of the Seventies when the national economy had risen gradually due to the oil production, the Sultanate like many regional countries, had received an influx of expatriate who were mainly labor workers and field experts. According to the 2010 census, the expatriate population represents nearly 30% of the total population with 816,143 people. Within merely seven years between the two censuses 2003 and 2010, the quantity of expatriate population had risen about 46% (256,886 people).

The international migrations have largely contributed to raising the problem of urban sprawl in Oman. Since the oil revolution in the early Seventies which boosted the national economy to a higher level, there was no alternative other than handing the urban development over to expertise and experienced workforces from other countries. However, according to the 2010 census, the expatriate population had formed nearly one third of the total population in Oman. The expatriate workforces have many advantages such as pushing up the rental market.

This performance has benefited the local citizens as they are the major owners of the real estate properties. In spite of this, the expatriate population has largely participated in the boosting of comprehensive development that Oman has experienced during the last four decades; it has many impacts on economic, social and environmental levels. On the economic level, for instance, as this category is enabled to utilize the basic services nearly free of charge, it has consequently contributed to boosting the general public spending.

On the social level, the expatriate population, particularly the low-educated labor-forces, have contributed to raising the rate of crime, drugs, robbery, rape as well as merging many exotic customs and cultures that have been imported from their countries of origin to Oman's society. Additionally, it is believed that the expatriate population has become the most prominent factor in raising the rate of unemployment since it has created a competitive milieu on career opportunities in the country. Environmentally, this category has largely contributed to boosting the burden on natural resources such as water and energy.

Governorate/ Region	2003		2010	
	Number	%	Number	%
Muscat	250,461	44.8	368,872	45.2
Batinah	89,098	15.9	151,640	18.6
Musandam	8,054	1.5	9,527	1.1
Dhahirah	59,326	10.6	32,787	4.0
Dakhliyah	31,803	5.7	57,582	7.1
Sharqiyyah	49,392	8.8	57,120	7.0
Wusta	6,122	1.1	23,068	2.8
Dofar	65,001	11.6	85,656	10.5
Buraimi	-	-	29,891	3.7
Total	559,257	100	816,143	100

Table 12: Expatriate Population % by Region (2003&2010)

Source: MNE, Annual Report, 2010

3.4. The Governance

3.4.1. The characteristics of governance prior to oil age

Like other countries in the Arabian Peninsula, governance in the period just before oil production was characterized by adecentralization of responsibilities. The governance in that time could be described as 'territorialization' as every territory was controlled by tribal leaders or sheikhs. The lack of economic sources and weakness of agricultural products had led to internal conflicts from the Forties up to the late Sixties. Every territory was semi-separated from other territories with regards to its economic sources. This was a major reason that these settlements were totally castellated against any external attack. The sheikhs, who mostly owned huge areas of arable lands, let farmers utilize parts of these lands for cultivation and had shared yields. Decisions were made after single or multiple meetings among the *'tribal sheikhs'* and old people. The local ordinances and laws were normally applied after consulting every tribal member which was based on *Shura* principles in Islam. At that time, there were no courts or judicial and legal enterprises, as all civic issues were solved via conciliation between the disputing parties by sheikhs and elderly people. As sheikhs were only controlling those who belonged to the same tribe or territory, where population was not more than 2,000 individuals, it was easy for them to rule these areas with wisdom and competence.

3.4.2. The characteristics of governance at oil age

Since the socio-economic transformation which occurred in the beginning of the 1970s, new governors have emerged in the Sultanate. The central government has altered the Sheikhdom and Imams ruling. The sheikh who was controlling his territory has lost his power. The country has been changed to a legal country since his Majesty Sultan Qaboos took power in 1970. Most ordinances and legislations are approved and declared in the form of Royal Decrees. Also, major projects and schemes are declared and approved by Royal Decrees. Some decrees relocate some properties to other areas when public services pass through. For instance, the new coastal highway, which runs from Muscat to the north of Oman for more than 400 kilometers and costs more than OMR1billion, passes through plenty of private properties that have been relocated.

3.4.3. Urban governance prior to oil-age

At every neighborhood locally called *hara*-people were allocated a space, normally in the middle of the neighborhood, to host their meetings. Due to the harsh environment at that time, the need for homogeneous and livable urban space created challenges for urban governors. The oasis settlement stands as evidence for those people who defeated most of environmental difficulties at that time. Every settlement showed its capability of living with autonomous society and integrated urban fabric which succeeded in achieving most of the sustainable criteria. The majority of the tribe was satisfied with the distribution of the land. The desired land for housing purposes was normally chosen in accordance with many aspects, such as its proximity degree from parents and cousins at a primary level and its proximity degree from the same tribal community at a secondary level.

3.4.4. Urban governance at oil-age

A governmental authority called "Ministry of Land Affairs and Municipalities" was established in the early 1970s to control the urban management, planning and the distribution of lands. Town Planning in Oman has been undertaken in the context of extremely rapid change since the accession of His Majesty Sultan Qaboos bin Said in 1970. The benefits of national oil wealth have been distributed to improve the quality of life of Oman's citizens, manifested partly through great progress in the standards of educations, healthcare and the provision of other social and cultural facilities. 'Responsibility for planning, land allocation and provision of infrastructure services has, over the year, been divided between a numbers of government agencies. In recognition of the difficulties experienced in the past by these various agencies in preparing plans for development in the Sultanate, the Supreme Committee for Town Planning was set up under Royal Decree 27/85, to establish a general policy for town planning.'[1]

The parties related to the General Policy of Town Planning are Ministers' Council and the Supreme Committee for Town Planning, while the parties which are related to the Detail Policy of Town Planning are Ministry of Housing and Sohar Development Office. The parties which are responsible for the policies of basic infrastructure services are Ministry of Transport, Ministry of Electricity and Water, Ministry of Regional Municipalities and Water Resources, Minister of State and Governorate of Dofar, Muscat Municipality and Oman Telecommunication Company. See Diagram [5].

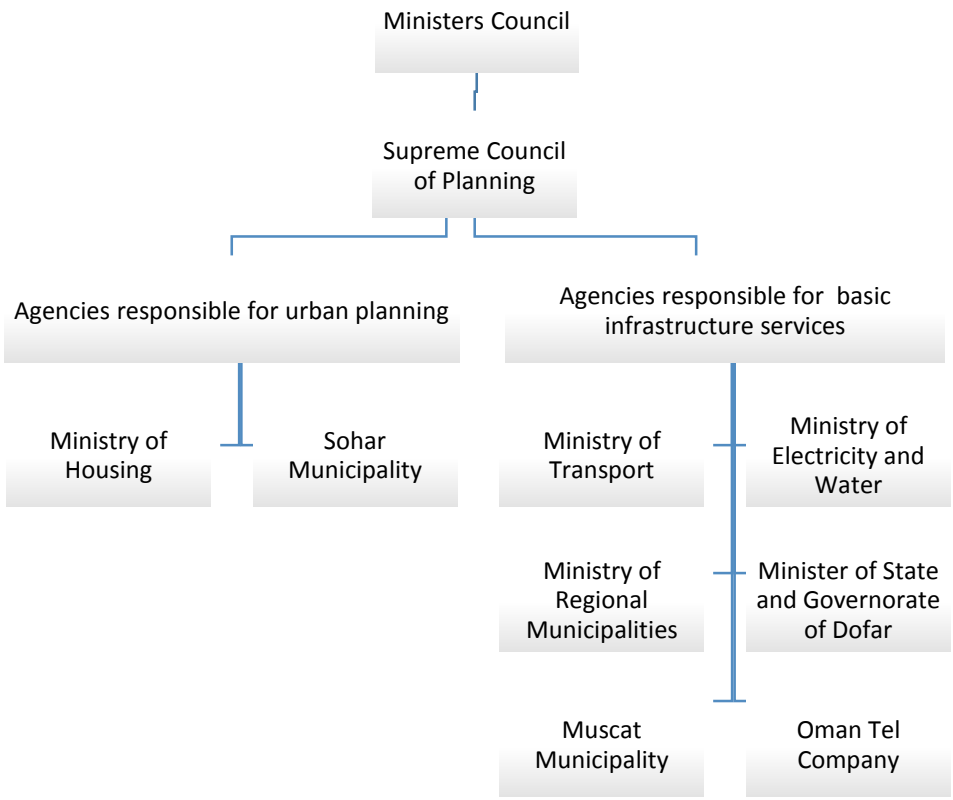


Diagram 5: Parties related to the General Policy of Town Planning Source: The author based on SCTP (1991)

[1]SCTP (1991)

3.4.4.1. Ministers' Council

According to the Law of Administrative Board of the State which is released by the Royal Decree (26/75), the Ministers' Council is the supreme executive authority for the Administrative Board of the State. It approves the general policy of town planning in the Sultanate and supervises and follows the performance of all governmental units and ministries for applying their responsibilities and their correlations among them. The Ministers' Council approved the general framework for preparing the general policy for town planning according to the decision held at meeting (6/88) on the 5th of April, 1988. [1]

3.4.4.2. Supreme Committee for Town Planning

The Supreme Committee for Town Planning (SCTP) was set up under Royal Decree 27/85 and Royal Decree 70/93 to establish a general policy for town planning according to the approved development plan and according to the economic and social considerations which will be then shown to the Ministers' Council to be then approved by His Majesty the Sultan. The general roles as follows:

- Policy-making at all levels of urban planning according to economic, social and environmental considerations
- The preparation of urban development strategy to achieve the objectives of the comprehensive and sustainable development in all provinces and regions of the Sultanate.
- Issuance of planning approvals of the allocation of lands for different purposes.
- Obtain rules and suggest the necessary legislation to regulate and direct the work of the Urban Planning.
- The establishment of an integrated information system includes a geographic databases and maps for all provinces and regions of the Sultanate.
- Production of base maps that meet the requirements of the civil work of the Planning and Development in coordination with the concerned authorities.
- Lay the foundations for valuation of real estate expropriated under the law of expropriation for the public benefit.[2]

Despite the above stated roles of the SCTP, its impact on the urban growth has remained blurred for years since it has established. The planning policy is still not clear and seems incapable even to guide the urban development in urban and suburban areas. The fragmentation of planning policy among multiple authorities has had a large impact on the emergence of the current urban patchwork and the fragmentation of land uses.

[1] SCTP (1991)

[2] http://www.sctp.gov.om/ Accessed (22/5/2010)

3.4.4.3. Ministry of Housing

The general role of the Directorate General of Town Planning and Survey, which is a part of the Ministry of Housing, is the preparation of strategy that aims at achieving the balance in the development in the various governorates and regions of the Sultanate in order to provide citizens stability their places of residence. The urban planning policies in most regions of the Sultanate depend on the following levels of services:

- *Structural plans:* To determine land use at the level of cities and villages.
- *Detailed plans:* To prepare detailed plans of the components of cities and villages.
- *Assistant studies to take technical decisions.*[1]

3.4.4.4. Land Acquisition

Land in Oman is generally acquired by two common means, personal claim and governmental grant. The first type is established to offer citizens the chance to submit official papers that prove that their properties were owned or inherited before the January1, 1970. The second type enables a citizen to acquire a residential plot as a grant without any restrictions, and also other land with various land-uses such as commercial and industrial with some restrictions. For instance, a citizen can apply for commercial or industrial land if he/she has a valid commercial or industrial activity and was operating the in past three years respectively.

Land Claiming System: This type enables a citizen to apply for claims for legal possession for land. The land law ensures that the claimed land must be owned or inherited before the January 1, 1970. The claim must not only include the occupied lands but also vacant lands with all their uses. The claim must provide certain papers either from the local sheikh or from the legal courts to enhance the application and substantiate the claim. The first Land Law which was declared via Royal Decree (5/80) included that every land belongs to the government unless the possession is legally proved prior to January 1, 1970. Although this law has bounded the acquirement of governmental vacant land, plenty of acres of lands have been acquired by cheat of applicants even to this day. The vagueness of land management has created blurred conditions regarding the correct process, or technique that should be utilized to govern the acquisition of land. The Lands Affairs Committees, which consist of members mainly *sheikhs* who are appointed by the Ministry of Housing for every Wilayat need to be restructured. Although the Land Affairs Committee which was first announced by Royal Decree (11/79) proposed regulating the claiming of lands, it does not posess the authority to limit the increasing demands for reclaiming vacant governmental lands. Therefore, planning authorities can do nothing about the emergence of random and arbitrary development which is seen in every Wilayat in the Sultanate. This issue is not only causing the rapid consumption of lands but also confuses and dilutes the effectiveness of urban and suburban growth. Undeveloped lands that are left vacant and can be observed here and there throughout the Sultanate are one implication of this issue.

[1]Ministry of Housing. *The Ministry of Housing Profile*, Department of Public Relations and Information.

Land Granting System: According to the land law which is published, Royal Decree number (81/84), every Omani citizen has the right to gain a residential plot from the government as a grant. Every citizen has **to draw a plot** at a public **random lottery** from the planning areas prepared by the Ministry of Housing. Distributing lands in this manner has paved the way for creating the patchy urban layout and the fragmented development. Royal Decree (88/2005) issued on the 24thof October, 2005, amended some provisions of the maturity of government land. The General Conditions contained in the system of entitlement to government land referred to an applicant to be as follows:

The Ministry of Housing, under the provisions of this system, would have to grant a piece of land to those who submit a request, according to the following conditions:

- Not be less than the age of twenty-four years unless he proves that he is the only breadwinner for his family.
- To draw lots at the random lottery.
- To pay the charge on time.

If the applicant misses the date of Random Lottery, the application will lapse unless he has a reasonable excuse. He may submit a new application two years after the date of lapsed request.

Up until 2008, only men were legally granted land in the Sultanate. However, Royal Decree (125/2008) issued on the 16th of November, 2008 amended some provisions of government land allocation as per Royal Decree (81/84). This decree equalized the right of granting lands among men and women. The decree also stated three conditions for official application. They are:

1. Applicant's (male or female) age should generally be not less than 23 years. In the case of married applicants, age should be not less than 21 years or he/she should be the only breadwinner of his/her family.
2. The land will be allocated as and when it is available in the regions/governorate in line with the approved housing plan.
3. Priority will be given to those who have not been allocated government lands earlier or who do not own lands on the date of submission of application.

Although this decree achieved the equalization of granted lands among the two genders, it seems that land availability was put under even greater pressure. Since women have taken this authorization, thousands of hectares were consumed in order to meet the demand, particularly if we know that there are very limited vacant lands remaining in Muscat particularly appropriate for development. Sometimes the sprawl is caused because of unsuitable physical terrain (such as rugged terrain, wetlands, mineral lands, or water bodies, etc.) for continuous development. 'This often creates leap-frog development sprawl'[1] Important to mention that in many instances these problems cannot be overcome and therefore should be overlooked. Harvey and Clark stated that 'many institutions and even individuals desire for the ownership of land. Often these lands left vacant within the core city area and makes infill policies unsuccessful.'[2]

[1]Harvey and Clark (1965); Barnes et al. (2001) quoted by Bhatta, B (2010), p.22

[2]Harvey and Clark, (1965) quoted by Bhatta, B (2010), p.22

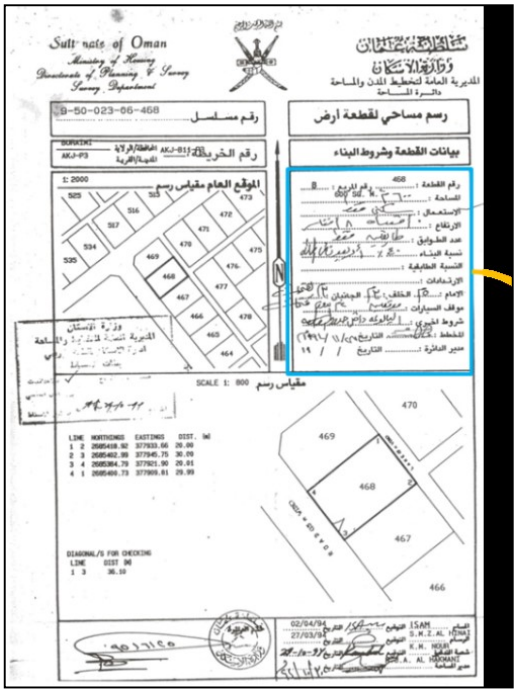
Bhatta (2010) indicated that 'speculation about the future growth, future government policies and facilities (like transportation etc.) may cause premature growth without proper planning. It produces withholding of land for development which is one reason of discontinuous development.'[1] Speculation of future development has become obvious in Oman with the encouragement of the existing urban management. As there is no law or ordinance that obliges owners to develop their lands at certain time, the owners feel absolutely free about the time of developing their lands. Vast majorities of lands are kept undeveloped by owners. The majority of landowners remain eager to change in the areas that boost the value of their lands. Therefore, this attitude is one of the most significant reasons that have led to the existing scattered and patchy urban pattern in Oman.

Owning plots without any development restrictions such as stating a limited time line for construction allows people to keep their plots vacant as long as they decide to develop them. This situation also encourages people to buy as many plots as they can, mostly to reserve them in their possession for ages. They have the right to sell at any time or to keep those plots for as long as they desire. Consequently, you might find a plot which was developed this year adjacent to a plot that might be developed after 10 or 20 years, or even one that is never intended to be developed.

In order to fulfill the huge demand for land, the Ministry of Housing starts by searching for a convenient piece of land, mainly after a short site visit by the area planner. Then the area will be reported to the Land Affairs Committee -- its members are mainly Sheikhs -- which proves that the potential area is not claimed by any local people and it has no legally-bounded restrictions. The area will then be subjected to a detailed survey that shows all the natural and physical objects. Consequently, the urban planner subdivides this land into parcels, or plots, with certain land uses being assigned. All plots will then be transformed to an A4 sheets showing the serial number of the plot at the top of the sheet, the dimension of the plot, area, site location, coordinates and the building restrictions. Picture [6].

Then this sheet-- called a 'Krooki' -- is thrown into a random lottery box to be drawn by an applicant. The applicant will be then announced by media with other applicants to draw a plot at a certain date, see Picture [7]. The plot cannot be replaced or changed once it has been drawn.

[1]Bhatta, B. (2010), p.21



Picture 6: plot details sheet prepared to be drawn at a random lottery Source: MoH

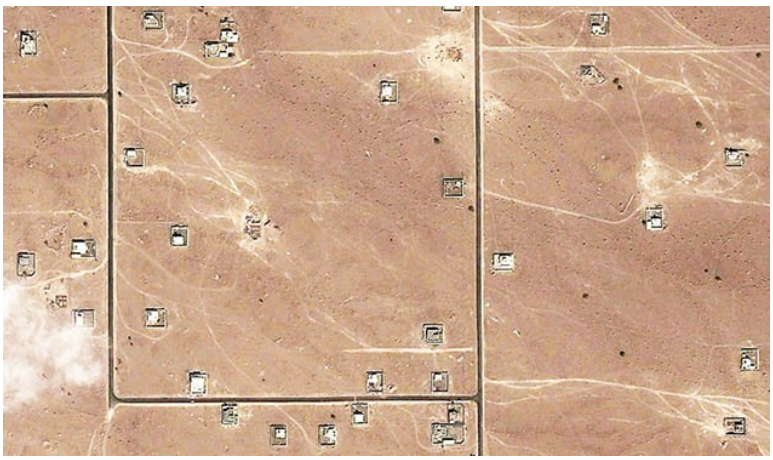
م	الاسم	رقم البطاقة الشخصية	م	الاسم	رقم البطاقة الشخصية
١.	اشلوم بنت محمد دعنوق الشنجرية	٠٥٢٦٥٣٦٥	٥١.	فضيلة بنت فرج سهيل العامرية	١٠١٩٥٣٨٧
٢.	احمد بن محمد حسارك رغديص	٠٥٩٢٩٦٩٣	٥٢.	فاطمة بنت احمد دستهيل لقرم الشنجرية	١٤١٤١٧٧١
٣.	اسماء بنت حفيظ احمد الكاف	٠٩٤٨١٤٤٢	٥٣.	فاطمة بنت بخيت محمد كلنوب	٠٤٦٩٥٢١٤
٤.	اسماء بنت علوي عبدالله دقديل	٠٦٠١٢٨٥٤	٥٤.	فاطمة بنت سالم عبدالله الروانس	٠٧٩٨٥٧٦٢
٥.	الخيار بنت سهيل سعيد الهوائد	١٠٦٢٥٤٨٩	٥٥.	فاطمة بنت سالم علي غواحس	١٤٧١١١٧٧
٦.	الخيار بنت محمد سالم دمين	٠٩٢١٨٠٨٤	٥٦.	فاطمة بنت سالم محمد دمين	٠٦٠٧٧٩١٧
٧.	انجله بنت سعيد سهيل غواحس	١١٠٦٢١٤٢	٥٧.	فاطمة بنت سعيد احمد لقرم الشنجرية	٠٧١٣٨١٥٢
٨.	انجله بنت سعيد محساد حسارذان	٠٧٠٦٨٢٧١	٥٨.	فاطمة بنت سعيد محساد حسارذان	٠٦٥٥٧٨٧٨
٩.	انجره بنت سهيل علي المسيلية	٠٣٧٥٦٣٠٥	٥٩.	فاطمة بنت سعيد محمد صقرار الشنجرية	١٥١٠٦٤٥٧
١٠.	انجله بنت دظر غوشن بخيت جديل	١٠٧٨٠٤١١	٦٠.	فاطمة بنت سعيد محمد كلنوب	٠٣٠٦٦٤٤٧
١١.	انيسه بنت حفيظ احمد الكاف	٠٩٤٨١٤٣٧	٦١.	فاطمة بنت سهيل سالم شداس	٠٦٣٢٣٣٣٨
١٢.	بهية بنت عبدالقادر حفيظ الكاف	٠٣٣٣٣٤٠٩	٦٢.	فاطمة بنت شرجي دسلم رغديوت	٠٧٠٤٠١٠٣
١٣.	بهيجه بنت عقيديل عمير بامعمر	١٣٢٦٣٢٣٧	٦٣.	فاطمة بنت عبدالله علي باعوين	٠٥٦١٦٩١٣
١٤.	تماريد بنت صمالح شمعدان	٠٦٧١٧٠٨٨	٦٤.	فاطمة بنت علوي عقيديل دقديل	٠٣٩٨٦٠٧٣
١٥.	حدله بنت سعيد عمير الكلدية	٠٨٩٦١١٠٦	٦٥.	فاطمة بنت عوض احمد صقرار	٠٩١٧٧٤٤٧

Picture 7: List of applicants' names announced by media to draw the lottery of lands

Source: www.alwatan.com Accessed 21-12-2011

Picture 8: Land lottery draw. Source: The author

At the time that the plot is drawn, the planning area lacks the basic infrastructure services such as roads, water, electricity, etc. The citizen has a choice, either to develop his plot in this condition and accept the challenges of many environmental and social problems, or to wait until local authorities implement the basic infrastructure services. A granted land may take decades of deliberating at the real estate market until it is developed. A plot maybe passed under many real-estate actions such as selling or pledging and makes a fortune for its owner/s until it is developed. Some people prefer selling their plots in this condition with very low prices and purchasing others which are located near or within existing developments. The value of plots is influenced by the availability of basic infrastructure services and the distances from the existing development.



Picture 9: In some areas, roads are constructed before other services.

Source: www.googleearth.com

It is obvious that agencies responsible for urban planning and the ones responsible for the basic infrastructure services are not working together. It seems that every part of these agencies works alone i.e., in some planning areas, roads are constructed before other services, while in others electricity comes first. See Picture [9]. This urban landscape makes life unbearable because this environment fails in meeting the basic sustainable urban patterns. At a social level, people become disconnected from their parents, relatives and friends. With notable absence of viable public transport, the only way to commute requiring the use of a private automobile. On a security level, these built structures will be susceptible to robbery more than if they are built in denser built forms. At the economic level, this built form encourages people to use their private automobiles, causing fuel consumption to be extremely high and consequently the environmental footprint will be notably higher. Though the cost of infrastructure in these areas is extremely high, few people share these services because the population density in these areas is very low.

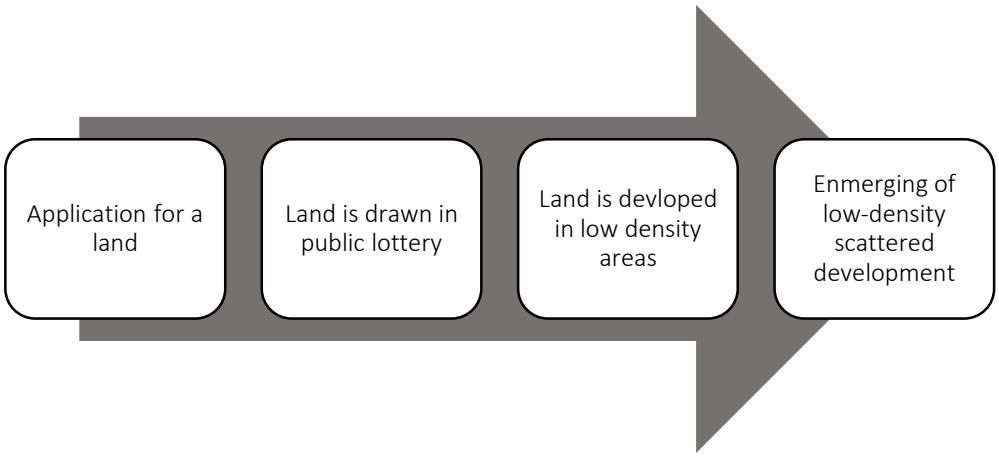
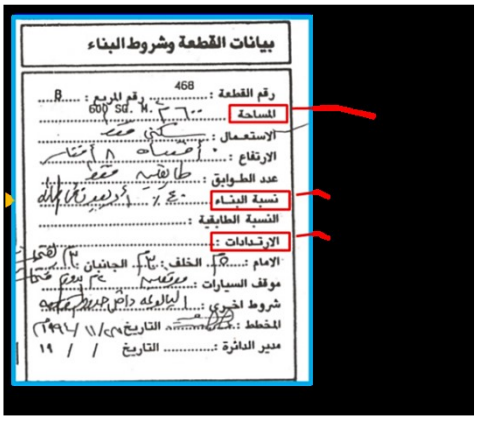


Diagram 6: Process of land management system in Oman Source: The author

3.4.4.5. Land development

The question that might be raised is how are these plots developed? Housing units in Oman are developed by individuals, built to designs of personal preference on land allocation under the land laws that have been previously outlined. Areas of social housing are designed and built by the Ministry of Housing. Planning standards for housing are the detailed controls which determine the built form. The Planning Authority established a sort of planning framework to regulate houses and their relationship with the surrounding public spaces, such as roads and neighborhood houses. The regulation includes:



Picture 10: Planning standards for housing which determine the built form Source: MoH

- the house must be a central unit on its plot;
- specified stated set-backs for the house from its boundary walls according to the plot area;
- restricted floor heights, and
- a limited built-up area for each plot according to the plot area.

These standards were set up by the planning authorities in order to attain the maximum privacy between housing units. For example, for a plot with an area of 600 square meters, the minimum front setback is five meters from the compound wall; the minimum rear set-back is three meters while the minimum side's set-backs must be three meters. The height of the building must not exceed eight meters while the maximum number of floors for each house is two floors.[1]

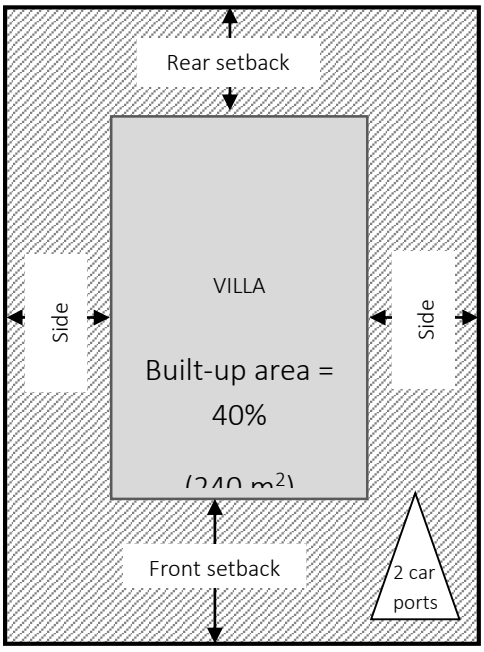


Figure 17: Built form based on the planning standards for plot 600m² (20mx30m)

Source: The author based on the MoH planning standards

Planning standards use privacy as a design priority but disregard other influential factors which do not meet the minimum optimal and ecological built form. For instance, setbacks which are 3meters as a minimum width consume a vast majority of the plot area. Figure [17] indicates a plot with an area of 600 square meters and maximum built up area as 40% (240square meters) which means 60% (360square meters) of the area is not allowed to be developed. Hence, these area are neither suitable for a courtyard nor for other purposes. Therefore, a majority of residences leave these areas as vacant spaces. Environmentally, these detached free standing built structures will fail to withstand the harsh environmental conditions such as hot wind, dust, high temperature, moving sands, etc. Bhatta (2010) argued that 'single-family residences increase the size of a city in multiple magnitudes because it sates vertical space significantly resulting in horizontal growth.'[2]

[1]Source: The author based on MoH data.
[2]Bhatta, B (2010), p.25

3.4.4.6. Financing and Subsidies Mechanisms

There are various financial enterprises and banks that are considered as principal partners for urban development. Almost the entire financial sector in Oman has played an essential role in subsidizing the individual housing projects. These financial actors are responsible for providing grants, loans and mortgages in housing sectors. A few of them are affiliated to government, such as Ministry of Housing, Development Bank and Oman Housing Bank. Some institutions such as Ministry of Defense (MOD) and Petroleum Development of Oman (PDO) provide their employees with interest-free housing subsidies. ***Ministry of Housing:*** Ministry of Housing provides three kinds of housing subsidies: Social Housing Program, Housing Assistance Program and Housing Loans Program. Firstly, the '**Social Housing Program'** is comprised normally of estates of affordable housing units which are built to be granted for those who are under the social security umbrella and eligible to gain this facility. The '**Housing Assistance Program'** is designed for citizens who have limited income (not exceeding OMR129 per month) and for families who are under the social security umbrella. The grant is a 'non-refundable value of 'OMR15,000' to pay for the construction of a new housing unit. The '**Housing Loans Program'** also targets those who have limited income but with earnings that are less than OMR 300 (per month). This target group gets residential interest-free loans for up to OMR 20,000.

Oman Housing Bank[1]***:*** Until recently, the Oman Housing Bank was no different from other commercial banks, rather it merely provides housing loans for individuals with large interest rates of up to 9% with various restrictions that have already been mentioned in this thesis. However, in response to recent demonstrations and protests which have been taken place in several Arab countries, including Oman, His Majesty the Sultan issued his instructions in November 2012 to lessen the interest rate to be more affordable for citizens. Although this responsive action might boost the housing construction to a certain level, it will still not cope with accelerating demands for houses. The majority of these houses are developed through minor contractors that have limited capabilities and lack of good practice in managing and developing the housing projects. Consequently, many problems emerge between the owners and those contractors which mostly lead to stalling the projects. Therefore, the lack of financial subsidies and poor construction managements have largely contributed to creating patchy and fragmented urban development that is seen throughout the Sultanate. Oman Housing Bank proposes to improve the housing sector for Omanis at large by providing long term loans for constructing or purchasing residential units. Since the local private banks have not provided the long term loans for housing purposes at that time, the bank played an essential role in developing the local real estate market. The bank offers the following facilities: construction of a house, purchase of a completed house, purchase and completion of an uncompleted house, completion of an uncompleted house, expansion of an existing house, repayment of loan arising from (construction/purchase) of a house and maintaining a house.

[1]*Oman Housing Bank* is a profitable banking enterprise as a cooperative banking scheme which was established in 11.07.1977 by virtue of the Royal Decree No. 51/77 as an Omani stock company with a capital of RO. 10 million as successor of Oman National Housing Development Co., which had been involved in housing financing in Oman since 1974 to finance the local private housing projects for Omani-nationals with competitive interests.

Other financial sources: Financing the private housing projects is also obtained by commercial banks. For instance, *'Baituna'* in Bank Muscat and Daruna in Bank Dofar (both words mean our house) are home finance schemes which are primarily offered for Omani nationals for financing the construction or the purchase of houses and lands. However, because of the high interest rate and incompatibility with *Islamic Shari'ah*, which prohibits dealing with usury, the demand for these types of loans remains very weak. In contrast, a large proportion of nationals have set up free-interest *Symbiotic Associations* for financing the construction or purchase of private houses or even finance the cost of marriages or buying car, etc. The main disadvantage of this type of financing method is the beneficiaries often do not get the funding at once, but instead they get it in shares over a period of time up to several years, depending on the quantity of members and the duration of the *Symbiotic Associations*. Most of the members prefer to receive the full amount of lease to finance their projects. Diagram [7] summarizes the mechanism used for financing private houses in Oman.

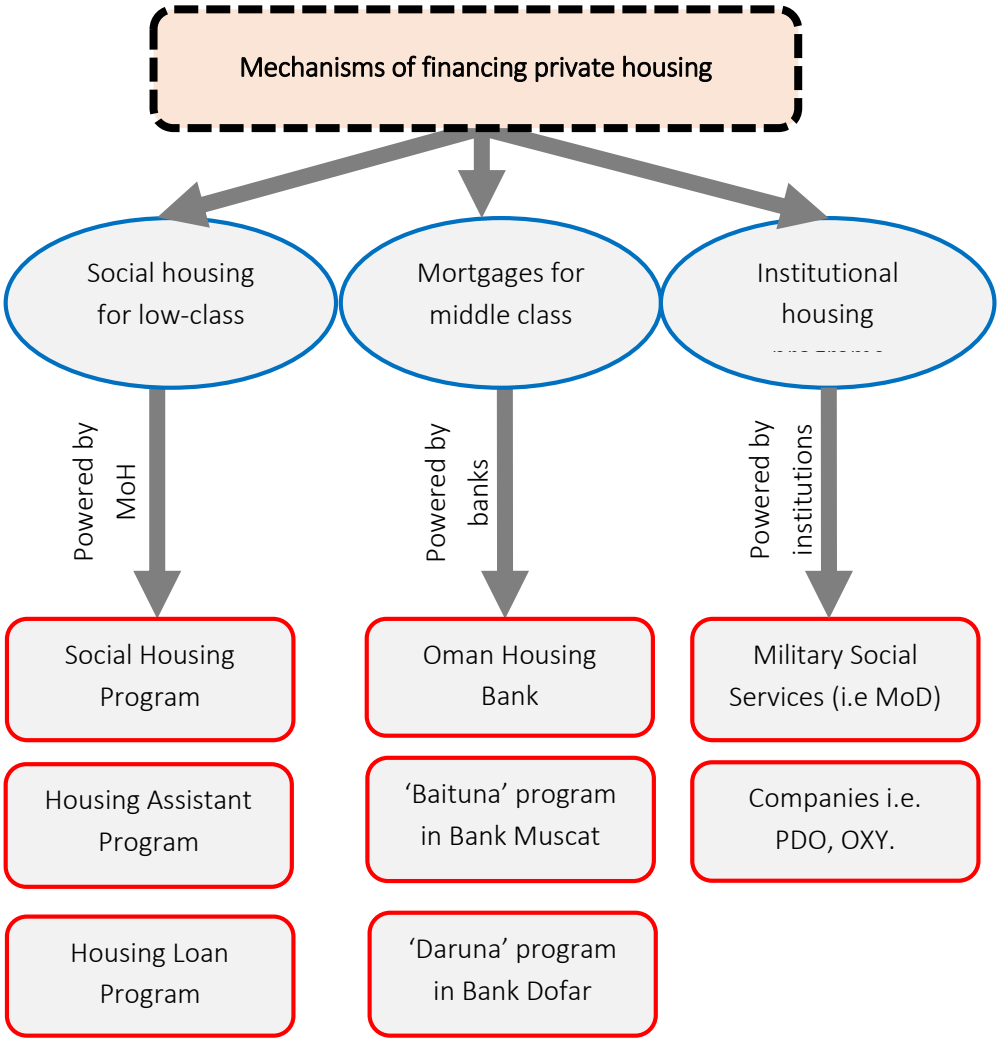


Diagram 7: Mechanisms of financing private housing in Oman

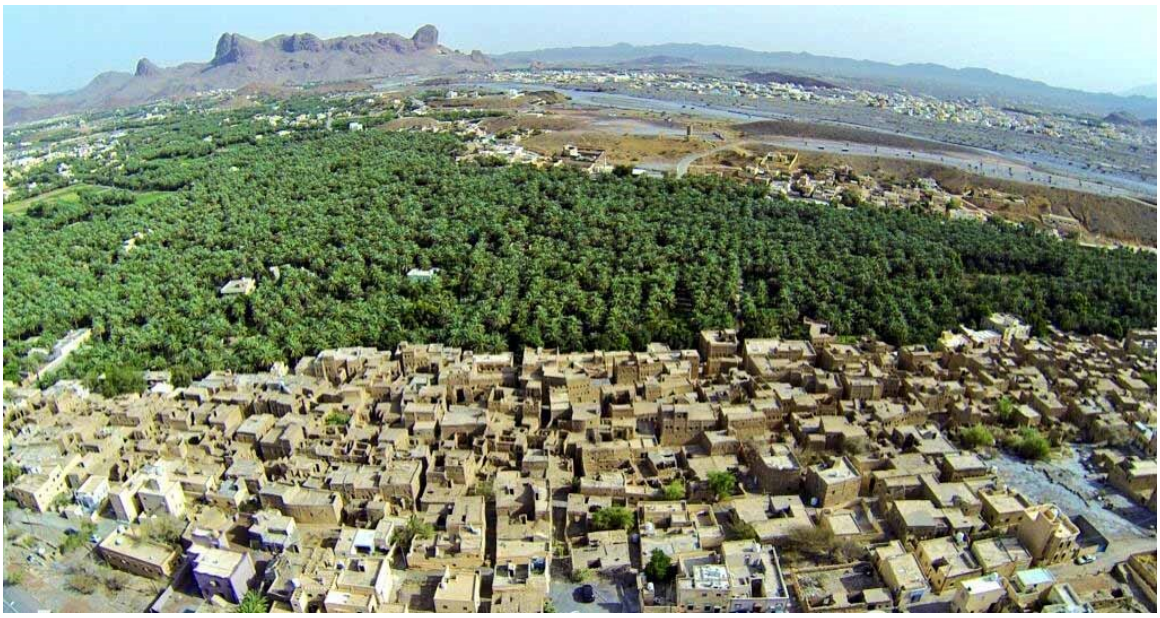
Source: The author

3.4.5. The urban patterns

3.4.5.1. Characteristics of urban pattern prior to oil age

According to Haser *et al.* in Buerkert & Schlecht (2010) 'Oases are a particular strategy of human adaption to a desert environment, and they have played a crucial role in the history of man on the Oman Peninsula over the last five millennia.'[1] The availability of water was an essential factor that has determined the location of every oasis settlement throughout the Sultanate. The oasis settlement was created as a natural pattern that derived from local geo-environmental conditions. Most of these oasis categories are characterized as high density built-form and housed very high density populations.

Based on a field study organized by an Omani-German research team named *"Transformation processes in oasis settlements of Oman",* held in 1999, the total area of the traditional settlement was nearly 30 hectares and holds about 15,000 inhabitants with a population average density of 500 inhabitants per hectare. Meanwhile, 'the area of palm tree oasis is about 600 hectare and mainly surrounds the traditional built-up area. It has been found that the area ratio for settlement and green lands represents 1:20. Consequently, this ratio indicates that one hectare of palm tree cultivation area is occupied by nearly 25 inhabitants. This typical model could be observed at most of existing traditional oases throughout the Sultanate.'[2] The hot wind is filtrated by the irrigated bedews soil and the green palm leaves before reaching the built up area at the core of the oasis. The majority of heat is absorbed by this environment-friendly technique to keep the local inhabitants feeling comfortable even in harsh weather. The irrigation water channel (*falaj)* plays an important role in ecological accumulation. With its functionalism aspects being used for drinking, washing and plant irrigation, the *falaj* plays a crucial role in keeping the entire environment refresh and homogenous. At the social level, the falaj was a place where people gathered during the day and night.



Picture 11: Oasis urban pattern

Source: DJI Oman (@DJI_Oman)

[1] Buerkert & Schlecht (2010), p.16

[2] Deutsches Archaologisches Institute (www.dainst.org)

The spatial hierarchy, which was a unique feature in the traditional neighborhood, has been omitted since the emergence of the oil-age. Even the term 'neighborhood' should not be applied to today's urban form. The housing units in the traditional units were clustered around public or semi-public space. The spatial hierarchy from private to public spaces was outlined very precisely. Normally the private house leads to a sheltered pedestrian pathway called *'Sikka'*. This pathway leads to the semi-public space used as a collective space. See Figure (18). This space is normally a building called *'Sablah'* which is a very large room used to gather local people every day and night. It was also a space which was utilized to welcome guests and to celebrate the events. In addition to its role of reinforcing and maintaining the social cohesion, Sabla was utilized as a public parliament that hosted local people for practicing democracy in decision-making. However, since the transformation to the 'modern' lifestyle, Sabla has lost its highbred function and is now merely utilized occasionally in condolence events. The abandonment of the Sabla's roles has reduced the social interactions and enlarged the family fragmentations which are seen in the contemporary built-form.

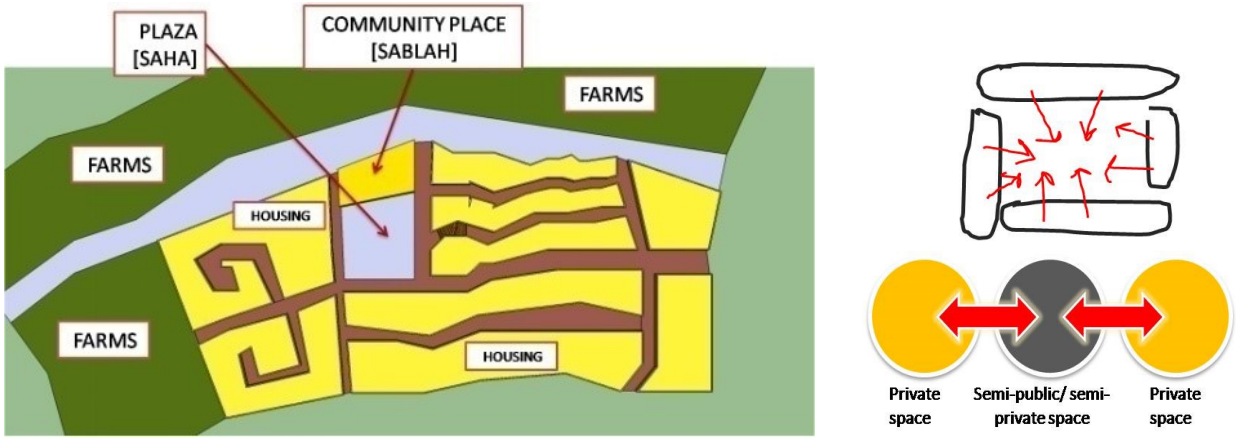


Figure 18: Built form and spatial hierarchy of the traditional neighbourhood which encourage social unity Source: The author

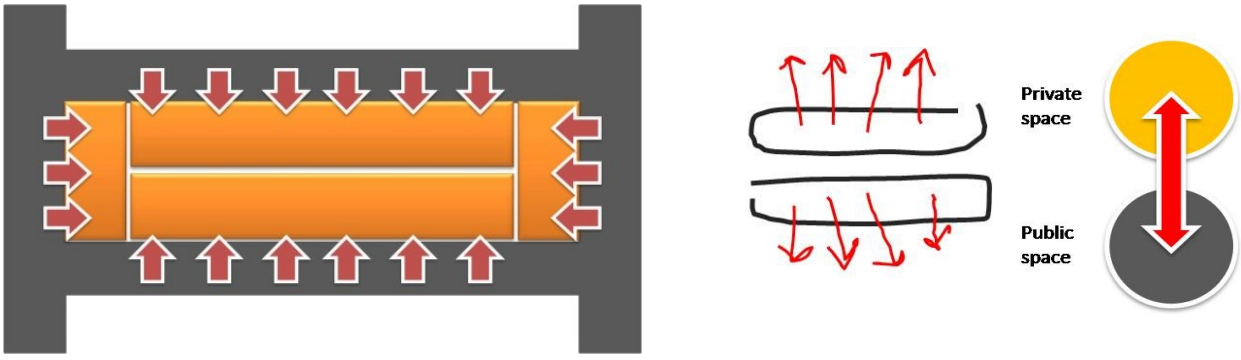


Figure 19: Built form and spatial hierarchy of the current planning areas which encourage the social segregation.

Source: The author

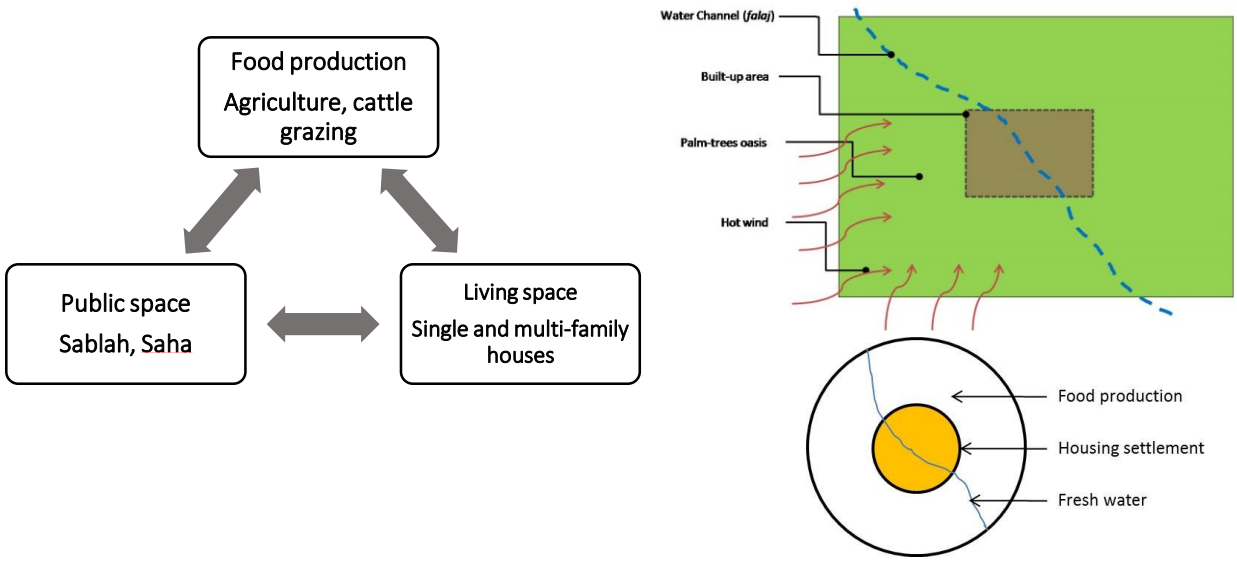


Diagram 8: The relationship among living spaces, public spaces and food production areas in the Omani traditional settlement. Source: The author

Traditional buildings in Oman were built stacked to each other forming an integrated urban form and allowing energy saving. This built form ensures the maximum protection against climatic conditions such as high or low temperature. The external walls exposed to the air flow are kept at a minimal level. The width of the external wall is commonly not less than 50 centimeters to delay heat transmission to the interior space in summer time, and to delay the warming loss to outside in winter time.

Picture 12: Sometimes the traditional social compactness is reflected on built-form

Pictures Sources, left: www.octm-folk.gov.om/marab/gallary/pic09.JPG
Right http://www.omanlight.com/vb/gallery/

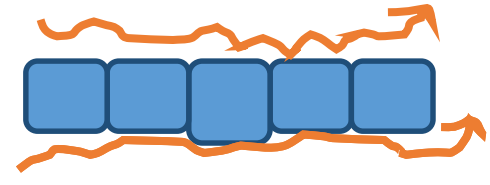


Figure 20: Hot air circulation in traditional compact houses circulation

Source: The author

Picture 13: The width of external wall in traditional building was commonly varied from 40-80 cm

Source: The author

The traditional building in Oman is considered as a self-defender against the climate's fluctuation. This construction's paradigm was common in most of the traditional built structures. 'In dry climate with big differences of temperature between day time and night, houses were built from backed bricks, natural stones or mud walls with thickness not less than 50 centimeters wide'[1]. Picture [13].

In a hot-dry climate, the materials used and the thickness of the walls represent a high thermal inertia that reduces the temperature of the interior space to the minimum level. Whilst in the hot-humid climate--mainly in the coastal cities -- buildings are built with higher ceiling spans and larger openings to ventilate the interior space.

The geography, the climatic conditions, the existing resources and the historical context of the different regions determine the settlement structures and their functions, the typology of the houses as well as the building constructions in stone or mud.[2] The single unit consists of multiple rooms and terraces which form a climatically homogeneous model. The walls are thick enough to create a highly thermal comfort zone in the inner spaces in both summer and winter. The terraces are used as sitting and sleeping areas in fair climates. The concept of various massing heights is to create shaded areas to be used as outdoor living spaces. Mainly, the walls are constructed of raw materials like dried mud bricks which work as a resistance against environmental conditions.

The analysis of the house-forms revealed that houses in al-Hamra[3] have only a small courtyard. They present a compact house type with an interior stair case and ventilation shafts in adaptation to the area's extreme summer temperatures for which even the classical courtyard house is inadequate. The mud-brick houses are vertically organized, with the dark, lower floor used for storage purposes, the upper floors for living purposes, and the roof terrace taking the place of the missing courtyard. On the constructive level, the

[1]Al Gharibi (2008)

[2]A. Gangler, *Oasis Settlement Structures / Oman* found in:http://www.agrar.uni-kassel.de/ink/oman/documents/publications/Gangler_2003.PDF

[3]Al Hamra is a Wilayat in Dakhliyah Region

building serves its different functions: the defensive, up to 80 centimeters thick walls of the ground floor are tapering towards the upper floors and give way to an almost fragile structure with numerous windows and niches, and the parapets of the roof terrace.[1] 'The houses are of thick mud-brick-walls on stone foundations and few windows at the ground floor level. At the first floor the rooms have the two level windows, with an opening at floor level and a smaller window above it to provide better control of air movement. The living rooms are decorated with painted wooden ceilings Drain spouts channels the rainwater from the roof level into the street and from there into the palm gardens.'[2] The unique urban morphology and the irregular arrangement of structures have contributed to providing thermal comfort to the entire environment and defeat the harsh climate in that period.

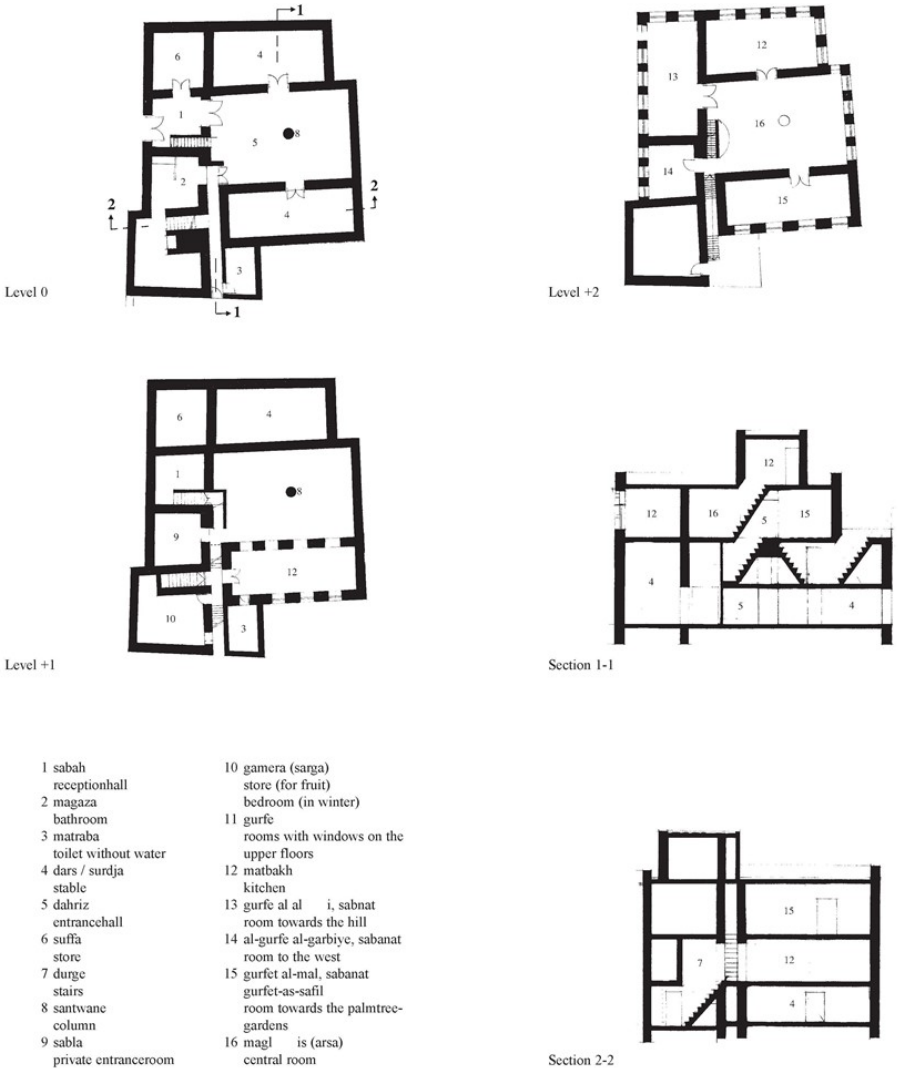


Figure 21: Traditional house typology in Al Hamra. Source: Ribbeck et al (2001)

[1] Ribbeck et al.,(2001), p.21

[2] A. Gangler, found in: http://www.agrar.unikassel.de/ink/oman/documents/publications/Gangler_2003.PDF

3.4.5.2. Transformation of built form at oil-age

Since oil production in the late 1960s, the form of housing has dramatically changed. After the compact high density housing layout that was built prior to oil-age, single detached housing structures have emerged since the early 1970s. The typical model of urban pattern in Oman has been associated with environmental, economic, and social problems. Diagram [9] below indicates the urbanization process in Oman. The urban pattern at oil-age is characterized by *low density urban form* as most buildings in Oman are single-story, inside large plots with an average area of 600 square meters. The average population density normally ranges from 15 to 20 people per hectare which is considered very low according to Elkin: 'a population density of fewer than 25 people per hectare is generally considered 'low density' (Elkin, 1991). Elkin states that cities have never been sustainable; rather 'the process of urbanism in antiquity has been frequently linked with desertification in the hinterland. Cities have always exploited the surplus food and materials produced in the hinterland, and thus interfered with previously more cyclical ecological systems.' (Elkin, 1991).

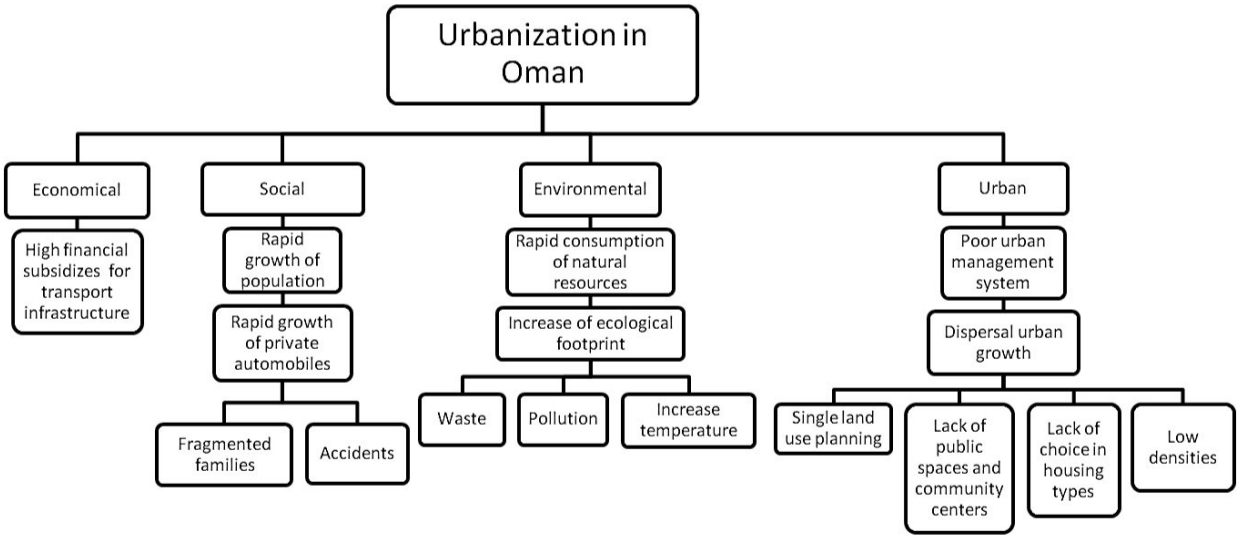


Diagram 9: Urbanisation process in Oman Source: The author

Box 6: The current type of housings in Oman

1. ***Villa:*** single-detached dwelling unit mainly constructed at a center of plot.
2. ***Flat/apartment:*** a residential unit mainly a part of one or multistory building.
3. ***Arabic House:*** a single detached family residential unit. Its domestic rooms are mainly overlooking an inner courtyard.
4. ***Traditional House:*** A single family house mainly built attached to one or more housing units. It is mainly built from local building materials such as mud, stone, palm-tree trunks, etc.
5. ***Labour accommodation:*** collective residential units which are usually built within the workplace.

Source: SCTP (1991)

Arabic house was common in the 1980s as a typical housing model. The typical plot's area for this housing model was 324 square meters (18 metersx18 meters). The typical layout of a building was characterized by a median courtyard which is considered the most functional and collective space that integrates the house's inner and outer spaces. The rooms are built in one half of the plot while the other half remains as an open-to-sky courtyard. The courtyard is surrounded by a 2-2.5 meter high wall to keep the maximum privacy to the inner spaces. The built-up structure in the inner space consisted of 2-3 bedrooms, *Majlis* (Guests Sitting Room), kitchen and *Liwan* (lounge).[1] The toilets take one corner of the courtyard normally near the main gate and the *animal pen* takes the other corner normally near an exit door that allows animals to walk through, Figure [22]. A big tree is normally planted in the middle of the courtyard so residents spend much time beneath enjoying the shade in fair weather. Therefore, people are not required to use the air-conditioning system for as much time. Hence this courtyard is used as an open air and family-collective space, this model is considered as more energy efficient in relation to the *villa* model.

The disadvantage of this model is the five-meter-wide proximity that segregates each structure form the other, Figure [24]. This gap --locally called *'Sikkah'* -- is considered as a lost space (about 90 square meters for each Sikkah) and sometimes is used as junk space for garbage and waste. Furthermore, this gap is neither appropriate for car parking nor for public space because of its narrow width. On the border line of energy consumption, this kind of building model affects the macro ecosystem, because most people use window-air-conditioning type which exhausts its hot air in this narrow passage creating an extreme hot zone, which afterwards infiltrates to other parts of the district leading to rise the local temperature and therefore consuming more energy

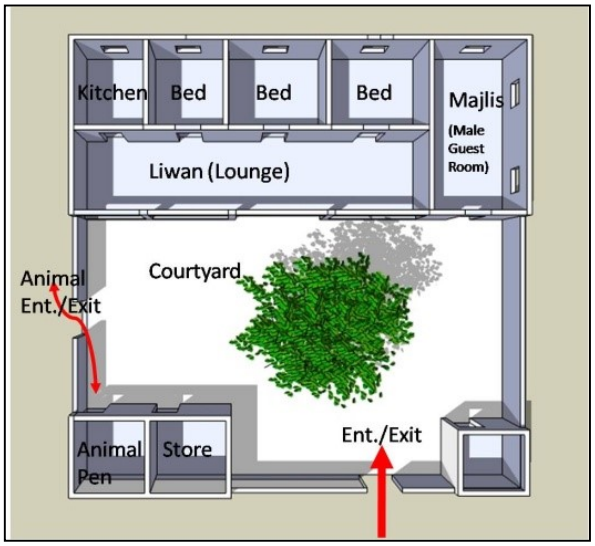


Figure 22: *Arabic house*, 1980's typical housing model.

Source: The author

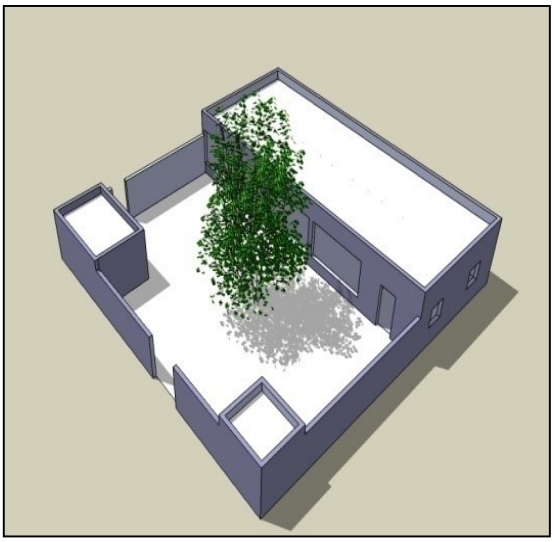


Figure 23: Function of the Arabic house's courtyard and the median big tree.

Source: The author

[1] Some people prefer the kitchen to be at the outer space near the toilets.

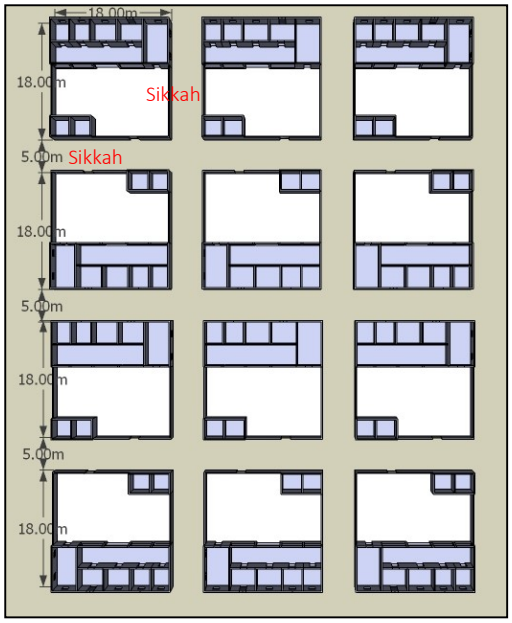


Figure 24: Arabic houses urban form layout

Source: The author

Picture 14: Aerial photo indicates Arabic houses in Ibri.

Source: www.googleearth.com

According to the Ministry of National Economy censuses, Census 2003 indicated that there were 430,996 dwellings in the Sultanate compared with 344,846 in 1993, or an average annual increase of about 2.5%. During that period, the Arabic House is the most prevalent type of housing with about 40% of the total housing in the Sultanate followed by Villas at about 24%. The censuses also found that the predominant housing character of tenure in Oman is the 'owner occupation' except for apartments that are mostly leased.

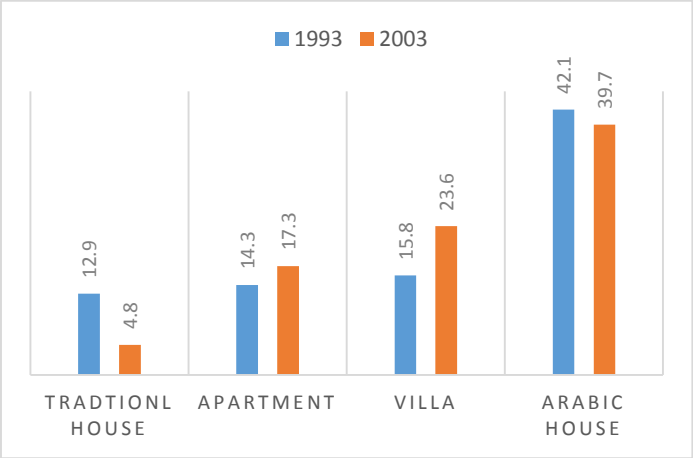


Figure 25: Percentage of houses by type in Oman in both censuses. Source: The author based on MNE report (2010).

Although the Arabic House represents the most prevalent housing-type because of intensive construction in the Seventies and Eighties, Villa-type has begun to grow more quickly because of the conversion of preference to this type of residential building since the beginning of the Nineties. This percentage is clear through statistics of the Ministry of National Economy that is shown in Figure [25] where Villas rate rose to 23.6% in 2003, compared with 15.8% in 1993, whereas the percentage of Arabic Houses has fallen to 39.7% in 2003, compared with 42.1% in 1993.

Since our approach to the third millennium, the Villa remains the people's most favorite type of housing with a notable decline in building Arabic Houses. Regarding the ownership in terms of the type of dwelling, in 2003, the Villa leads other housing types owned by their inhabitants. About 77% of Villas were owned by their inhabitants followed by traditional houses and Arabic Houses by nearly 74% and 70% respectively. However, according to the 1993 census, Arabic Houses were the most in terms of ownership by their occupation by nearly 74.5% followed by the villa-type and traditional house. It should be noted that the average family-household members in the Villa and the Arabic House was about eight people in both censuses, while in apartment housing in 2003, it was four members compared to five members in 1993.

Villas have emerged as a standard housing type since the early 1990s. Figure (26) indicates that villas represent about 92% of the housing type in Oman. This housing model is being used as typical model not only in Oman but in the whole of the Gulf Region. It is a one- to two-story large cubic built form which stands with its decorative facades that might show the wealth of owner. Obviously, the house is often laid at the center of the plot and surrounded by 2-2.5 meter high compound wall to ensure the maximum level of privacy.

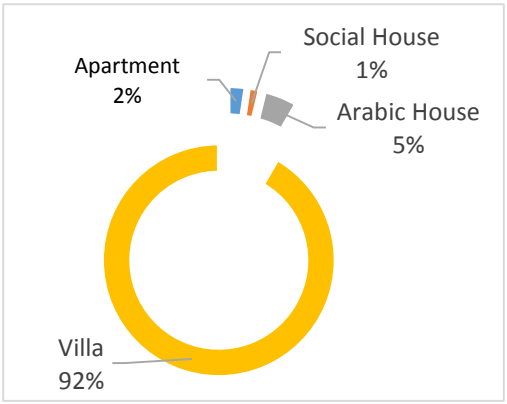
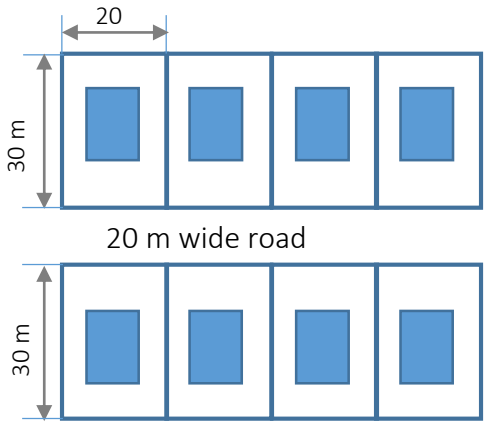


Figure 26: Percentage of building permits in Oman by type of building in 2009

The exterior façade partly reflects western structures incorporated with little Islamic–Arabic characteristics. Unlike the traditional buildings which involved small openings to limit the sunrays that went through to the internal spaces, the contemporary buildings integrate large transparent windows that allow high amounts of solar rays to easily reach the inner spaces. The court yard area is converted to a narrow surplus space between the wall and the building outline. This area

Source: MNE, Annual Report, 2009



Source: The author

Picture 15: The current free-standing housing model.

Source: The author

normally is formed due to the building setbacks that are determined as regulations by the planning authorities.

Since early 1990s, the plot layout has been under a lot of revision in relation to size and the built form. The plot's area has increased from 324 square meters to an average of 600 square meters, whereas some plots' areas reach more than 1200 square meters.

Source: The author

Figure 27: the current standard houses' sequence.

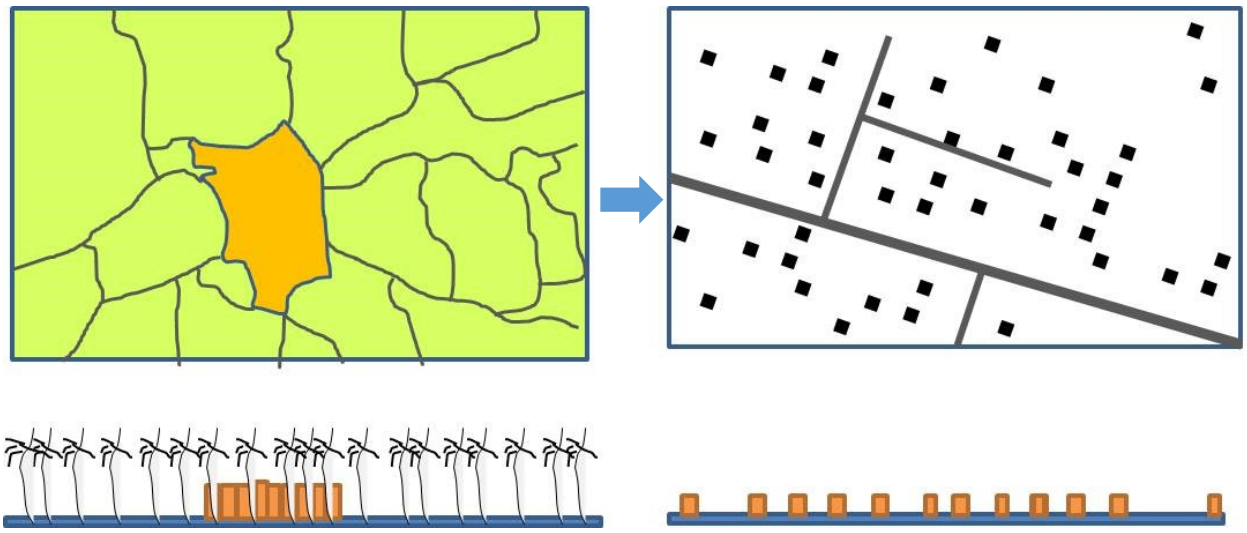


Figure 28: the transformation of urban pattern from dense at pre-oil to scattered at oil-age

3.5. The characteristics of urban form at the border line of resources

3.5.1. From walkability to car-dependency

Since the oil revolution, people have been encouraged by the automobile industry and financial companies to acquiring their life's dream. Cars now dominate short and long trips not only in Muscat but in the whole Gulf Region. The notable absence of public transport and the inefficient urban pattern have contributed to an increase in the reliance on private automobiles. Our city's design is primarily based on the automobile while the sustainable city should be designed for pedestrian and cycling. The patterns of transportation and urban land use associated with high levels of automobile dependence present an array of environmental, economic and social problems for the sustainability of cities. (Newman and Kenworthy, 1999).

Environmental problems: The facts indicate that the high rate of private automobile use has led to a high rate of energy consumption. Table [13] indicates that Oman is ranked the world's 8thhighest country with reported increase in fuel. This is because of the rapid increase in private vehicle use as a preferred mode of transportation. According to the ROP statistics, within 25 years (1970-2005), more than 500'000 cars have been added on Oman's streets while within merely five years (2006-2010), more than half million cars have been added. Based on the NCSI and ROP data, the number of new automobiles have nearly doubled four times in period (1970-2011), the new licenses have been doubled about 13 times within the same period. Figure (29). Consequently, the rapid consumption of energy by automobiles leads to rapid depletion of natural resources because automobiles are considered the most pollution generators which directly harm the environment. Automobiles also consume huge amounts of productive and arable areas for roads and parking. Asphalting massive urban areas, particularly in low-density urban form, can cause water runoff and local floods. This tragedy is very common in Oman, and recently in particular in Muscat where huge areas are paved for the use of automobiles.

highest reported increase in fuel use		
Rank	**Country**	**Value**
1	Equatorial Guinea	11394
2	Israel	8410
3	Singapore	5431
4	Iceland	5069
5	Republic of Korea	3368
6	Seychelles	3363
7	Trinidad & Tobago	3250
8	**Oman**	**2940**
9	Mauritius	2393
10	Saudi Arabia	2370
(additional kg oil equivalent/person 1980 to 2001)		

Table 13: Highest reported increase in fuel use.

Source: SASI Group (University of Sheffield) and Mark Newman (University of Michigan) www.worldmapper.org based on United Nations Development Programme (UNDP) Human Development Report 2004

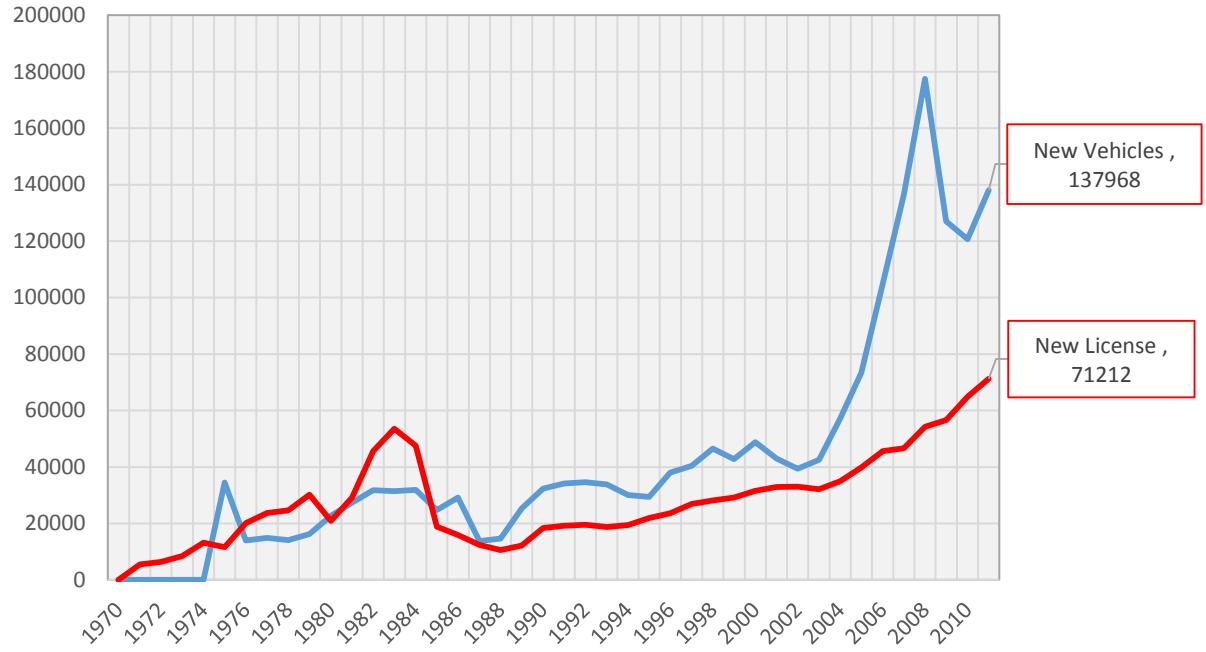


Figure 29: Trend in quantity of new vehicles and licenses in Oman (1970-2011)
Source: NCSI based on ROP data (organized by the author)

Air pollution is another issue that auto-dependent cities suffer, Newman and Kenworthy (1999) argued 'we can still count on sprawl-related increases in car travel to make air pollution 30 percent worse in 2010 than in 1989.'[1] 'The more a community tries to reduce traffic congestion in conventional ways, the worse its air quality gets. The California Air Resources Board, for example, has found that congestion is less a factor in creating air pollution than the number of vehicle trips.'[2] Sayer (1993) indicated that 'reducing congestion by building wider roads encourages more solo car trips. By the same token, the more dispersed a community's suburbs, producing more car trips and longer trip distances per person, the more air pollution—20 percent to 50 percent more than compact development produces.'[3]

Picture 16: Traffic evolution in Muscat terrifies the public life
Picture source: The author

[1]Newman, P. and Kenworthy, J. (1999), pp. 141–142 (quoted by Nozzi, D., 2003, p.3)
[2]Ewing, R.(1994), p.10 (quoted by Nozzi, D., 2003, pp.3-4)
[3]Sayer (1993), p.11(quoted by Nozzi, D., 2003, p.4)

According to Nozzi (2003), 'because the widened road now carries more high-speed traffic, housing values decline along the road, and owner-occupied single family homes get converted to rental units, offices, and businesses like convenience stores and pawn shops.'[1] Noise pollution by traffic is considered one issue that affects the local environment, too. For example the street of 18th November in Khuwair has transformed from a minor street to a high street though it crosses residential areas and makes living in those urban settlements unbearable. A witness said that "it is so hard to live in this situation; the traffic is so heavy, noisy and unsafe." Once the road has widened, a wide range of housing units have turned into commercial uses resulting in the invading of the remaining public-realm areas which are accordingly used as parking areas. The value of the area and streets has been lost among the various-scaled advertising billboards and the un-sequential streetscape. See Figure [30].

Figure 30: Street of 18th Nov. in Khuwair transformed from minor street to high street.

Source: The author based on googlearth.com

Stephen Plowden (1972) noted that '[widened] roads will also encourage people to live further from their work or from other places of activity, which means that their journeys become longer and are less easily catered for by public transport.' Development then tends 'to take place either along the lines of new roads or at least in places convenient to them.'[2] 'A neighborhood can only have a strong identity if it is protected from heavy traffic. Donald Appleyard and Mark Linteli have found that the heavier the traffic in an area, the less people think of it as home territory. The Appleyard-Lintell study found that with more than 200 cars per hour, the quality of the neighborhood begins to deteriorate. On the streets with 550 cars per hour people visit their neighbors less and never gather in the street to meet and talk.'[3]According to Pacione (2009), 'the need for, and extent of, private transport are closely related to the structure of the built environment. The physical separation of activities affects travel needs and therefore energy requirements for transport. The key variables at the urban scale are density and degree of mixing of different land uses, with, in general, lower energy use for transport with higher urban densities.'[4] This indicates the high increasing rate of fuel consumption in Oman.

[1]Nozzi (2003), p.17
[2]Plowden, (1972),p.18 (quoted by Nozzi, 2003, p.20)
[3]Appleyard and Lintell (1971), (quoted by Alexander, C., 1977, p.84)
[4]Pacione.(2009), p.614

Economic problems: Automobile cities suffer a number of economic impacts, such as congestion costs in terms of lost time and the high costs of urban infrastructure for the extra distances that must be traversed for water, sewage and drainage systems, roads, and a variety of social infrastructure such as schools, medical centers and community halls that must be duplicated as the city spreads. In the meantime, vast areas of existing urban infrastructure remain underutilized due to demographic changes and are begging for revitalization through better transit and higher densities.[1] Nozzi (2003) visualized the cost of sprawl when he said 'we pay a price for all that convenience as air, water and noise pollution, injury and death, environmental degradation and loss of land.' [2]

Road accident costs worldwide are conservatively estimated to be US$518 billion.[3] A new six lane highway has launched in 2011 to support the increasing of traffic in Muscat. This road costs several million Oman Riyals. Widening the 18th November road to be a four-lane-primary road even though it penetrates residential settlements. At the same, the government has begun to construct a coastal highway from the Muscat up to the northern part of Oman with a budget exceeds OMR 1 billion.[4] At reality, this huge amount of money is paid for a temporary reduction in traffic congestion because in contrast there is a huge increase of private car ownership. By those projects which support the single mode of transit, social, environmental and urban problem are becoming worse.

Road accidents in auto-dependent cities cause huge economic impact as result of death, injuries and damages. According to the Washington Post Newspaper based on World Health Organisation (WHO), Oman is one of the world's 10 most dangerous countries for driving which is marked in dark red on the map below, Figure (31). This map is based on the rate of road traffic deaths reported by the WHO. The statistics in 2005 indicates that there are about 9,247 car crashes in Oman which resulted in 688 deaths and 6,500 injuries.[5] Consequently, huge amounts of money are paid annually to finance these accidents. Oman's road traffic death rate is 28 per 100,000 persons which is far higher than the global average of '19 killed per 100,000.'[6] In 2011, the number of deaths jumped to 1,051and 11,322 injuries.[7]

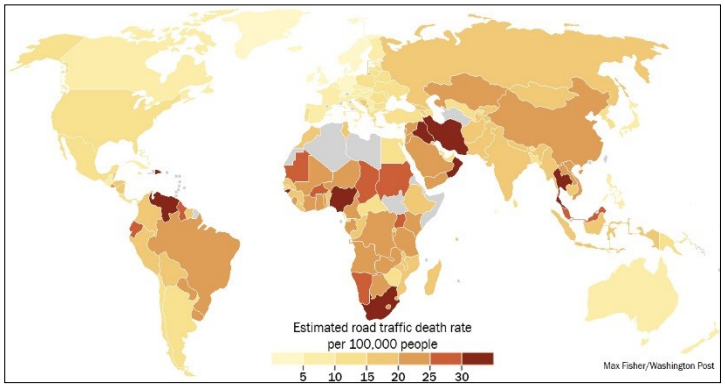


Figure 31: Oman is one of the world's ten countries with most dangerous roads (based on rate of traffic deaths).

Source: Max Fisher, Washington Post Newspaper, published: 07/06/ 2013, based on (WHO) statistics found in: http://m.washingtonpost.com/blogs/worldviews/wp/2013/06/07/a-map-of-the-countries-with-the-most-dangrous-roads Accessed 16-04-2012

[1]Newman and Kenworthy (1999)
[2]Nozzi D. (2003), p.2
[3]For more detail browse: www.factbook.net/EGRF_Economic_costs.htm
[4]www.omania.com
[5]www.rop.gov.om
[6]http://www.car-accidents.com/
[7]Oman Daily Observer, 1st page, Issues no vol.31. No.48. 1/1/2011

Consequently, the rate of death increased to nearly 39 per 100,000, which is 20 percent higher than the global average rate. As a result, the average death rate in 2011 is three victims every 24 hours. It seems that the problem is becoming worse because '20 deaths'[1] have been recorded in just the first six days of 2012 which means an average of one victim every 7 hours. Based on the NCSI and ROP data, the number of car accidents have nearly doubled 154 times in period (1970-2011), injuries have been doubled about ten times while the death rates in result of car accidents have been doubled 352 times within the same period. Figure [32] indicates the trend in car accidents, deaths and injuries in Oman. Box [7] shows the evolution of the number of traffic accidents in Oman in 2011.

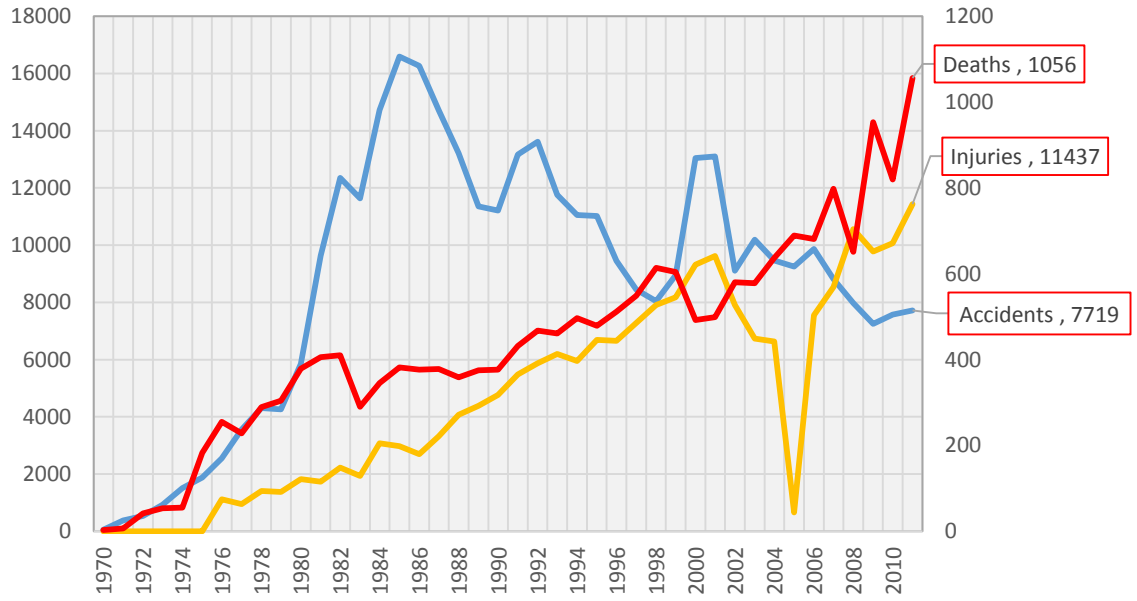


Figure 32: Trend in quantity of accidents, deaths and injuries in Oman (1970-2011)

Source: NCSI based on ROP data (organized by the author)

Box 7: Evolution of the number of traffic accidents in Oman

- 71% of traffic accidents in 2011 resulted in injuries and 11% of traffic accidents resulting in deaths.
- The census indicate that disability rate in result of car-accidents has increased in Oman from 2.4% in the 1993 census to 3.4% in the 2003 census, which it reaches 4.8% in the 2010 census.
- The death rate in consequence of car-accidents of the entire death rate in Oman rose from 13.2% in 2005 to 13.9% in 2011.
- Number increased injuries caused by traffic accidents in Oman increased form 6658 in 2005 to About 11437 injuries in 2011.
- 19 disability cases every month occurred due to traffic accidents in the period (2003 – 2010).
- In 2011, male dominated of 87% of total deaths and 74% of total injured.
- In 2011, Omani nationals represent about 71% of total deaths and 79% of total injured.
- 81% of total deaths and 46% of total injuries were in the (16-50) year's age-group.

Data source: ROP, Traffic Statistics, collected by the author

[1]Oman Daily (Arabic Newspaper), 21/01/2012

This rate is not merely a normal statistic but it should be observed as a horrible trend that affects the entire socio-economic conditions of the society because the majority of car accidents victims are youths. Now imagine the loss in mankind and money alike resulting from these accidents. In addition to the loss of a national-young workforce, the government receives the bulky amount of loss as it bails the injuries that are normally treated in the governmental hospitals. These horrific trends of car accidents and death rates have occurred at the time of launching multiple modern highways and service roads in 2011 such as the six-carriageway Muscat Express highway that penetrates hills, mountains and terrains. These highways and roads aim at reducing the amount of car-accidents and traffic jams.

The Inspector General of Police and Customs argued 'we need more coordinated efforts from all public and private institutions to reduce accidents.'[1] Another issue related to the economic impact of auto-dependence is obesity, which is mainly caused from relying on driving rather than walking to reach a certain destination. Illnesses such as diabetes and heart disease which result from a lack of body activities require huge financial burdens for curing. Obviously, it seems the traffic problem cannot be solved by constructing or widening the streets. However, authorities and individuals alike have to be integrated in order to investigate the problem in multiple dimensions. It is obvious that we have created the traffic problem because our current cities are solely designed for cars not for people.

Social problem: Haregewoin Bekele (2005) argued that 'sprawl in developed countries is usually a matter of *preference.* In the developed world, the movement of people from rural area of the country to more heavily populated cities and towns has been reversed. In contrast, for developing countries sprawl is largely a result of *necessity*.'[2] Territory size shows the proportion of all extra people that will start living in urban areas between 2002 and 2015 by territory.

Rank	Territory	Value
1	Brunei Darussalam	63
2	Gaza Strip & West Bank	47
3	Mauritania	45
4	Saint Lucia	44
5	Kuwait	41
6	Saudi Arabia	40
7	**Oman**	**38**
8	Rwanda	35
9	Equatorial Guinea	34
10	Afghanistan	33

Table 14: Most Urban Dwellers - Projected increase in urban population from 2002 to 2015 as a percentage of the 2002 population

Source: 2006 SASI Group (University of Sheffield) and Mark Newman (University of Michigan) www.worldmapper.org

[1]Oman Daily (Arabic Newspaper), 21/01/2012, p.1
[2]Bekele (2005), p.8

In regard to the auto-dependency, Preston *et al.* (2010) argued that 'people lose the capacity to function in a participatory society, lose their sense of being 'citizens', then it is more difficult to enact the kind of policies and programs needed to address these problems'.[1] Over the last four decades, people in Oman have lost their eagerness toward social interactions as a result of car-dependent activities.

The transformation from walkable society to auto-dependent society has led to family fragmentation. Since the car has become the most favorite transit means, people have not taken into consideration where to live or where to work. For example, a person can live in a cheaper area even though it is further away from the workplace. A large part of the social customs which have defined Omani society has been thrown under the wheels of the car. In urban areas, it is nowadays common for neighbors to not meet for ages, even though their houses are so close together (just six meters apart), because they cannot visually verify if people are home or not. This is because the cars pass directly from the street to the inner garage. Figure [33]. Children do not have a place to play with their neighbors. The most astonishing transformation in our society is the availability of marriage and funeral ceremonies at two adjacent houses at the same time.

Picture 17: The automobile dependent community.

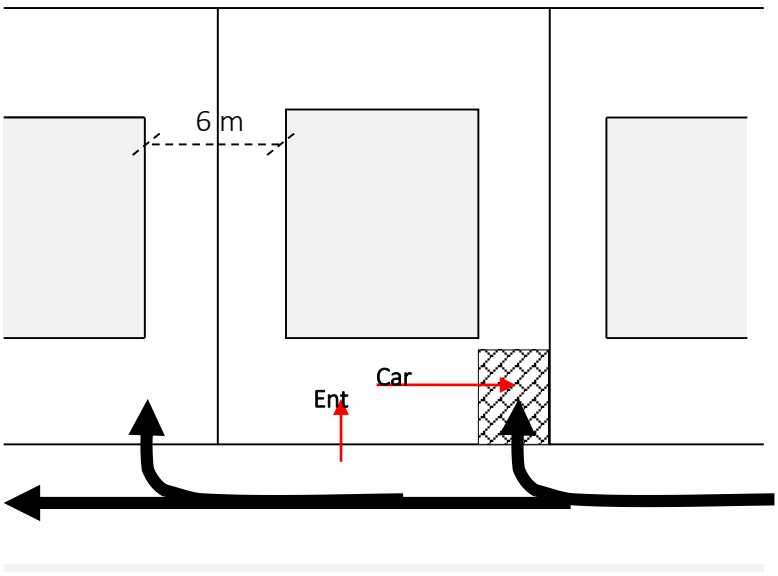


Figure 33: **Car accessibility of today's house contribute of social segregation**

Source: The author

[1]Preston et al (2010), p.13

3.5.2. From multi-family housing to villa type

As it was indicated earlier in this section, the type of Omani family before the oil-age was extended family. Every house was subdivided into rooms for the multi-family. Every house's domestic spaces such as the bathrooms, stores, halls, etc. were shared with all families. The majority of houses were commonly multi-story buildings to save ground space for public utilities as well as for food productions. The ground floor was normally utilized for house-domestics and reception, whereas upper levels were generally utilized for sleeping. The traditional house was not merely a place for rest and sleeping as the current villa type, but it was also a place where sustenance -- source was made and a place where all family members were communicated with and cooperated every day and night. Every house had an animal pen on the ground level with direct access to outdoor spaces that enabled cattle to walk through to grazing areas and return easily. There are many rooms which were also utilized as stores, locally called (Suffah). Every house had at least one store area for storing palms dates; one store for the animals' food and one for keeping house furniture and work tools. Despite the large size of families, the size of the building where they lived was only 10-20 percent the size of today's housing units. The interior spaces were much smaller than present day residential buildings.

For instance, bedroom areas ranged from 6-9 square meters while today's standard bedrooms range from 12-30 square meters. As was indicated in Ribbeck *et al.* (2001) detailed survey of a traditional house in Al Hamra, the hall (locally called Dauhriz) represented the most important space at every house. This space was normally positioned at the entrance. It was normally a space where all family members gathered and it was utilized to welcome guests and neighbors. It also took the function of a courtyard for the houses which did not include courtyards. Dauhriz was often utilized in winter because it was the warmest space in the house. In the center of the Dauhriz there was normally a hearth which warmed the surrounding spaces in winter. The hearth was normally utilized for preparing hot drinks such as coffee and tea at times when it was surrounded by all family members talking while enjoying the warming space. In certain facets of the room just slightly beneath the ceiling, various small openings were placed to easily exhaust the smoke that emanated from the hearth. This space was normally utilized to perform the work associated with home-production activities such as preparing the dates to be dried and stored for winter.

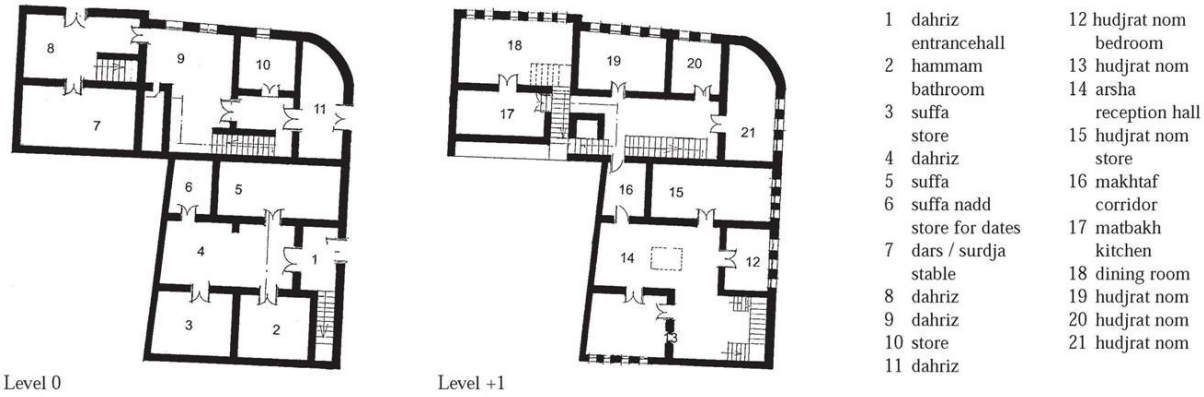


Figure 34: Typical size of house for extended family in Al Hamra Source: Ribbeck et al. (2001), p.31

Unlike villa types nowadays, which mostly lack a courtyard, the internal courtyard of the traditional building worked as a moderator space and a homogenous and functional hub for the surrounding spaces. The courtyard also worked as the transition point between the private space and public space. In addition to its principal function of being a place where all family members gathered, the courtyard was also utilized as a semi-private space to perform certain daily collective works normally associated with preparing palm yields to be dried by sun and then stored in pottery containers. This work was normally accomplished with the assistance of neighbors and relatives in the same area.

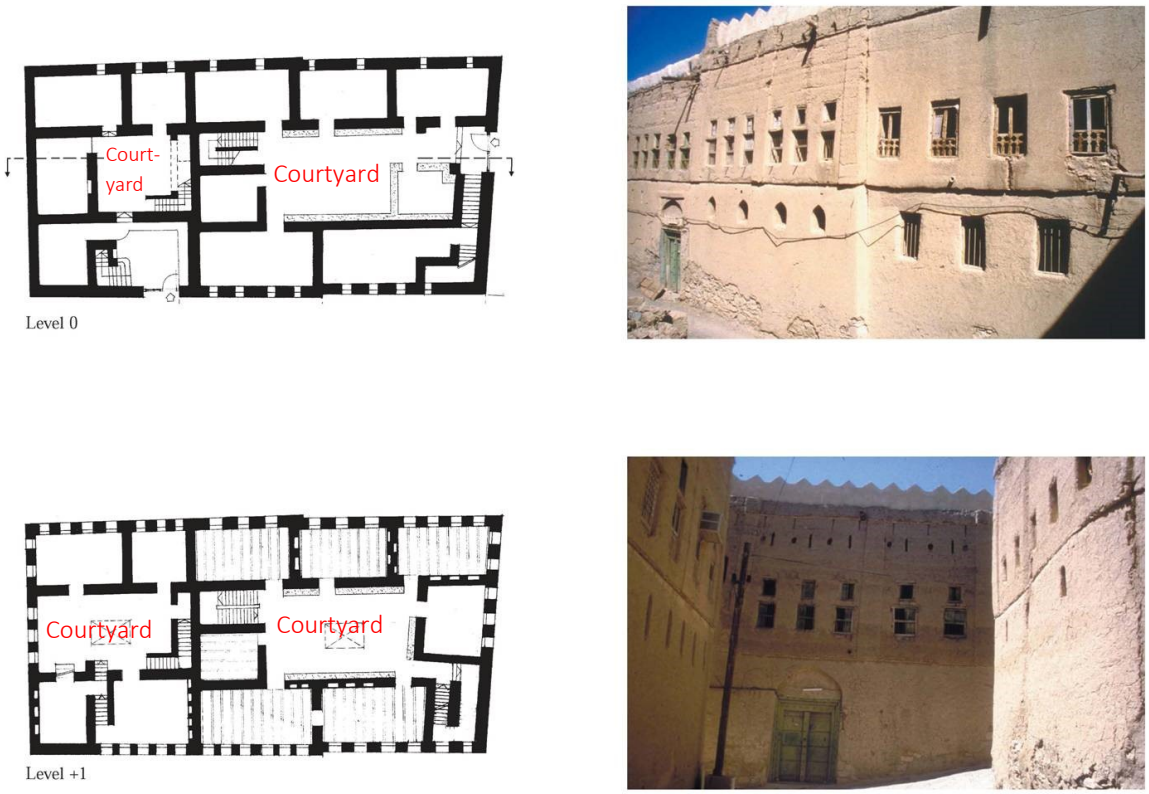


Figure 35: Typical house in Al Hamra indicates the internal courtyard

Source: Ribbeck et al. (2001),

The villa with its free-standing form has wiped out all these outstanding socio-economic attributes that were characterized by the traditional house. Unlike the traditional houses which were stacked to each other and inhabited by extended families, the villa is built separately in the middle of one land which results in consuming much more land. The villa also consumes more energy because of its detached free-standing built-form. It is normally built in single land use areas where other services are not easily accessible by walking or biking but only by private car. The single land use normally influences the size of the investment in the residential sector, which has a consequential influence on rental prices and tenure.

1.	Male Majlis	6mx8m
2.	Female Majlis	5mx4.5m
3.	Dining	7mx5m
4.	Kitchen	5mx3.6m
5.	Sitting Room	5mx5m
6.	Bedroom	5mx4.8m
7.	Bedroom	6mx5m
8.	Bedroom	5mx5m
9.	Main Bedroom	6mx6m

Figure 36: Typical size of current house and internal spaces.

Source: Al Maskan Magazine

3.5.3. Land consumption

Sustainable development was identified in Bruntland Report from the World Commission on Environment and Development, ('our common future', 1987) as 'development that meets the needs of the present without compromising the ability of the future generations to meet their own needs'.[1] Since oil production, natural resources have been subjected to intensive consumption. The rate of lands which has been given for housing and transport infrastructures is considered much higher than the rate of population growth. Along with the granted plot, which is given by the government, a citizen can buy and reserve any amount of land in real estate markets. These lands can then be sold at higher prices after a certain period, particularly when the basic infrastructure services improve. According to Jenks M. and Burgess R. (2000), 'Some regulations and policies should be drawn up to encourage more compact land development to reduce land consumption. Otherwise, future generations of the city will suffer from the problems caused by the present urban sprawl'.[2] Areas with low density and lack of development force people to travel to get to their destinations. For example, mosques cannot be constructed at very low density areas. According to the regulations, there must be certain population and building densities to fulfill the requirements for building a new mosque. Consequently, a person needs to travel about ten times to do the obligatory five daily prayers.

As shown earlier, sustainability is to keep the resources for the future generations. Lands suitable for residential purposes are so limited, and with the current consumption ratio, the remaining land will run out very soon. While the recent census showed that nearly 60% of the total population represented youth, it should be said that they have the right to enjoy their lives as we, in this generation, enjoy ours. With the existing rate of land consumption, it will be so difficult to acquire suitable land for housing. Lands in developed areas with services and basic infrastructure will be extremely expensive and unaffordable to low- and middle-class families. The provision of housing must be based on evidence of needs for the

[1]WCED, (1987), (quoted by Jenks M. and Burgess R., 2000), p.82
[2]Jenks M. and Burgess R. (2000), p.79

future generations. The low- and middle-classes have the right to gain affordable housing near their relatives, or even near their income sources. According to the Ministry of National Economy statistics, nearly half a million plots have been given to the citizens since 1970. Up to the end of 2008, Muscat and Batinah have occupied more than half the amount of those plots. Muscat alone has dominated about 30% of the total given plots. This indicates the intensive consumption of land, particularly in Muscat where its area represents merely 1.3% of the total area in the Sultanate. Based on the Ministry of National Economy statistics, nearly 88% of the total land in the Sultanate has been given for residential purposes. Meanwhile, according to the above table, if it is assumed the average plot size is 650 square meters, approximately 20,000 hectares of land has been given for residential purposes in Muscat.

Picture 18: Muscat's highways consume as much land as an oasis settlement

The aerial photos, with the same scale.

Picture source: www.googleearth.com

Figure 37: Comparison of density of ancient settlement and the current urban development.

The aerial photos, with the same scale.

Pictures source: www.googleearth.com

Land Use / Region	R	C	R/C	R/Agr.	Ind.	Agr.	Gov. *	Gov.R**	
Buraimi	1,948	189	205	-	290	29	1	-	2,662
Dhofar	43,874	3,563	814	-	2,731	352	80	86	51,500
Wusta	1,706	254	67	-	209	2	8	258	2,504
Sharqiyah	57,693	2,841	983	-	1,513	514	154	331	64,029
Dakhliyah	53,152	1,352	1,795	-	1,102	872	499	478	59,250
Dhahirah	40,090	2,292	1,155	1	350	978	47	265	45,178
Musandam	5,603	437	90	1	125	48	2	285	6,591
Batinah	100,305	3,894	2,469	1	1,652	5,423	676	498	114,918
Muscat	128,816	4,117	5,751	78	3,107	474	884	2,783	146,010
Total	433,187	18,939	13,329	81	11,079	8,692	2,351	4,984	492,642

Table 15: Granted plots in regions by land use up to end 2008

Source: MNE, Statistical Year Book 2009 based on MoH statistics

Rapid consumption of productive arable land for pavements is another issue of the cost of sprawl. According to Preston, L. et al (2010), 'the excessive use of land in cities for the movement of cars to cater for upwards of 80 per cent of daily trips, when other less resource-consuming options are available, has a significant opportunity cost.'[1] The more a community tries to reduce traffic congestion in conventional ways, the worse its air quality gets. The California Air Resources Board, for example, has found that congestion is less a factor in creating air pollution than the number of vehicle trips.[2]In our society, cars become the most important object to perform major daily activities. The fragmentation of land use makes people rely on cars to reach their destinations. In contrast, the car is considered the mobility object that consumes the most area for its utilities. For instance, 'in Los Angeles, every car requires eight parking spaces: home and work, the grocery store, the doctor's office, various retail shops, restaurants, and other businesses. The family car consumes about three times more space than the average family home.'[3]

In Oman the situation is much worse because the scattered development -- due to poor urban management-- makes inhabitants drive extremely long distances to reach their desired destinations. It has been argued that 'a walking-oriented city allocates less than 10 per cent of its land to transportation, while an auto-oriented city must dedicate up to 30 per cent of its land to roads and another 20 per cent to off-street parking.'[4]

*Government includes (Mosque, School and other Government uses)

** Housing units built by the government and given to the families under social security as grants
R= Residential **C**= Commercial **R/C**= Residential /Commercial **R/Agr.=** Residential /Agricultural **Ind.**= Industrial **Agr.**= Agricultural **Gov.**= Governmental **Gov.R**= Govt. Residence

[1] Preston, L. et al (2010), p.11

[2] Ewing, R. (1994). p.10

[3] Hart, S. (1993) .p.31 (quoted by Nozzi, 2003, p.4)

[4] Dimitriou, H. (1993), p.136 (quoted by Nozzi, 2003, p.4)

In Muscat, for example, as it was shown earlier through this thesis, the rapid population growth has pushed up the number of automobiles. Despite the scarcity of Muscat's suitable lands, due to some restrictions that will be discussed in the next part of this thesis, acres of valuable lands are given for car utilities. For example, the City Centre shopping mall accommodates more than 1000 parking spaces which means more than six acres of valuable lands are paved for car utilities. This area is enough for housing more than 50 single family households.

The rise of shopping malls is considered as a prominent factor of rapid land consumption. As in many countries in the world, there are two types of malls that have emerged in Oman, *strip malls* and *shopping malls*. The first typology of a shopping mall is the *'strip mall'*[1]which has emerged in Oman since the early Seventies. The changes of agriculture and residential land uses to commercial purposes have led to the emergence of this kind of commercial attitude. The strip malls are developed out of the city centers and mainly dependent on the use of private automobiles rather than walking. Many highways and minor streets throughout the Sultanate have been transformed into commercial uses. In addition to their easy accessibility from the highways, the new strip malls have attracted investors and people alike as they offer wide ranges of imported goods and competitive merchandise. Muscat, like other parts in Oman, has miles of strip mall developed along several streets. The highway street from Ruwi until the airport has been transformed to commercial use. The highway street from *Burj Al Sahwa Roundabout* to *Bait Al Barakah Roundabout* has also been transformed into commercial use. In addition to their huge consumption of lands, these highway streets have notably reduced the value of urban centers and the traditional markets.

The second typology of mall is the *shopping mall* [2] which has emerged in Oman since the early Eighties. People have been oriented towards shopping malls which are mainly developed in suburban areas or at city outskirts. According to Jayne (2006), 'the key to the success of these malls is that they epitomise suburban values and could be replicated in any part of the city and constructed to meet the needs of middle-class consumers. They provide a safe, privatised, highly controlled version of the crowded street, free from contamination.'[3] Unlike the traditional market, which is considered as a part of the urban fabric, the shopping mall is kept isolated from the city and the only connection to the city is highways. This means, with the absence of public transport, the private automobile is the only means to reach this retail shopping mall. Consequently, to cope with the flood of shoppers, plenty of areas have to be allocated the parking lots. Picture [21] shows a shopping mall in Muscat, the commercial built-up area represents merely one third in comparison with the area utilized for the parking lot. On a social level, the new paradigm of shopping hinders the most social uniqueness that had characterized the traditional market. People's interactions no longer exist. Shoppers no longer look at people rather they look at the filled shelves. The local productions become rare due to competing with the imported goods.

[1]Strip mall is a row of shops and stores arranged at both sides of a street with frontage parking lots and side pathways.

[2]Shopping mall is 'a single structure that is planned, developed, owned, and managed as a unit. The other kind of shopping center is essentially a single structure that is planned, developed, owned, and managed as a unit. In this case, retailers pay rent to an owner or manager responsible for collective goods such as parking, security, sanitation, upkeep, and marketing.' (Hutchison, R., 2010, p.713)

[3]Jayne M. (2006), p.67

Shopping malls might be a reason for the decline of the workability attitudes which were common in the traditional market. Today's cart-shoppers pay little physical energy whereas shoppers in the traditional market perform much more physical efforts in strolling and carrying. With the lack of a viable public transport system, malls contribute to the reasons for the increasing prevalence of diabetes and obesity in Oman.

Picture 19: Muscat City Centre which houses more than 2,250 car ports in 3-levels building. Source: The author

Picture 20: A commercial mall in Buraimi which is 15 minutes' drive from the town centre. Source: The author

Picture 21: A commercial mall in Muscat with built-up area of less than 1/3 the parking area.

Source: The author, the aerial photo by www.googleearth.com

3.5.4. Energy consumption

Regarding energy consumption, the *Villa* with its cubic freestanding structure consumes much more energy compared to the traditional building and the *Arabic House*. In extreme hot weather, this free standing cubic house is only habitable with powerful air-conditioning. Thus the energy and water consumption is extremely high especially when we realize that this building is placed in a very low density area. This contemporary built form which is mainly a single family detached house, is completely failing to defeat the harsh climate.

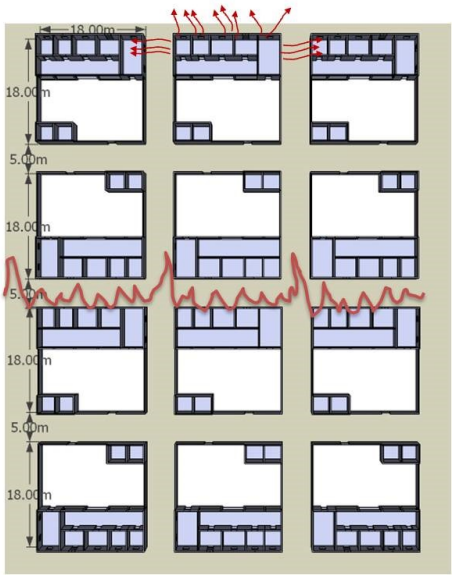


Figure 38 : The air-conditioning machine exhausts its hot air in the 5m-wide gap before it infiltrates other areas.

Source: The author

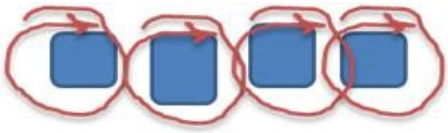


Figure 39: The single family detached house is totally exposed to hot air circulation.

Source: The author

The 20 centimeter-wide concrete wall without thermal insulation cannot protect interior spaces without modern technological mean. The heat flow tends to go through the inner space in a short time in summer while the heat gain inside can be easily lost to outside in winter time. It is well known that air-conditioning systems represent the greatest source of climate change gases of any kind of technological design. In Oman, houses consume 55% of the total energy produced; in the meanwhile the air-conditioning systems consume more than 80% of this ratio. In most parts of Oman, air conditioners work 24hours a day and 365 days a year. It is obvious to say that the air conditioner along with the automobile represent the main factors of the local environmental destruction. The Oil Revolution changed all of life's activities not only in Oman but in the whole of the Gulf Region. Air-conditioning is the way that all buildings are now treated in this region without any care about the effect that it might cause to the environment. In a cyclical manner, the rise of temperature leads to an increase in the usage of air-conditioning systems and the more they use air-conditioning the more energy it consumes, and all of this leads to an increase in the depletion of our natural resources, Diagram [10].

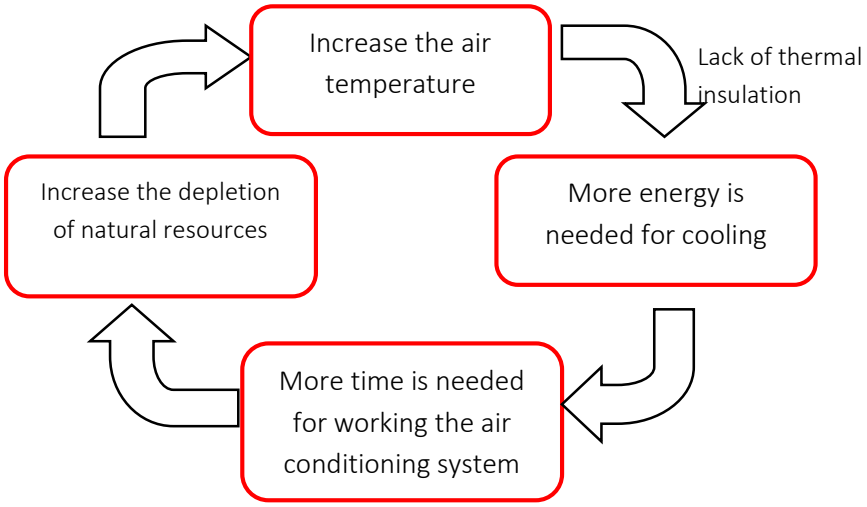


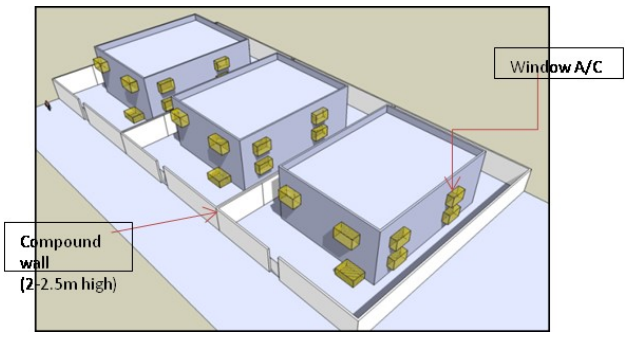
Diagram 10: The circular threats of the air-conditioning machine.

Source: The author

The rise of temperature causes many environmental issues such as drought, desertification, and water scarcity, etc. There are a lot of factors behind the rise of the usage of air-conditioning systems in buildings in Oman. Obviously, the following are the most effective factors that make the powerful air-conditioning systems work all the time:

- The unsustainable building design
- The material used
- The lack of thermal insulation
- The destruction or elimination of green covers
- The fragmented urban layout

These factors contribute to maximize the usage of air-conditioning systems. Most people use the **window air-conditioning system** which creates an "extreme hot zone "surrounding the buildings because of the compound wall which is normally 2-2.5 meters high. The hot air comes out of the air conditioner, encounters the compound wall and is returned back or spread out in the same area creating an extreme hot zone. This zone tends to raise the temperature, firstly in micro spaces which surround the building and, secondly in the macro spaces which are the local district. This leads to an increase in the consumption of power because the hot zone becomes hotter since air-conditioning is continuously working.



Picture 22: Window air-conditioning machines.
Source: The author

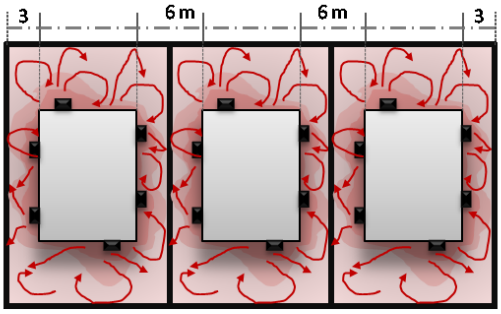


Figure 40: The Extreme Hot Zone created by window air-conditioning machine increases.
Source: The author

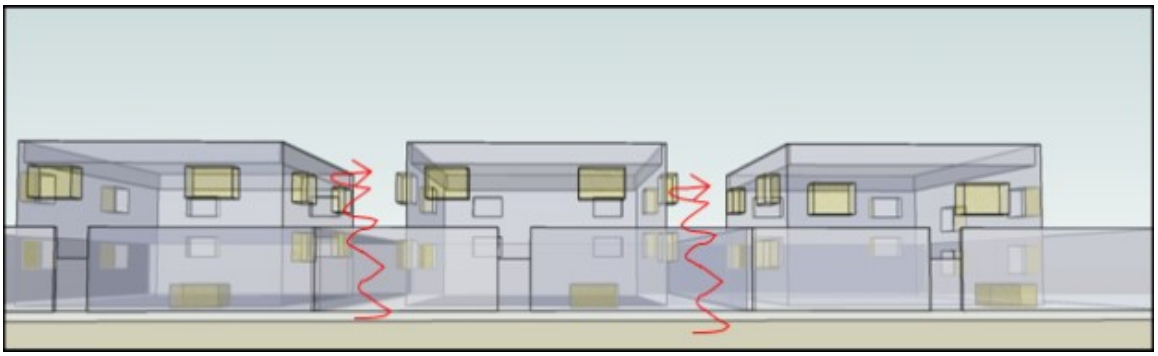


Figure 41: The Extreme Hot Zone created by window air-conditioning machine increases the energy consumption.
Source: The author

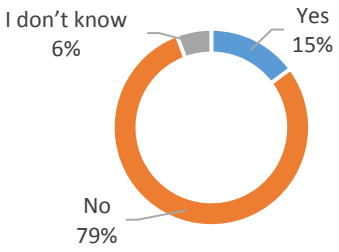


Figure 42: Percentage of the availability of thermal insulation at residential units

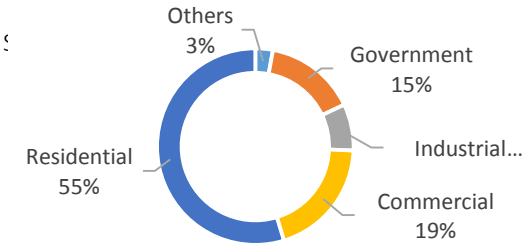


Figure 43: Consumption of Electric Power in Oman by Sector (GW/H), 2008.

Source: Statistical Year Book 2009, MNE

It is obvious that buildings are considered the most pollution producers on the earth; they consume half of the total energy used in developed countries and produce more than half of the total climate change gases. In Oman, residential use is considered the most energy consuming with 55% followed by commercial use of 19%, see Figure [42]. The overloading consumption of energy in households is mainly caused by air conditioning systems. The air-conditioning machines normally work 24 hours a day in most parts in Oman. The most effective factor that makes air-conditioning machines work so long is the lack of thermal insulation which has not been installed in most buildings in Oman. Figure [43] indicates that 79% of houses are without thermal insulation; therefore the exterior envelope is exposed to the hot air. Table [16] indicates the rapid increases of electricity consumption. According to SASI Group (University of Sheffield) and Mark Newman (2008), Oman occupies rank 12 of the world's highest energy depletion territories per person.[1] Figure [44] shows the historical trend of adjusted savings energy depletion (% of GNI) in Oman.

Rank	Country	Value
1	Kuwait	9.1
2	Saudi Arabia	4.4
3	Norway	3.0
4	Trinidad & Tobago	3.0
5	Venezuela	1.3
6	Canada	1.2
7	Iraq	0.9
8	Afghanistan	0.9
8	Turkmenistan	0.9
12	**Oman**	**0.9**
1000 US$ per person (2003)		

Table 16: Highest energy depletion

Source: Danny Dorling (2007), World mapper Dataset 312: Energy Depletion[2]

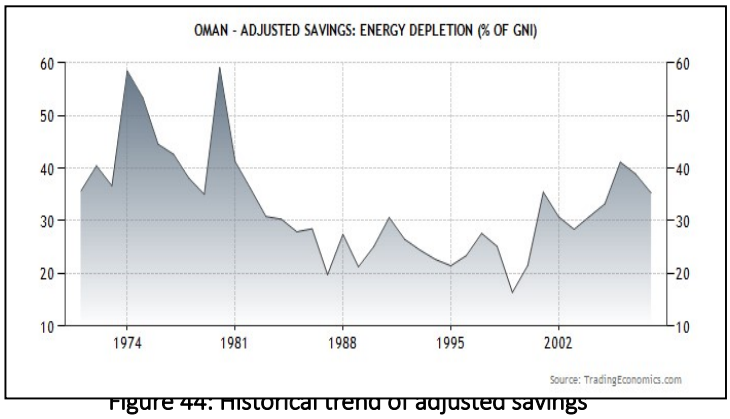


Figure 44: Historical trend of adjusted savings energy depletion (% of GNI) in Oman

Source: http://www.tradingeconomics.com/oman/adjusted-savings-energy-depletion-percent-of-gni-wb-data.html retrieved on 22/8/2011

[1]Shown here is the fall in the financial value of resources due to current rates of fossil fuel extraction. Territories that extract a lot, whether for internal consumption or export, have high 'energy depletion'

[2] "Energy depletion is equal to the product of unit resource rents and the physical quantities of energy extracted. It covers coal, crude oil, and natural gas" Here the % of Gross National Income (GNI) that is estimated to make up energy depletion costs is multiplied by the estimate of total GNI to produce this estimate of energy consumed that is depleted in a year: "For a detailed methodological note see www.worldbank.org/data"

Picture 23: Villa-model is characterized by large openings and energy-inefficient building materials

Source: The author. Date taken 15-05-21012

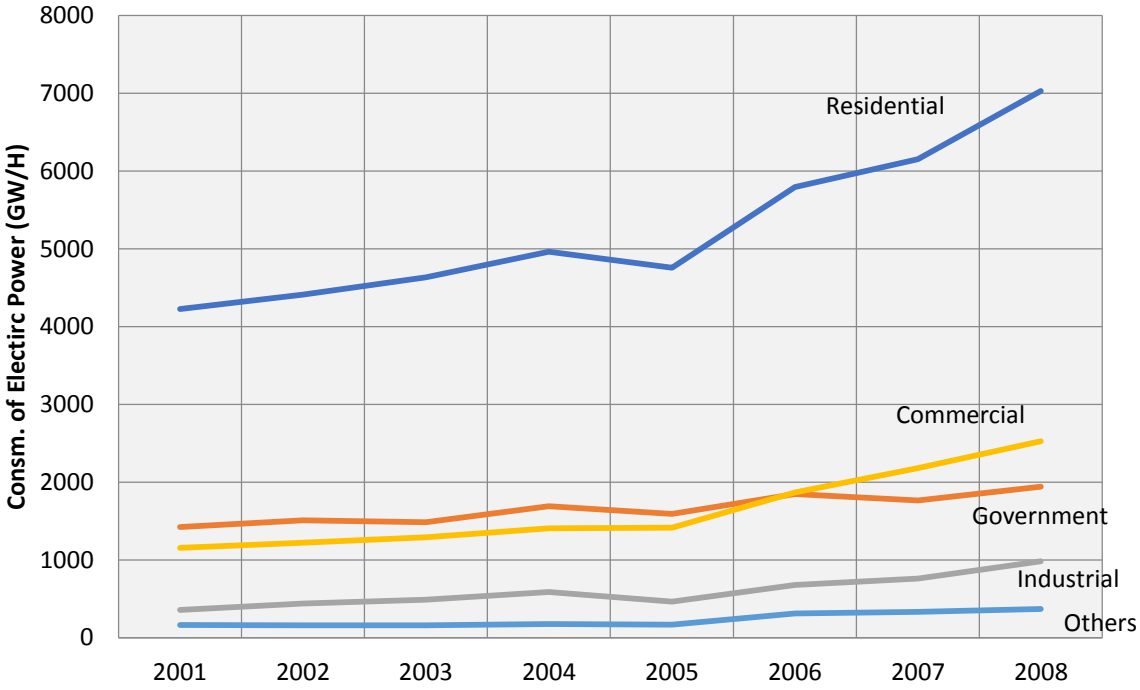


Figure 45: Consumption of electric power in Oman (GW/H) (2001-20080) by sector

Source: MNE, Statistical Year Book 2009

SASI, University of Sheffield: Publisher, http://www.sheffield.ac.uk/sasi
See notes in data worksheet and more detail at http://www.worldmapper.org/

With the increasing population, the demand for energy increases gradually. Figures [46] indicate the rapid production and consumption of electricity in the period (1980-2010). Within 30 years, the production and consumption of electricity redoubled about 15 times. The consumption of electricity in summer months (June, July, August and September) is extremely higher than the rest of the year due to the operation of air conditioners usually 24 hours a day.

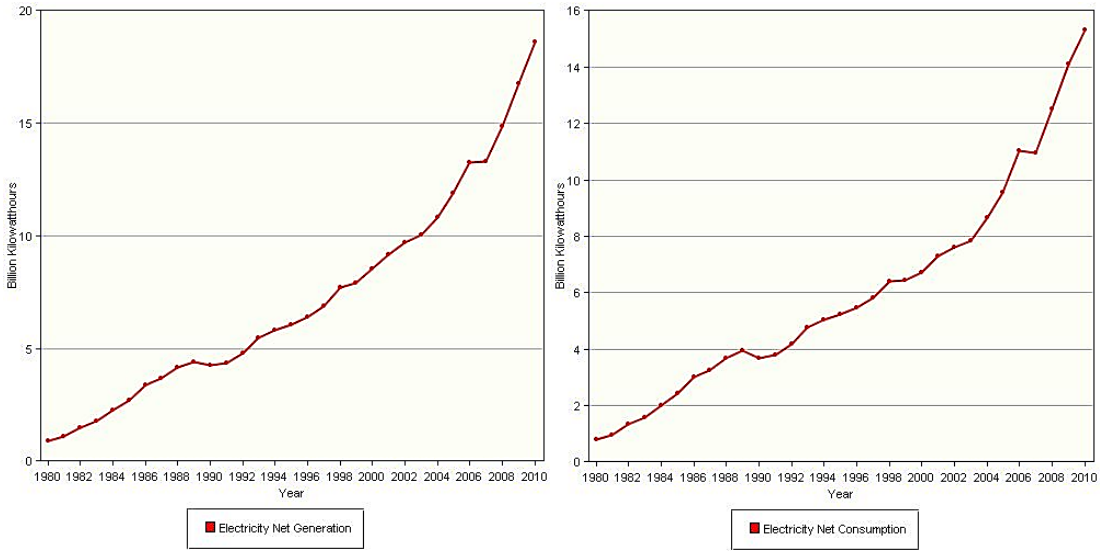


Figure 46: Generation and consumption of Electricity.

Source: US. Energy Information Administration (EIA) http://www.eia.gov/countries/country-data.cfm?fips=MU#elec retrieved on 30/06/2013

3.5.5. Water consumption

Oman is characterized by unique geographical nature and containment of mountains and wadies (valleys). When the rainfalls on those mountains, water profusely runs through wadies until water finally drains into the oceans or desert which is far from population centers. Oman is considered one of the world's highest water footprint rates as indicated with the map below.[1] These records were based on statistics of excessive consumption of fresh water due to the use of inefficient techniques particularly for irrigation system.

[1]The water footprint of a country, an indicator introduced in 2002, measures the volume of freshwater used to produce the goods and services consumed by the inhabitants of a country, calculated over the product's entire global supply chain. (Source: United Nations (2010), Department of Economic and Social Affairs Division, Trends in Sustainable Development: Towards Sustainable Consumption and Production, p.7)

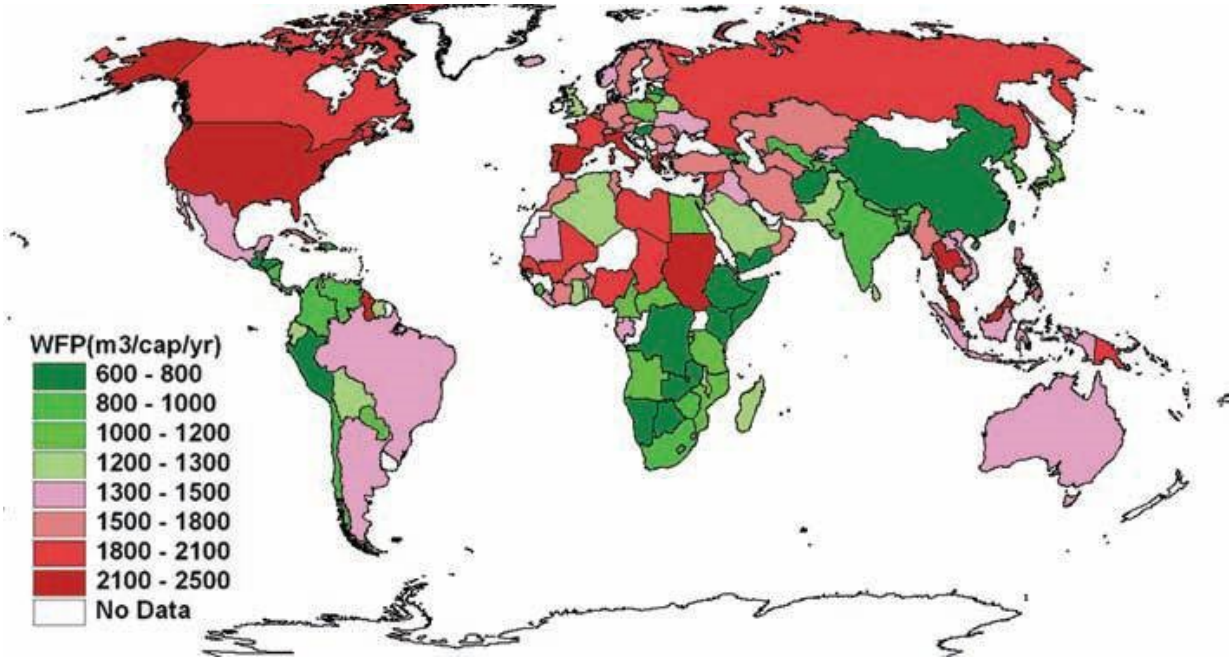
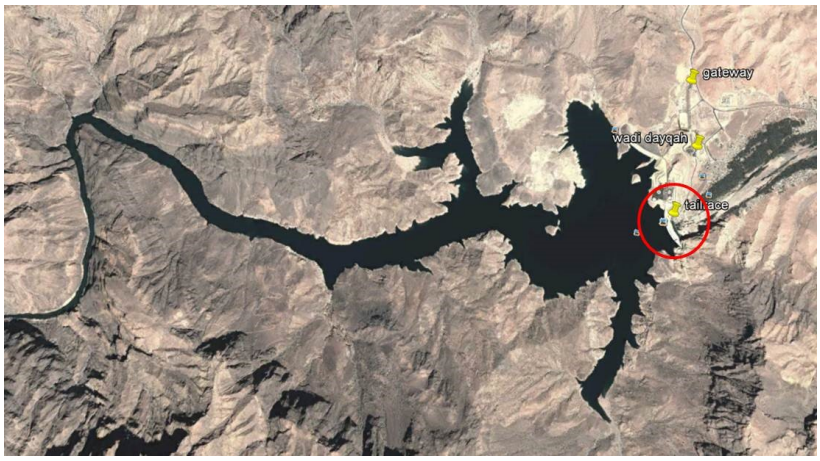


Figure 47: Average national water footprint per capita (2007)
Source: United Nations (2010), p.8 based on Hoekstra, A.Y. & Chapagain, A.K. (2007)

Obviously, these natural conditions work as indicators of possible exploitation of underground water storage during rainfall by increasing the number of dams for water storage so that it can be exploited in agriculture and drinking in the non-rainy times. According to the Ministry of Regional Municipalities and Water Resources statistics, '32 groundwater recharge dams and 67 surface storage dams have been established in various governorates and regions in the Sultanate, in addition to 43 groundwater recharge dams.'[1] Despite the importance of these dams for reserving the ground water (they collectively held about 1064 million cubic meters of flood waters until the end of 2009)[2], this quantity of dam is not adequate to catchall rainfall as the highest amount of rainfall water is just lost.



Picture 24: Wadi Dayqah Dam in Muscat

Source: www.googleearth.com

[1] http://www.mrmwr.gov.om/en/Page.aspx?id=73&li=10&Type=W_Sec&Slide=true accessed on 8-6-2013
[2] ibid

Picture 25: Wadi Dayqah Dam in Muscat

Source: http://im26.gulfup.com/2012-04-21/1334996699681.jpg

Population growth and the lack of recycling policies, as it is used in *Aflaj* System for drinking and washing and agriculture simultaneously, has led to excessive use of water. Most *Aflaj* channels penetrate community settlements before reaching the farms. The Aflaj water is utilized by local inhabitants for bathing and drinking on its way to irrigate farms.

For instance, unlike the current Mosques that rely on water tanks, the ancient mosques were built close to Falaj channels so that the worshipers can perform *Wud'u* (prayer wash) or having a bath before each prayer time inside small rooms where the Falaj's channels pass through. This attitude ensures that the user can have a bath and wash without loss of used water.

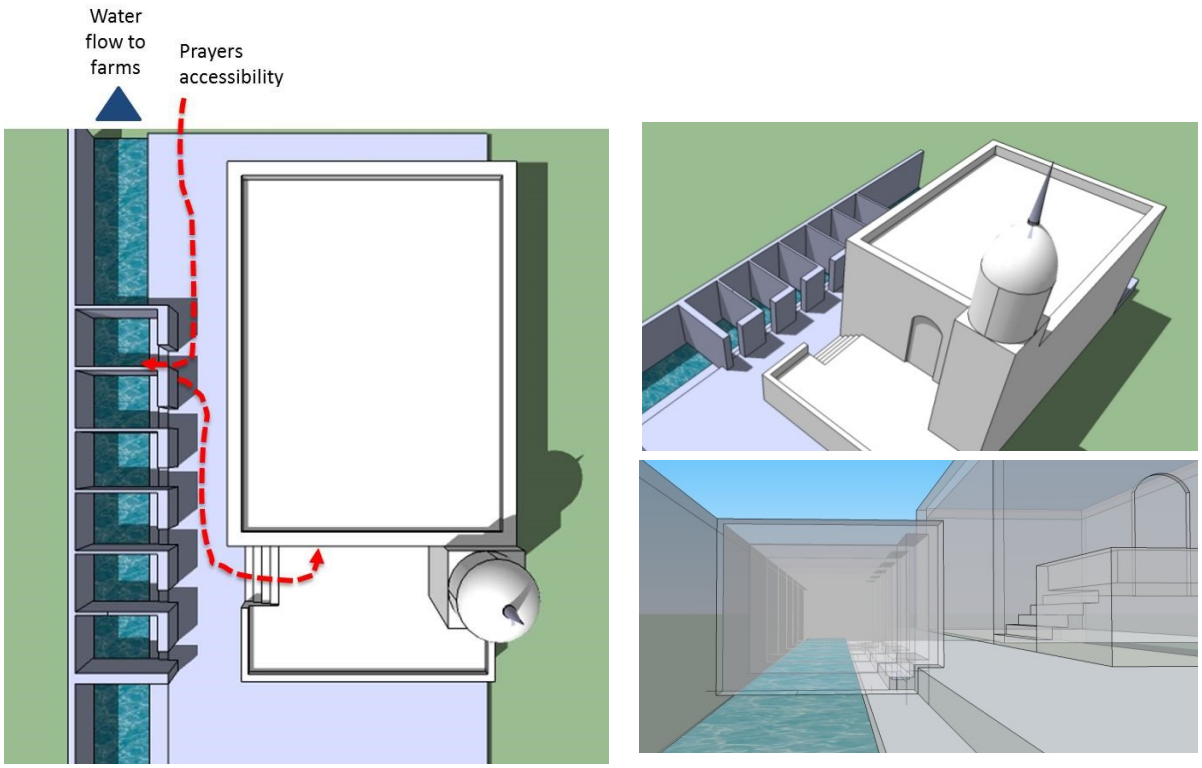


Figure 48: Falaj system complies with water recycling. Source: The author

However, since the early Seventies, the methods of using water have changed. Unlike the traditional method of *Falaj*, water has been extracted from the ground by drilling wells in some areas that are proved as basins for water, such as Al Massarat Water Basin in Dhahira Governorate and A'Sharqiyah Sand Basin in the eastern part of Oman. Water is transferred to homes either by using water tankers or by using public water networks that are established with high cost in high density areas. The consumer pays a definite tariff of 20 Baisa (USD 0.06) per gallon of water.

The other way to get water is by desalination plants, which are built on coastal cities and require exorbitant costs, such as Al Ghubrah Desalination Plant in Muscat that feeds most of Muscat's houses. In line with rainfall scarcity and lack of adopting the water recycling policies, both methods which rely on using water one time only, contribute to the depletion of the inventory of underground water because water is lost once used. Since the early Seventies, citizens have been allowed (some also are granted agricultural lands) to establish farms that rely on pumping ground water. Due to the increase in quantity of those farms and wells that feed them, Aflaj systems went into deterioration. The intensive consumption of the underground water basin has led to the depletion of most Aflaj systems and the farms they irrigated throughout the Sultanate. As a consequence, people left those farms to settle in modern villas in planned areas that are prepared by the Ministry of Housing. These planning areas are normally away from the existing settlements which makes supplying these areas with water a difficult task. The basic method to supply this low-density scattered development is water tankers that are authorized to buy a certain amount of water every day from wells and water tanks owned by the General Authority of Electricity and Water, and to sell it to the local inhabitants as retail. The problem lies in the fact that this fresh water is not merely utilized for drinking but also for cooking and bathing which certainly shrinks the level of ground water reservoirs. With the increase in population, the demand of water increases gradually. Figure [49] indicates the rapid production of water in the period (1980-2011). Within ten years, the production of water doubled about ten times.

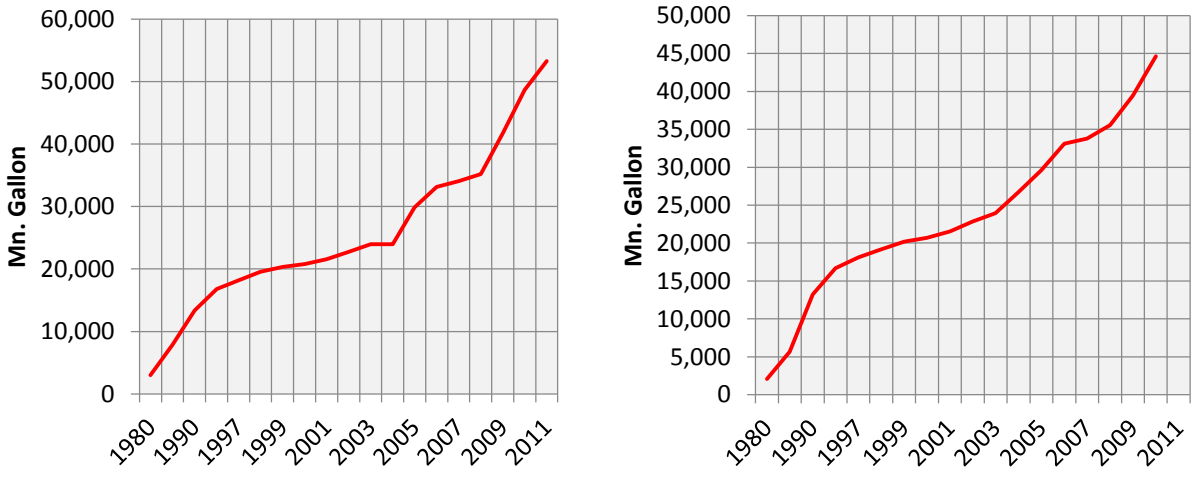


Figure 49: Production and consumption of Water in Oman of Water in Oman.

Source: NCSI, Statistical Year Book 2012

3.6. Conclusion

This part has investigated the transformation of lifestyle and urban patterns since the pre-oil ages until the current oil-age. It highlighted the impacts that have occurred as a consequence of the rapid transformation of local society to modern lifestyle. The oil-age has been usually associated with a huge consumption of natural resources, mainly land, energy and water. It is obvious from the previous discussions that the existing building regulations, the planning standards and the method of distributing lands are the major aspects that have largely contributed to emerging low-density urban patterns which are seen today in most urban and suburban areas in Oman. Despite the economic five-year plans that have been utilized as long-term planning techniques to finance and manage the major basic infrastructural services in the past four decades, it seems, however, that the government has not paid an optimum amount of attention to employ a part from oil fortunes to attain an extensive sustainable development at all socio-economic and environmental levels.

Local authorities have no expectations or even awareness about the outcome of rapid growth of the population. In contrast, they encourage low-density and car-dependent development to cope with this growth. Regulations and legislations are not viable or mostly absent when it comes to standardizing the development process. As the current financial sector focuses on single projects which are seen scattered here and there, the private sector has not been requested to exert more effort for subsidizing the affordable housing estates for middle-classes.

The researcher believes that the fragmented low-density development which is seen in most urban areas in Oman resulted from the method of land distribution. The Land Grating System which is based on random lottery is the major factor to be blamed for social segregation and environmental deterioration. The current poor ordinances and policies that have been employed to control the land use and urban patterning has led to the emergence of scattered developments which have not contributed to a sense of place and quality of lifestyle that were customary in the traditional neighborhoods.

Through the review of main disparities between the governance of Oman's ancient settlements and the current urban governance, it seems difficult to govern those areas to attain sustainable development via central governance. This is due to many reasons, such as the rapid population growth and geographic separation of population settlements. It is obvious that understanding the correlation and interrelation of the effect of socio-economic development and the population growth is essential for any intelligent urban planning. If this correlation is logically adapted, no doubt, it will lead to proper development that enables people to live a better life. Table [17] summarizes the transformation of lifestyle patterns from pre-oil ages to the oil-age, while Table [18] summarizes the driving forces of urban sprawl that have occurred in Oman in the past four decades according to the previous discussions.

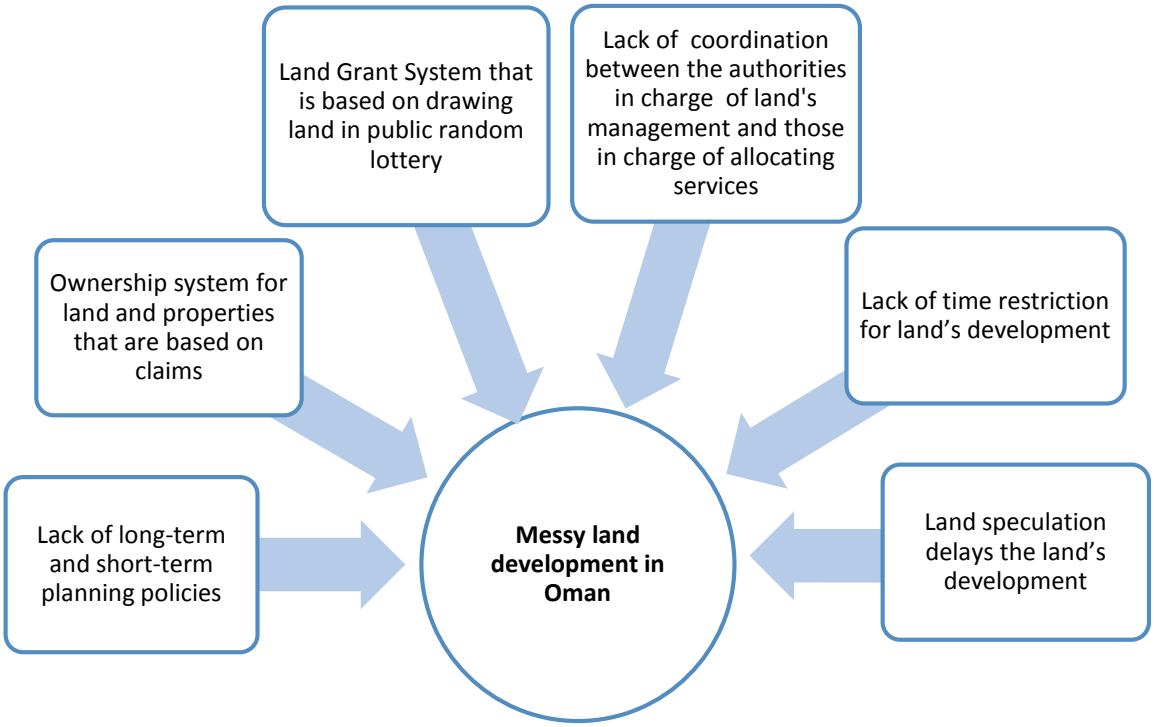


Diagram 11: Mutual drivers for messy land's development in Oman.

Source: The author

Pillar	Parameter	Pre-oil ages	Oil-age
Economy	Revenues	Based on the agro-fishing sector	Based on oil revenues
	Products	Based on local products	Based on imported products
Social aspects	Population	Modest population growth	High population growth
	Family	Extended families	Nuclear families
Governance	Urban management	Every territory is governed by sheikh/s	Central governance
		Based on participation of local people	Solitary ordinances
	Density	High dense oases settlements	Low density scattered developments
	Land use	Mixed use development	Single-use and fragmented developments
	Built form structure	Joint built structures	Free standing built structures (i.e. villa)
	Shopping structures	Traditional market adjacent to houses	Isolated strip and shopping malls
	Building materials	Local materials: *mud, backed bricks, stones, palm trunks*	Imported materials: *cement, steel, glass*
	Mobility behaviors	Based on walking	Based on private car
	Transport infrastructure	narrow and shaded pedestrian pathways	Wide corridors for car accessibility
	Consumption of natural resources	Consumption of energy and water based on need	Extreme consumption of energy and water
	Land	Lands appropriate for agriculture are conserved	Extreme consumption of lands for urbanisation
Environment	Environmental conditions	Healthy	Air pollution Large footprint

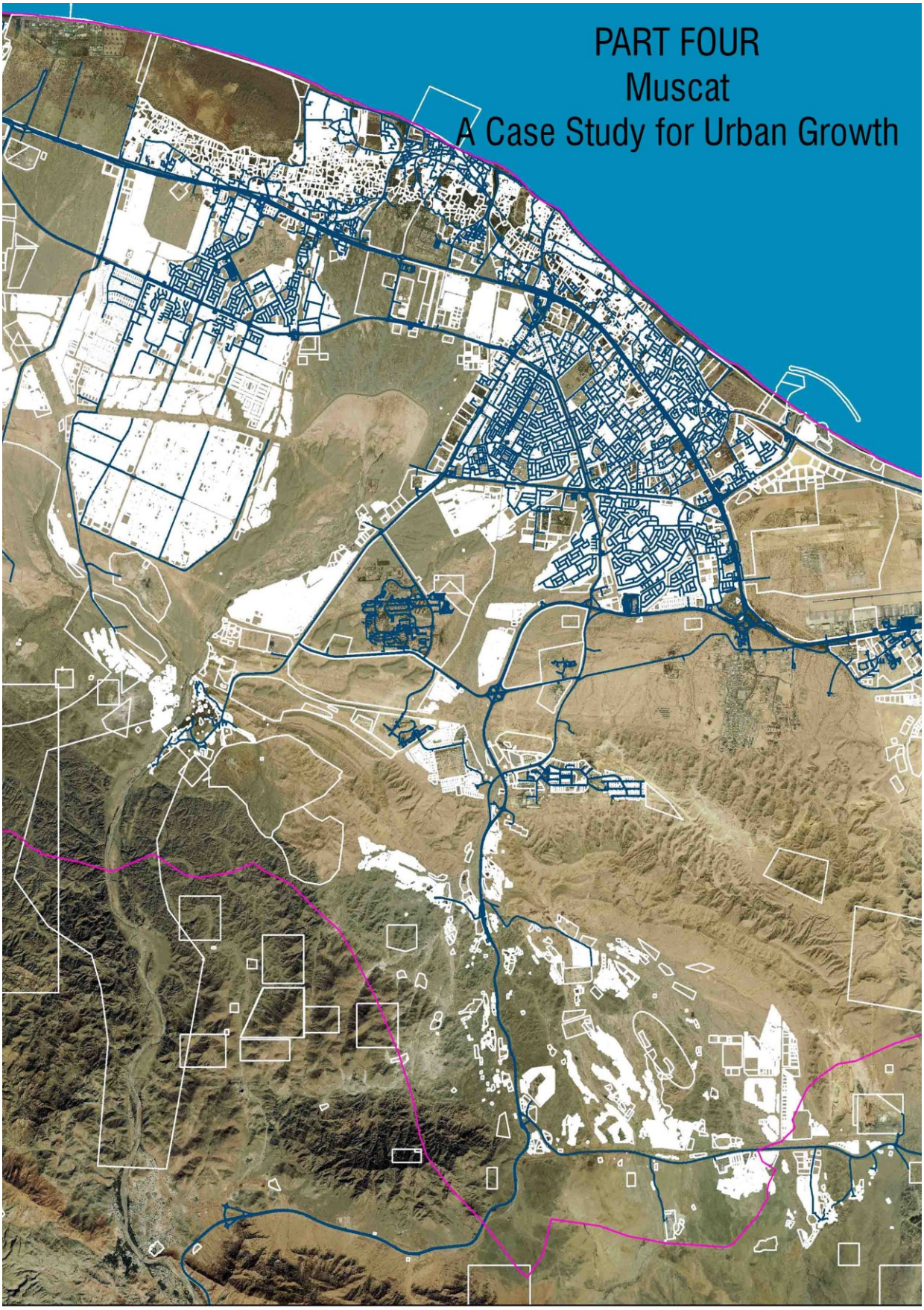
Table 17: Summary of the transformation of lifestyle pattern from pre-oil to the oil age.

Source: The author

Pillar	Parameter	Leaded to	Impacts
Economy	Economic growth	Increase in GDP per capita Increase of labor force	The demand for housing spaces is increased Discontinuous uncorrelated developments.
Social	Population growth	Increase the urban population	The burden on natural resources is increased, i.e. land, energy, water
	Change from extended to nuclear families	Family segregation	The demand on land for housing spaces is increased. Social fragmentation
	Migration to urban areas: internal & international	Increase urban population	The burden on natural resources is Increased, i.e. land, energy, water increase the rate of unemployment
Urban Governance	Central governance	Independence of decision making	The public feel unsatisfied
	Lack of proper planning policies	Poor urban management	Uncontrolled urban growth
	Lack of affordable housing in urban centers	Build houses at city's outskirts	Scattered low-density urban development.
	Low density scattered developments	Houses and services are disconnected	Increase transit time
	Single use fragmented and developments	Car dependent society Increase transit time	Car accidents Obesity, diabetes
	Free standing built structures	Increase of consumption of land, energy and water	Depleting those natural resources
	Large lot size	Increase the consumption of land	Land has become scarce
	Isolated strip and shopping malls	Car-dependency to reach those facilities	Increase the transit time Increase lands consumption for car utilities.
Environment	Based on private car	Increase traffic jams, car accidents, death rates	Social segregation Depleting those natural resources
	Wide corridors for car accessibility	Increase quantity of cars and transit time	Quantity of traffic jams, car accidents, death rates have reached extremely high rates
	Extreme consumption of energy and water	Increase the burden on those basic services	Water and energy have become unaffordable
	Extreme consumption of lands for urbanisation	Increase the demand for the available lands	Lands have become scarce
	Air pollution Large footprint	Increase in temperature	Climate change become obvious
	Lack of thermal insulation at buildings. The lack of utilizing energy-efficient building materials	Increase in energy consumption	Energy become unaffordable

Table 18: Summary of driving forces of urban sprawl in Oman

Source: The author


PART FOUR
Muscat
A Case Study for Urban Growth

4. PART FOUR: MUSCAT: A CASE STUDY FOR URBAN GROWTH

4.1 Urban growth in Muscat

4.1.1 General outlook

According to the available literature, the history of Muscat is environed by ambiguity. Peterson (2007) indicated that 'although preliminary archaeological investigations in the general Muscat region have provided some glimmers, extremely little historical evidence exists regarding settlement in the Muscat area, including the principle towns of Muscat and Muttrah, before the 16th century'[1] However, Muscat has emerged as an attractive place for merchants and colonists due to its strategic location on the Sea of Oman and it has played an essential role as an interchange point among the Persian Gulf, the Indian Ocean and other parts of the world. The vital harbor and the self-defensive rigid terrain are two characteristics that made the city a convenient settlement in early history. The modern history of Muscat can be summarized according to the most striking event which was the Portuguese invasion in the 16thcentury.

This part of the thesis aims to present the historical circumstances that Muscat experienced during the period prior to the oil-age which largely influenced the pattern of urban growth. It is important to trace the major transformation of urban pattern in Muscat initiated from the pre-oil age up to date. There are many reasons for selecting Muscat as a case study: Muscat has been and remains the political and the economical capital of Oman. Currently, it holds about one third of the total of Oman's population even though it only represents about 1.3% of the total area of Oman. It also has more than two thirds of the public-sector workforce. It hosts the headquarters of ministries, companies, banks and other enterprises and institutions. This part of the thesis also discusses the driving forces that have contributed to urban growth in Muscat. It also highlights the issues that have resulted from these driving forces.

4.1.2 History of urban growth prior to oil-age

Despite Muscat's long history, which involved lots of political and socio-economic variables, the period of Portuguese invasion of Oman's coastal cities in the 16th century was the most significant event that largely influenced old Muscat's general form. Peterson (2007) indicated that 'the arrival of the Portuguese in A.D. 1507 not only provided the first extant descriptions of Muscat of any relevance but also marked the initial changes in the shape, definition, and composition of Muscat town that are capable of identification today. Many of the principle features of Muscat were either built at this time or adapted by the Portuguese occupiers.'[2] A lot of scholars and explorers have illustrated Muscat as a lively place. For instance, the Portuguese admiral, Albuquerque, Muscat's conqueror, noted Muscat as:
'*... a large and populous city ... It is the principle entrepôt of Hormuz, of old a market for the carriage of horses and dates; it is a very elegant town with very fine houses....*'[3]

[1]Peterson (2007), p.4
[2]Ibid
[3]Ibid., p.5

In order to secure their sailing routes, the Portuguese invaded and conquered Muscat and other coastal cities in Oman and consequently controlled the whole coast of Oman. This Portuguese fleet's plan was successfully implemented when 'Albuquerque set sail for Sohar and Hormuz just after 8 days after conquering Muscat.'[1] 'After the fall of Hormuz from Portuguese control in 1622, the Portuguese made Muscat their regional center and added other maritime defenses to make the city virtually impregnable from sea.'[2] Although 'the initial period of Al Bu Sa'id rule (*i.e.* the latter half of the 18th century) was marked by an interest and growth in maritime trade, which furthered the importance of Muscat'. However, 'the history of Muscat during the 19th century eventually became associated with neglect and decline more than anything else.'[3] Muscat fell behind in socio-economic levels as a result of losing control and power of the whole country.

At the economic level, the country only depended on the agro-fishing sector. Socially, most people did not have educational opportunities or access to good health care facilities. The entire country of Oman was fragmented, with each area being controlled by its tribal community. As a result of this, Muscat had become a physically and socially segregated area from the entire areas in Oman. 'The town was divided by its walls: most of the enduring structures were located Intramuros while the poorer inhabitants tended to live Extramuros.'[4] 'The castellated wall proposed to counteract any attempted attack. 'Virtually no changes had been made to the wall in centuries. Its contours followed the same line set down by the Portuguese and the integrated watchtowers still stood as before.'[5]

The wall comprises three main gates: *Bab Al Mathaib*, *Bab Al Kabeer* (The Big Gate) and *Bab Al Sagheer* (The Little Gate). *Bab Al Mathaib* is located in the western corner, below *Al Mirani Fort*[6], and *Bab Al Kabeer* is positioned at the end of the western side of the walls and serves as the entrance to most roads leading to suburban Muscat and Muttrah City and accordingly it became the primary gate. For security purposes, the gate was closed down before dark every day.*Bab Al Sagheer* lies in the mid-southern side, and is considered one of the city's main entrances which led directly into the *suq* quarter (market).

[1]Ibid., p.5
[2]Ibid., p.8
[3]Ibid, pp.12-13
[4]Ibid, p.20
[5]Ibid, p.20
[6]The castle is located in the old hometown overlooking the Sea of Oman. It was built at the base of the big rock basins of ships overlooking the high fence in the last western, and is climbing up through the staircase carved in the rock. Some said the name came from "*meranti*" a Portuguese word meaning "Admiral," as others return it to the word "*Miran Shah*," which is one of the leaders of the Persians. *Mitha'ib* means drains that allows water run-off through from the *wadi (valley)* which collected from the adjacent and distant mountains.

Picture 26: Al-Bab al-Sagheer, "the little gate," in 1966. The gate provided a direct access to the suq (market)
Source: Peterson (2007)

Picture 27: Al-Bab al-Kabir at present
Source: Peterson (2007)

However, 'an 18th century anonymous French map, which provides the most detailed plan of old Muscat, clearly shows that the old water canal from the Extramuros wells to the *khawr* entered Intramuros precisely at *al-Bab al-Kabir*. It might therefore be postulated that the original entrance to the town was al-Bab al-Saghir and that al-Bab al-Kabir was developed later after the canal had fallen into disuse and was replaced by a pipeline.'[1] It should be noted here that even prior to Sultan Qaboos' taking over the country's power in July 1970, custom fees were collected through *al-Bab al-Kabir.* Old Muscat was a little village compared to what is seen today.

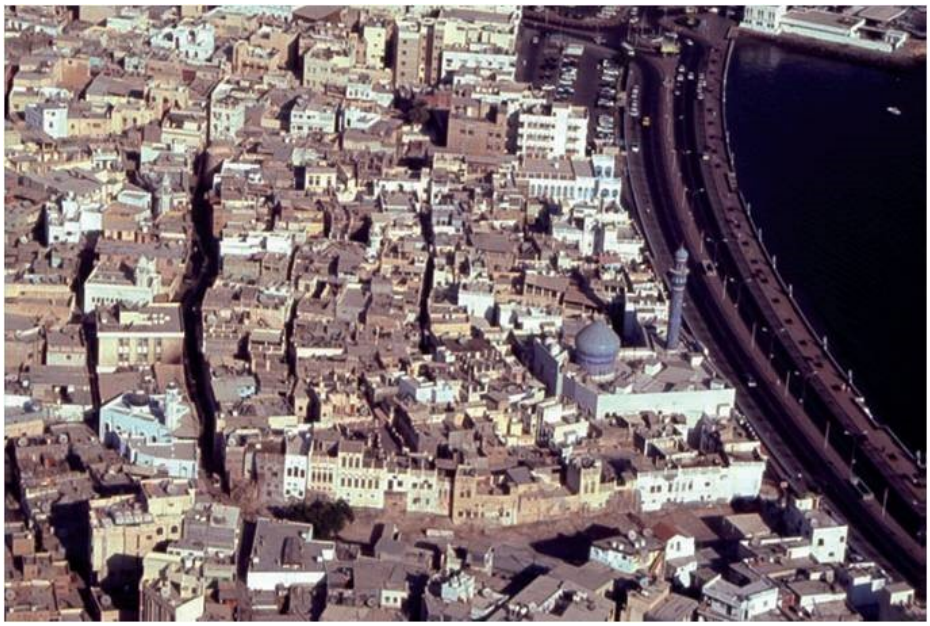
'The most prominent structure of Muscat Intramuros was Bayt al-*'Alam Palace*, which occupied half the shoreline of the harbor. The palace had been repaired or rebuilt several times since its construction but after Sultan Sa'id b. Taymur (r. 1932–1970) failed to return to his capital after 1958.'[2] The palace location shows intelligence by selecting its position where it is surrounded by rigid mountains from the south and offshore from northern sides which ensures self-defense against any attack attempts. 'In the past, the most substantial aspects of Muscat were almost always situated within the walls. To a large extent, this also included the population. Muscat Intramuros was the home of members of the ruling family and most of Muscat's prominent merchants, as well as what few foreign consuls were present. Many of the houses outside the walls tended to be of *barasti* (palm frond) construction. These structures were always the worst to suffer in times of political unrest or natural disaster; many were destroyed in a series of suspicious fires in the 1960s. The names of the Extramuros quarters often reflected the occupations of their inhabitants.'[3]

[1]Ibid, p.20
[2]Ibid, p.21
[3]Ibid, p.22

Figure 50: Muscat about 1960 Source: Peterson (2007)

Figure 51: Muttrah in 1966 Source: ONSA

4.1.3 Urban growth pattern in Muscat at oil age



Picture 28: Sur al Luwatiyah, Muttrah, 1998

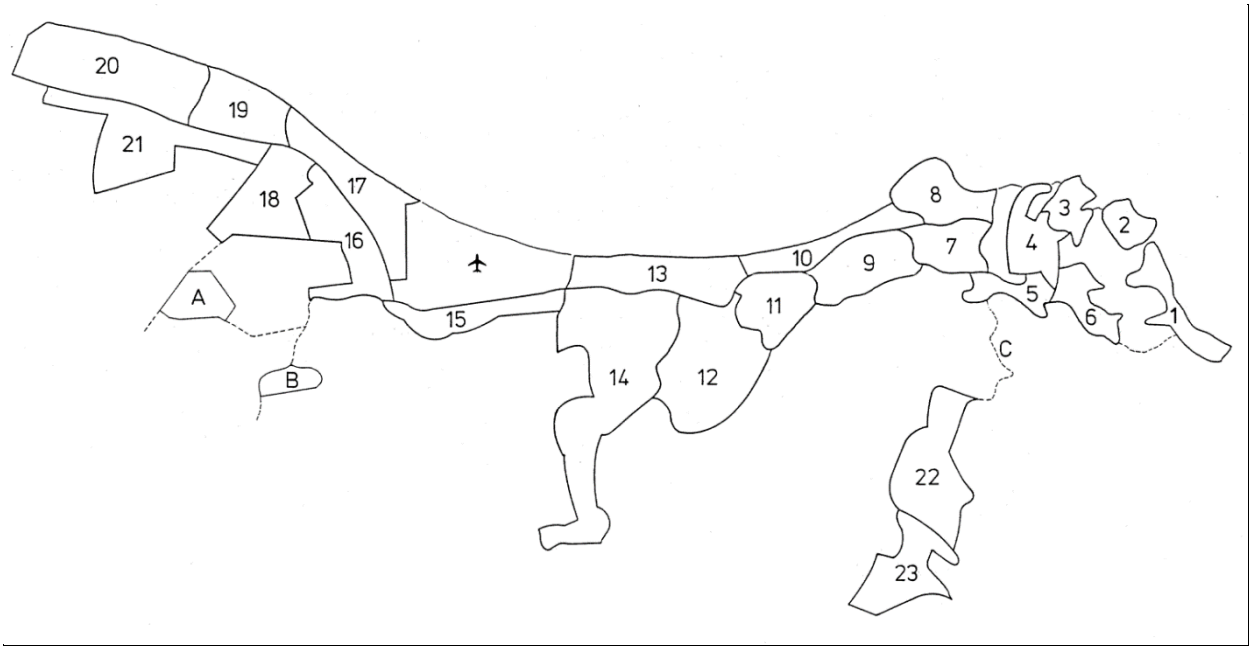
Source: Peterson (2007)

During the past four decades, modern Muscat has experienced three forms of urban growth that were largely analogous with those identified by Angel *et al.* (2007) as basic forms of urban growth that are characterized as sprawl: (a) a secondary urban center, (b) ribbon development, and (c) scattered development.[1]

Since the late 1960s, multi urban centers and sub-centers in various parts in Muscat have emerged as **secondary urban centers**. Muttrah was considered the oldest part which formed the core of the urban explosion towards other parts which are seen in Muscat today. 'The Greater Muttrah master plan prepared in the last years of Sultan Sa'id bin Taymur's rule envisaged an expansion over Muttrah's encircling hills to Wadi Bayt al-Falaj behind. Prior to 1970, this somewhat triangular-shaped valley contained the Bayt al-Falaj army camp at one point, the small village of Ruwi at a second point, and absolutely nothing at the third.'[2] The secondary urban centers include Baushar, Seeb and Amart. Those urban centers are also split into 'sub-centers' such as Khuwair and Qurm in Baushar and Khoad and Um Abailah in Seeb. Those areas were developed due to the increasing demand for land by citizens through the land granting system which enables the national people to gain residential plots. Those areas represent the basic sprawled form that Angel *et al.* (2007) identified. The development in those areas seems scattered, ribbon development with low-density and extremely far from the existing developments. Figure [52] indicates Muscat's centers and sub-centers that have emerged since the late Sixties.

[1]Bhatta (2010), p.12

[2]Peterson (2007), p.24, Sa'id bin Taymur's the former sultan of Oman and father of HM Sultan Qaboos (the current leader).



1	Sidab, Bustan, Qantab	8	Qurm	15	Airport Heights, Civil Aviation Area	22	Amarat
2	Muscat	9	Madinat Qaboos, Information city	16	Mawalah	23	Madinat Al Nahda
3	Muttrah	10	Qurm Beach, Diplomatic Area	17	Hail	A	University
4	Darsait, Ruwi North, MBD	11	Khuwair	18	Khoad	B	Rusayl Industrial Complex
5	Ruwi South, Hamriya, Wadi Adai	12	Ghobra, Baushar	19	Seeb	C	Wadi Area
6	Wadi Al Kabir	13	Adheibah	20	Manuma		
7	Wattayah	14	Ghala Industrial Area	21	Ma'abela		

Figure 52: Muscat's centres and sub-centres that have emerged since the late sixties

Source of map: Weidleplan & Muamir (1991), p.10

The **ribbon development** commenced since the development of the new dual-carriageway that runs from Muttrah's new Cornish towards Ruwi in 1975. 'The village of Ruwi was swamped under a hodgepodge of shops along the new Ruwi High Street, small workshops, and cheap housing. Other houses and apartment blocks began to fill in the area around Bayt al-Falaj, as well as the new al-Falaj Hotel. This indicates the *linear branch* expansion that surrounded by non-developed land and is some distance from existing developed land.'[1]

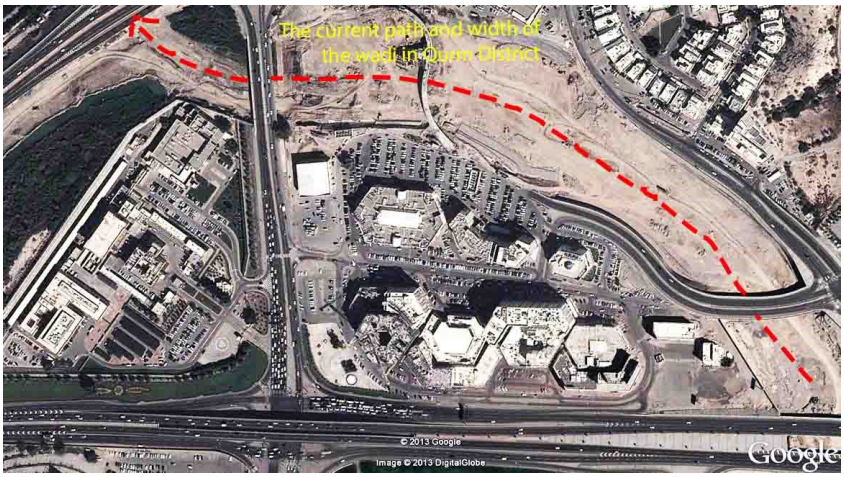
[1]Peterson (2007), p.24

Furthermore, the ribbon development has been resumed by the construction of the main car-corridor named the *Sultan Qaboos Highway.*[1]This wide corridor has demonstrated ribbon development because it works as the main thread that links all urban centers and sub-centers from Muttrah in Muscat Governorate to the last northern city in the Batinah Governorate. This corridor has bisected urban areas into linear segments forming very strong edges. The multi-interchange nodes that have been provided along this highway to connect the urban centers have failed to defeat the gridlock. The highway has largely contributed to the emergence of ribbon developments on both sides. The major fault is transforming the land use to commercial use on both sides of the highway which created many problems including the decline of the traditional markets on one side and the increase of traffic jams on the others. 'The main dual-carriageway worked well most of the time but slowed to a crawl during rush hours. When accidents or the movement of the Sultan or VIPs closed the road, traffic throughout the ribbon came to a virtual dead-stop. Elsewhere, traffic jams and black accident areas turned commercial areas into mazes of one-way streets.'[2]

Some areas in Muscat, which were basically kept for the public realm or even reserved for valley floods, have changed dramatically into residential and commercial developments. For instance, in the late 1980s the central area in Qurm was turned into a commercial district despite its initial function which was basically for wadi run off. Currently, this area accommodates multiple commercial malls and is surrounded by acres of car parking lots. Consequently, it becomes a drainage basin for water runoff particularly when it is flooding. So far, local authorities have not executed any initiative to treat this dilemma. Pictures [29-30].

Picture 29: *Qurm* was the most affected area by floods 2007.

Source: http://www.gulf4cars.com/vb/attachments/attachments/gulf4cars21960d1201948072/ retrieved 21-2-2012



Picture 30: The current path and width of the wadi in Qurm were largely restricted.

Picture source: www.googleearh.com retrieved 01-07-2013

[1]'A six-lane dual-carriageway launched in the mid-1980s provided the single main thoroughfare for the capital area, beginning in Muttrah and terminating in a great roundabout west of al-Seeb Airport.' Source: Ibid., p.25

[2]Ibid., p.26

The environmental and geographic constrains in Muscat have largely added more fiscal burdens needed to reform and prepare land to be appropriate for allocation to public utilities. 'As the cost of infrastructure provision depends substantially on environmental factors and technical complexity, it is clear that the costs of densification of low-income settlements could be higher than middle-income settlements. This is because these settlements often consist of disorganized layouts built in fragile environments, on steep slopes, geologically unstable land, tidal flats or on land which is prone to flooding.'[1]

Most of Muscat's urban areas are not much different from this expression. The land conditions are mainly characterized as depressed and sloppy which not only becomes borne to soil drift but also increases the level of urban fragmentation and disconnection of development. 'At the same time in the early 1970s, the Sultanate's first planned residential development, *Madinat Qaboos* (Qaboos City), was built in splendid isolation on the low hills overlooking the small village of *al-Saruj* and the sand dunes behind the sea at al-Qurm. By the mid-1980s, however, *Madinat Qaboos* was no longer isolated. Having filled *Wadi Bayt al-Falaj*, advancing urbanization snaked through narrow *Wadi 'Adayy* and spilled out into *al-Qurm flood plain*, where new shopping centers began to emerge.'[2] This new urban center was established to meet the increased demands on the residential purposes.

'The progress of ribbon development along a Ruwi-Qurm-Khuwair-'Udhaybah corridor was relentless. Once again, the path of urbanization was determined principally by geography. There was nowhere to go inland from Ruwi, as the only fissure in the hills was Wadi 'Adayy. The resultant coastal plain provided only several kilometers of depth between the sea and the hills, all the way to al-'Udhaybah. Thus the Muscat conurbation continued to spread west.'[3]

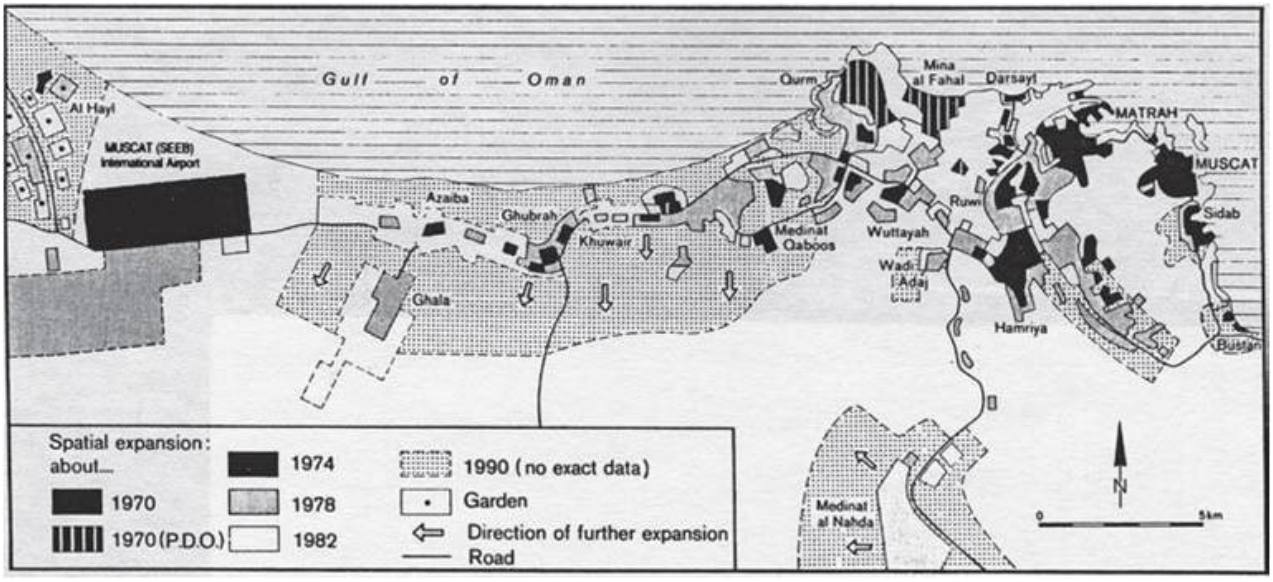


Figure 53: Muscat's spatial expansion (1970-1990) shows the ribbon development of oil city

Source: Fred Scholz

[1]Jenks, M. and Burgess, R. (2000), p.16

[2]Ibid., p.25

[3]Ibid

Picture 31: Burj Al Sahwah Roundabout

Source: The author. Taken: 22-8-2012

Burj al-Sahwah (Renaissance Tower) is a nodal roundabout which was launched in celebration on the15th anniversary of the country's renaissance. The roundabout is an interchange point that connects Muscat with all Oman's regions. This outstanding landmark with its cubic shape became the country's symbol. However, 'once meant to mark the end of Muscat, Burj al-Sahwah soon became a victim of unrelenting sprawl. To its northwest, al-Seeb village grew into a massive development of family houses. Residential building continued along the coast west of al-Seeb and inland towards the hills and a village named al-Khoad, the site of the country's new Sultan Qaboos University. The demands of increasing commuter traffic forced a realignment of the main thoroughfare to bypass the Burj al-Sahwah roundabout and another road was laid out along the coast north of the airport. Although never more than a few kilometers wide, metropolitan Muscat now stretched for some 60 kilometers or more from east to west.'[1] Picture [31].

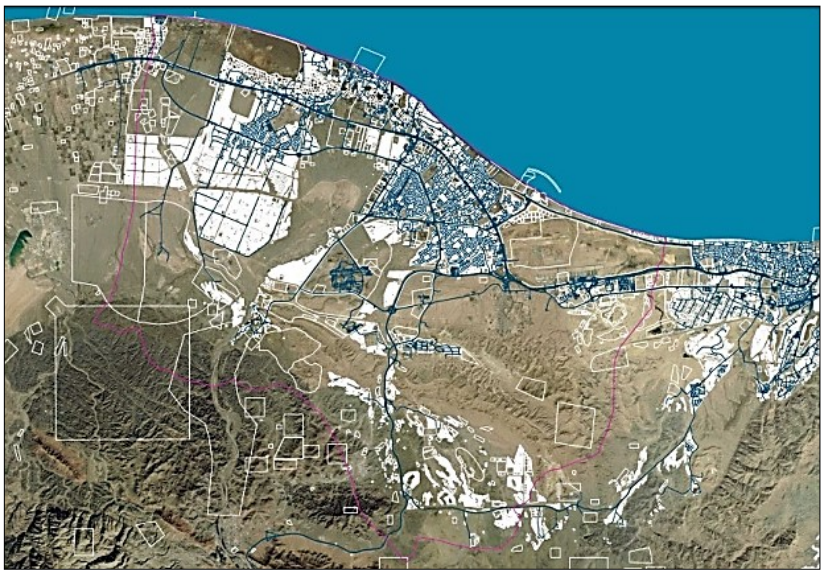


Figure 54: Urban expansion in Muscat in 2011. Source: MoH

'The filling in of nearly every available space within this area meant that industrial infrastructure and commercial warehouses were forced to relocate to more remote locations. A new industrial park was created in an isolated wadi alongside the main road to the interior. But soon even it was not big enough and new areas had to be found. Half-planned and half-accidental in origin, Muscat's ribbon development continues to evince numerous problems. Fortunately, the capital's superb road network was all but completed before the collapse of oil prices in 1986. Unfortunately, the growth in population and increasing numbers of vehicles on the road meant that traffic congestion became a severe problem throughout much of the capital.'[2]

[1]Ibid., p.25-26

[2]Ibíd., p.26

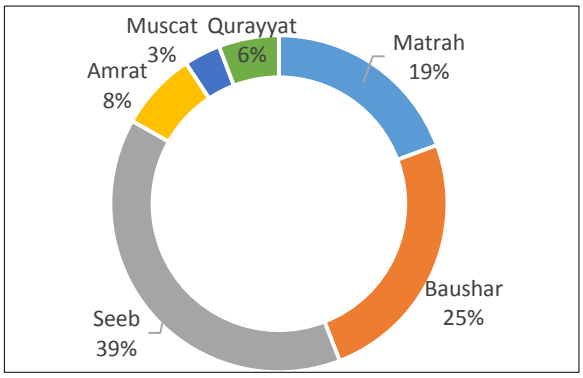


Figure 55: Seeb Wilayat occupies 39% of Muscat's inhabitants.
Source: MNE based on Census 2010

Since the early Nineties, to the western part of Muscat, Seeb Wilayat has been growing very fast to cope with the increasing demand for land and tenure. Large and cheap lots are the main factors that have largely contributed to attract people to reside and invest in Seeb Wilayat. Opening the *Sultan Qaboos University* in Khoad in 1986 also contributed to the tremendous demand for housing and business in Seeb. The price of land in Khoad and Mawalah –both are districts in Seeb Wilayat – increased more than ten times in the last ten years. The rapid population growth in Seeb augmented the traffic and raised the pressure on the local streets networks. The gridlock became a daily experience in the area. As a result, there was no choice rather than construction of new roads and widening some existing streets. Although the Khoad's main street was widened as dual carriageways, gridlock remains a painful fact for the local inhabitants and visitors particularly inside the commercial district.

The rapid urban development in Seeb augmented the car-mobility rate. As Seeb houses account for more than 39% of the total Muscat's population according to the 2010 census, Figure [55], there was no choice other than to construction a new highway to reduce the gridlocks along the main car-corridor, Sultan Qaboos Highway. The Muscat Expressway, launched in late 2010 with six lanes, is anticipated to enhance the traffic mobility and reduce the gridlock in Muscat.

The highway runs from Qurm in the eastern part towards western areas up to Halban in Seeb for a preliminary stage and is intended to carry on to other northern parts of Batinah Coast's Wilayats. See Figure [56]. Although this road has attracted traffic flows it would not manage the large increase in the quantity of automobiles. As major drivers have deserted other crowded roads such as Sultan Qaboos Road, this highway will not take a long time to be filled. The problem is not a matter of enhancing the asphalted roads but it is a matter of the urban management elements having to work as one integral system.

Source: www.googlemap.com

Figure 56: the new 6-lane Muscat Expressway

4.2 Urban growth driving forces in Muscat
4.2.1 Economic factors

For a long time, Muscat has been characterized as one of the world's most efficient place for trade and marine routes. Since the national economy has improved in the early 1970s, wages became higher, which enabled people to build new residential settlements.
The economic transformation has led to the abandoning of agro-fishing jobs for civil and military jobs that are mostly offered by the government. This has resulted in a notable deterioration of the agriculture and fishing sector in Muscat. Plenty of acres of arable lands in Muscat had been transformed into commercial and industrial utilities. Meanwhile, due to the rapid increase in traffic, large fractions of lands also have been allocated for transport infrastructure such as highways and parking lots. Since the economic transformation, major agricultural products have been imported from other countries. The decline of major local agro-fishing sectors has largely boosted the price of products.

Because Muscat is the capital of the country, it received exceptional attention from the government. For instance, 'in the sixth five-years development plans (2001-2005), Muscat Governorate received a total amount of 300 million Omani Riyals (about US$770 million) which is 50% of total budget of investment in the country in order to develop the infrastructure and services in Muscat Governorate.'[1] In contrast, the improvement of basic infrastructure has encouraged Omanis from other regions to settle in Muscat. The majority of this influx of people stayed in Muscat during the week and returned home for the weekend. Others decided to have another home to addition to the homes in their original areas.

A person was encouraged to own another home in Muscat because, at that time, the Land Granting System was allowing a citizen to acquire two plots as grants from government: one plot in the place of origin and the other plot in the Wilayat of workplace. Consequently, Muscat has experienced unusual internal migration in the late 1970s and 1980s. People were also encouraged to migrate to Muscat for the improvement of educational institutions, healthcare and recreational facilities.

In addition to hosting all headquarters of governmental institutions and private sectors, Muscat holds the country's first and largest governmental university, the only international airport, the only port for exporting oil, the largest specializing hospital, the largest industrial estate, the first oil refinery, the only port for tourism, utilities, etc. The demographic transformation has increasingly boosted the demand for natural resources such as land, water, energy, sewage, roads, etc. Developing these projects results in an increase in general public spending. The improvement of the economy has also attracted an influx of expatriates which has strongly contributed to the rapid growth of the population of Muscat.

[1] Al Awadi (2008)

4.2.2 Social factors

4.2.2.1 Rapid population growth

As indicated already through this thesis, since the oil production 40 years ago, the lifestyle in Oman has undergone a drastic transformation at social and urban levels. The immense transformation from the agro-fishing based economy to the oil-based economy is accompanied by remarkable changes in social and urban structures. Consequently, people were encouraged to leave their former jobs to find effortless jobs in the coastal and major cities. Muscat, the capital city, received the largest influx of internal and external immigrants. The collective immigration of people in the 1970s and 1980s has confirmed the tremendous urban growth phenomena and the population decline of rural areas.

'The initial impetus behind the urban explosion was the creation of the nucleus of a modern government. The growing flood of Omanis returning from abroad at this stage tended to relocate to their own villages and regions throughout the countryside.'[1] 'The total population of the Sultanate has redoubled nearly six times from 50,000 in 1950 to 2,775,878 in 2010. Although Muscat and Batinah represent merely 5.3% of the total area of the Sultanate, they accommodate about 56% of the total population by nearly 28% of each.'[2] Figure [57] represents the distribution of the Sultanate's population by regions according to the 2010 population census.

As a result, Muscat-- the capital city-- which hosts the majority of the governmental and companies headquarters is considered the highest region influenced by the urban sprawl phenomena. Multiple urban and social issues have emerged due to the poor urban management system and the transformation towards the current urban governors. Peterson (2007) argued that 'the dispersion of the Omani population in Muscat during the post-1970 period follows two patterns. The first began when the wealthier of Muscat and Muttrah's inhabitants moved to new homes in the initial new developments, such as the areas between *Bayt al-Falaj* and Ruwi. Al-Qurm Heights, developed from the mid-1970s, served as a magnet for senior members of the ruling family, wealthy merchants, and government ministers.'[3]

Figure 57: Distribution of Oman's population by regions, 2010. Source: MNE

[1]Peterson (2007), p.23
[2]MNE, Final Result Report, Census 2010 , total population of the Sultanate is 2'773'479
[3]Peterson (2007),p.27

The 2003 census indicates that Muscat Governorate received about 60% of the total Omanis who have changed their residence from other regions. The work and educational opportunities on one hand and the rapid change towards civic life pattern on the other hand led to Muscat receiving flocks of citizens from other regions. Despite that the total area of Muscat is merely 1.3%, Figure [58], which is the second smallest area in Oman, it holds nearly one third of the total population of the Sultanate, Figure [61]. Muscat represents the highest population density in Oman by 243 persons for every square kilometer, Figure [59]. According to the population censuses, in less than 40 years, the population of Muscat has doubled more than 32 times, Figure [60]. According to the last two years population growth rate, in 2030, the population of Muscat will reach approximately two million.

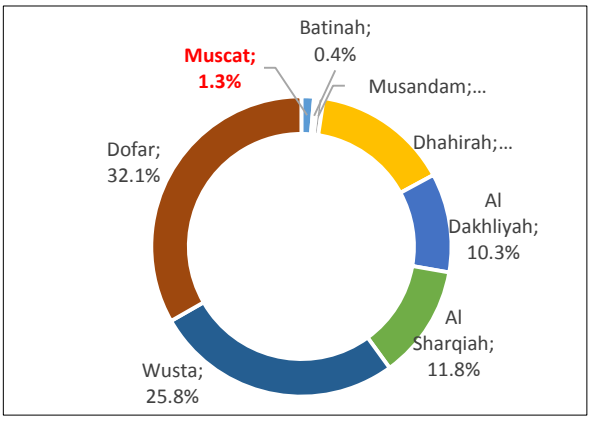


Figure 58: Muscat represents only 1.3% of the total area in Oman

Source: Own calculation based on MNE, Annual Report, 2009

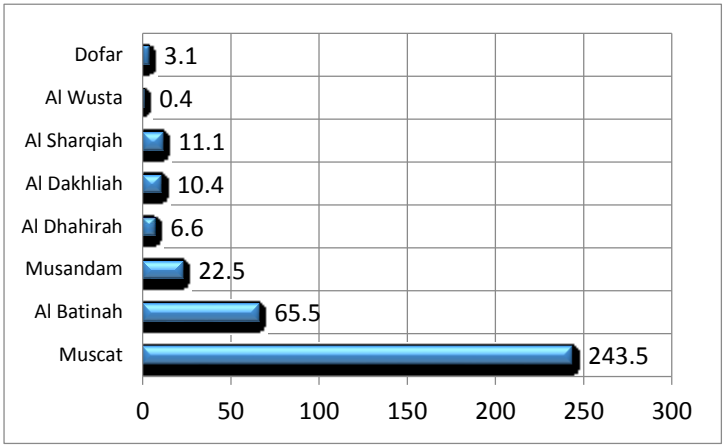


Figure 59: Muscat is the highest population density in Oman by 243 persons/ sq.km².

Source: Own calculation based on MNE, Annual Report, 2009

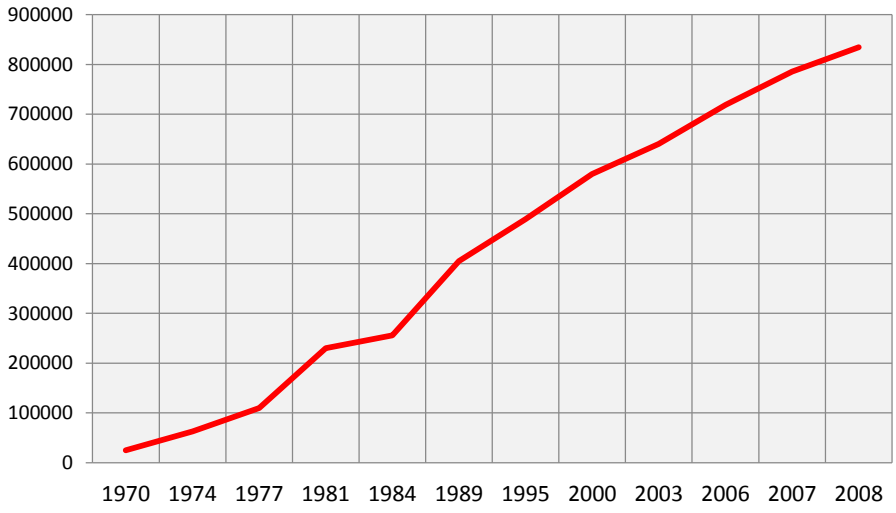


Figure 60: Population growth in Muscat in the era (1970-2008)

Source: Own calculation based on MNE, Annual Report, 2009

Census 2010 indicated that the populations in all Wilayats in Muscat Governorate have grown, except Muttrah, which has slightly dropped by 2.3% (3,402 people). The population decline in Muttrah was due to a lot of families moving to modern areas like Khoad, Um Abailah and Baushar. Census 2010 indicates Seeb Wilayat has the greatest population growth compared to the previous census in 2003. Seeb has grown more than 35% (79,543 people) in merely seven years. Census 2003 found the Seeb's population to be 223,449 people and it grew to 302,992 according to the census in 2010. This rapid growth in population is mainly due to two reasons; firstly, people moving from old areas such as Muttrah to modern areas such as Khoad and Um Abailah (belong to Seeb) and secondly, the great demand for housing units in these suburban areas are still cheaper than other areas such as Baushar. See Figure [63].

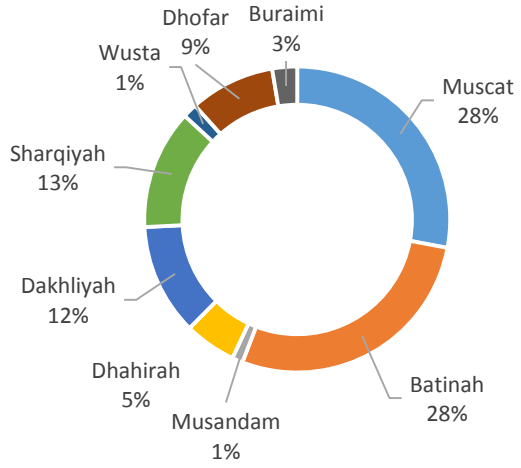


Figure 61: Muscat represents 28% of the total population in Oman.

Source: MNE, Census 2010

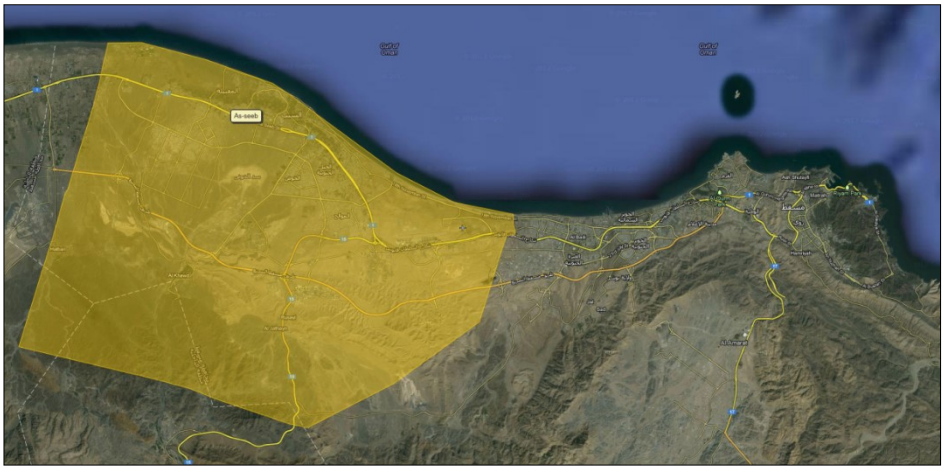


Figure 62: Seeb is the most populated city in Oman

Picture source: www.googleearth.com

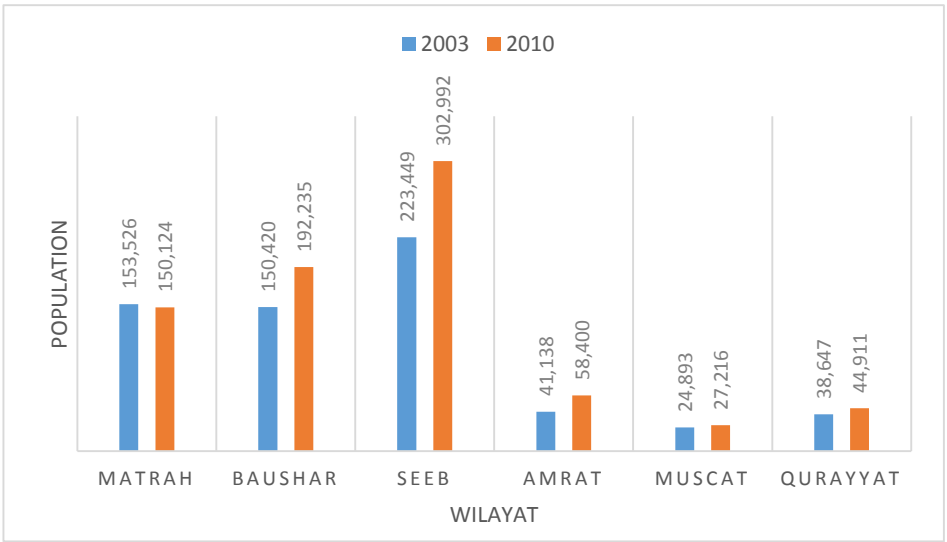


Figure 63: Population in Muscat Governorate by Willayat, 2003 & 2010

Source: MNE

This rapid increase in the population of Muscat has led to a rapid increase of private transport. Consequently, this trend has enlarged the traffic issues such as traffic jams, noise, pollution, etc. According to the survey conducted, 91% of the interviewees have morning jobs which indicate that most employees share the same route to and from their workplaces every day, making the traffic problem worse. Figure [64].

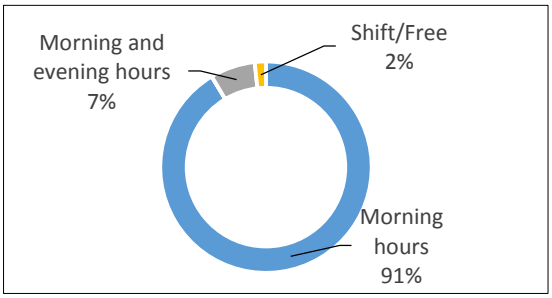


Figure 64: Ratio of job-timing types.

Source: Own calculation based on field survey.

4.2.2.2 Internal migration

Along with the natural increase of population and expatriate immigration, internal immigration is considered one of the most striking factors causing the rapid population growth in Muscat. Since the oil revolution, 40 years ago, Muscat, the capital of the Sultanate of Oman, has been under a massive wave of rural migration due to better employment vacancies, better services and better lifestyles. Consequently, rapid population growth leads to rapidly granted lands and rapidly built housing. Figure [65].

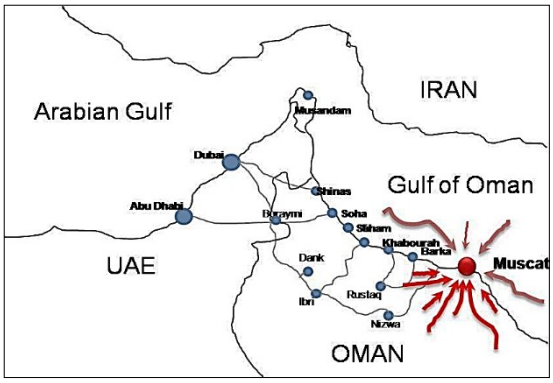


Figure 65: local immigration leads to rapid urban growth. Source: The author

According to the Ministry of National Economy Statistics and surveys in 1993, *Muscat* Governorate received more than half (51%) of the Sultanate's total internal immigrants. The ratio had risen slightly in 2003 to reach to 53%. However, according to our survey conducted in Muscat in 2011, 62% of the interviewees are considered as immigrants from other areas in the Sultanate. Figure [66]. The transformation of the national economy to prosperity has led to an influx of people emigrated from other parts in Oman to Muscat where better jobs and communal services can be found.

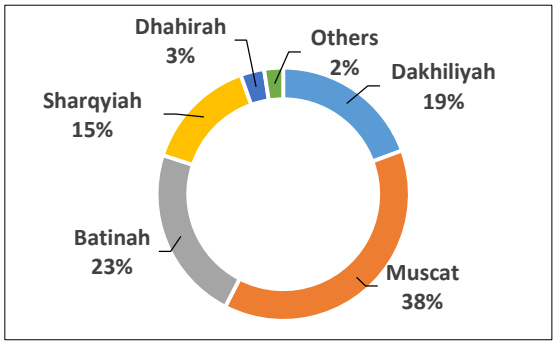


Figure 66: Ratio of interviewees' native places.

Source: Own calculation based on field survey.

Consequently, it is found that more than a quarter of civil service employees work in Muscat, see Figure [67]. This high percentage boosts the consumption of natural resources, mainly land, energy and water. It also largely influences the rental market and tenure. According to the 2003 census, Muscat Governorate received about 60% of the total Omanis who have changed their residence from other regions. The net internal migration in Muscat was 33,700 inhabitants.

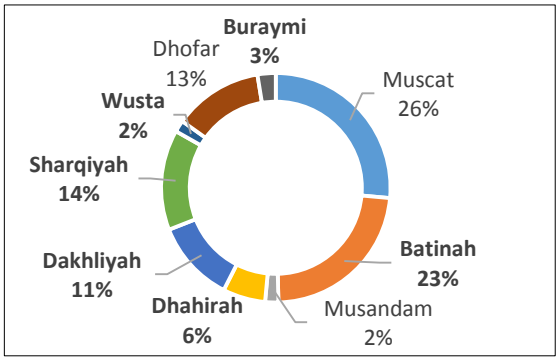


Figure 67: Civil service employees in government organizations by place of work in 2009. Source: MNE

4.2.2.3 International migration

The expatriate population is a prominent factor that boosts the population growth in Muscat. Currently, the expatriate population in Muscat forms nearly half of Muscat's community. See Figure [68]. Census 2010 indicated that Muscat held about 45.2% of the total expatriate population in Oman. According to data in Census 1993, Muscat Governorate received about 51% of the total internal immigrants in the Sultanate. Census 2003 indicated that 44% of the expatriate population was in Muscat Governorate.

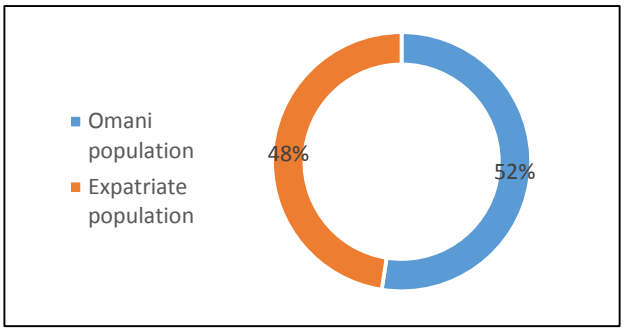


Figure 68: Percentage of Population (Omani - Expatriate) in Muscat, 2010. Source: MNE

The expatriate population in Muscat increased by about 47% in the period between 2003 and 2010. According to the 2010 census, expatriates represented about 45% of the total population in Muscat, see Figure [69]. This rapid transformation of expatriate rate within only seven years has created a high demand in the real estate market. 'The spatial dispersion of these expatriates corresponds to their socio-economic status. Senior and mid-level government employees, commercial managers, and nearly all Western workers occupy the same housing as their Omani counterparts throughout the urban spread from Qurm on the east to Seeb and Khoad on the west. Lower-income workers (apart from domestic servants who typically have quarters attached to their employers' residences) either live in company camps or find shared housing especially in the older areas of the capital.'[1]

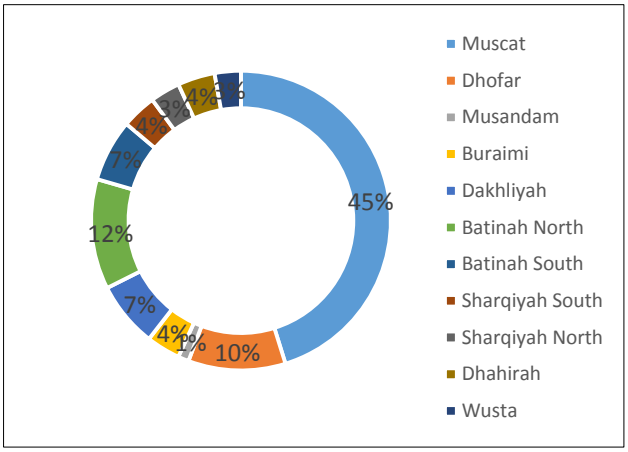


Figure 69: Percentage Distribution of Expatriate Population in Oman by Region, 2010.
Source: MNE, Census 2010

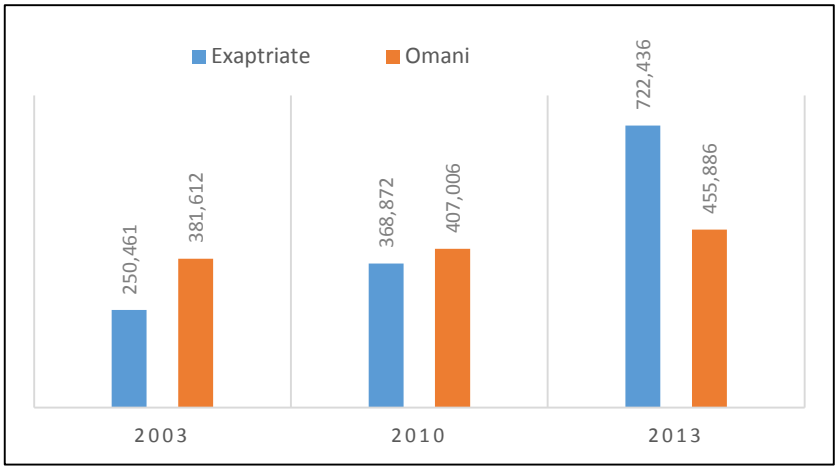


Figure 70: Population (Omani - Expatriate) in Muscat (2003, 2010, 2013)

Source: MNE and NCSI

[1]Peterson, (2007), p.27

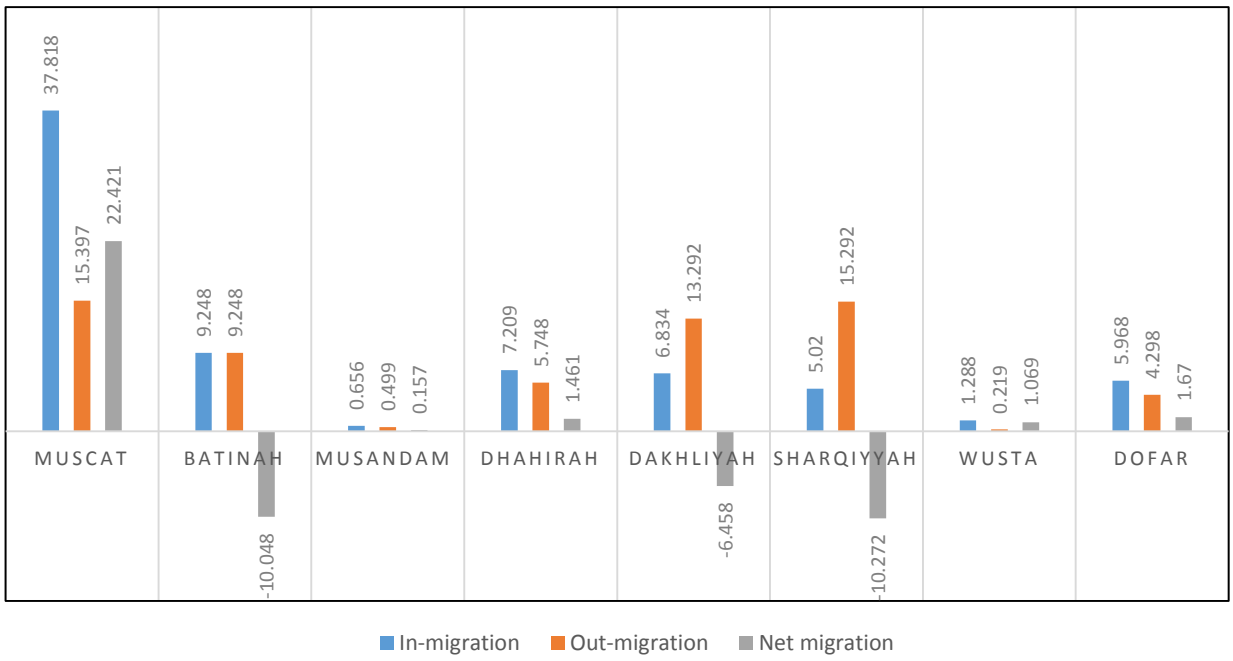


Figure 71: In, Out and Net-migration in Regions in Oman (2003).

Source: MNE, Family's Income and Expenditure, 2008

Generally, this attitude has boosted the demand for lands and tenure market which pushed the price to an unbelievable level, particularly in the 2004-2008period. Obviously, most of the expatriate population are low-educated laborers who are mainly employed in the construction sector. In general, this high proportion in demographic composition creates various socio-economic and environmental issues as was discussed in the former part of this thesis. Ruwi, as it hosts most of the company's headquarters, is considered as the collective place for expatriate laborers. It has been argued that there are negative impacts of this category in relation to behaviors, customs, culture, etc. For instance, the crime rates related to drugs, rape and robbery have been boosted in Muscat. Additionally, the expatriate population growth has directly impacted unemployment records as they create a rivalry ambience on the available careers and thus increase the citizens' unemployment.

4.2.2.4 Nuclear families

As it has been indicated already through this thesis, the household structure is a principle contributor that causes urban sprawl. As in many areas in Oman, the transformation of family structure from extended to nuclear families in Muscat have taken place since the early Seventies. The conducted survey proves this social transformation. About 45% of the interviewees in Muscat are considered single family households. Consequently, this is one reason that results in the burden of natural resources, particularly lands for housing purposes as every nuclear family now has its own housing unit. See Figure [72].

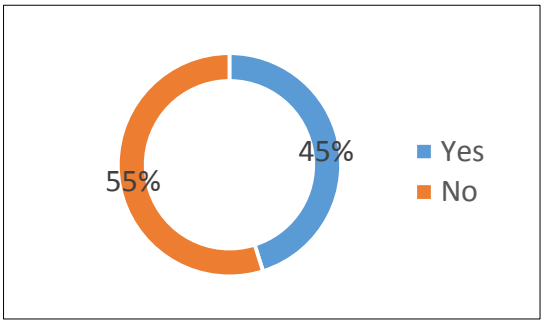


Figure 72: Household Type in Muscat, [Yes] Single family, [No] Sharing accommodation

Source: Own calculation based on a field survey

4.2.3 Governance factors

4.2.3.1 Imbalanced urban management

Since the beginning of the 1970s, urban management in Muscat was characterized by fragmentations in decision-making. Structure plans and master plans are normally carried out by the Ministry of Housing with the cooperation of the Supreme Committee of Town Planning. The Ministry of Housing leads the plot management system which includes land use planning and distribution of lands for citizens.

Muscat Municipality leads the land development system which includes issuing building permits and supervising the building construction process. The land management system is normally issued as laws either by Royal Decree or Ministry's Decision. These laws are decided by Ministry's Committees which are appointed for a certain issue. Sometimes these regulations are revised or breached by another Minister's Decision or Royal Decree.

Obviously, the service's beneficiary who represents the civil society is not involved in the decision-making. Those sole decisions directly impact the lifestyle pattern and neighborhood conditions. According to the survey conducted, about half of the interviewees are not pleased about their neighborhood in regards to level of service availability. In contrast, they don't have the power to change the existing situation other than to just apply and be patient until a decision is issued from the service providers.

Providing services to a certain area takes time-consuming procedures as they are all under the control of governors and decision-makers. The access of services such as electricity and water requires a lot of time and effort by residents. For example, access to a street from a residential area requires approval from Municipal Committees whose members are appointed and recommended by the governor and director of the local municipality. Each year the government represented by the Ministry of Regional Municipalities distributes the amount of streets in kilometers to all regions of the Sultanate. Then each Municipal Committee appointed in each state distributes those streets into specific areas according to applications submitted in advance by the citizens, or alternatively are distributed according to their personal vision. Note that there are no policies or deliberated strategies that determine the need, size and quantity of services that are required to be allocated.

The idea of the Municipal Council was exclusive for Muscat until now. It falls under the administration of Muscat Municipality. Despite its name, the substance of its terms of reference is largely similar to the functions of the municipal committees in other regions. However, since the end of 2011, the government circulated the idea of the Municipal Council to all regions in Oman. In its new form, the Municipal Council as a communal independent authority aims to eliminate the gap between the public and the decision-makers. As it was declared, the Municipal Council, which will include elected members, will be given more power in relation to urban management.

Muscat includes individual authorities that are created exclusively to be more efficient particularly for the execution of the basic infrastructure projects. For instance, Muscat Municipality and Sohar Municipality are the only two Municipalities that come under the control of Diwan Royal Court, the country's highest power authority. Other regional municipalities come under the control of the Ministry of Regional Municipalities and Water Resources. That is why Muscat Municipality has gained more attention from the government. For instance, the budget of Muscat Municipality in 2012 is OMR 42 million for serving merely

six Wilayats (7 million for every Wilayat). In contrast, the budget of the rest of the regional municipalities is merely 63 million for serving 44 Wilayats (nearly 1.4 million for every Wilayat). This signifies that every Wilayat received a municipal subsidy that was equal to only 20% of what every wilayat in Muscat received; whereas the municipal subsidy for Wilayat Sohar is more than 8 million.

Muscat Municipal Council was the first municipal council in Oman and was established in '1939'[1]. Unlike current municipal councils which are under the control of the Ministry of Interior, Muscat Municipal Council was under the control of Muscat Municipality. 'The Municipal Council represents the legislation apparatus that regulates Muscat Municipality works, in particular the decisions, recommendations and local ordinances all aim to regulate and develop the municipality works and facilitate all difficulties and obstacles that face the Executive apparatus in carrying out its function effectively and efficiently.'[2] Box [8] indicates the five main duties of Muscat Municipal Council.

Muscat also has an individual company in charge of treating grey water which is *Haya Water*. The company is a governmental authority which was launched late in 2002. It aims to 'build and operate a world class water reuse system for the Muscat Governorate by converting wastewater into environmental friendly products' and to serve 'at least 80% of the residential properties by the year 2018.'[3] However, drainage systems in other regions are the responsibility of Ministry of the Regional Municipalities and Water. Schemes, programs and financial subsidies vary from region to region, mostly dependent on the population density and the demands from local inhabitants.

Box 8: The main duties for Muscat Municipal Council

- Review the regulations & the municipal laws for modernization (if necessary) to comply with the development orientation during the current stage to lead to best performance of the executive apparatus in the municipality and to simplify the procedures for rendering the required services to the public. .
- Re-ballottement of the municipal jobs priorities in such a way that all efforts concentrated during the coming period for developing the sectors that not given adequate attention to equalized the municipal services provided to different localities.
- Putting more care about the municipality resources & consolidate the municipality abilities to execute its projects regarding spreading of the municipal services.
- Paying more care for the health & environmental awareness and maintaining good level of hygiene services and developing the cleaning works including treatment of the leftovers which is considered as vital service that should be done.
- Concentrating & consolidating the efforts towards the awareness of conserving the public utilities in general and in particular the utilities belong to the municipality to avoid any act that damage the municipal utilities whether by playing or breaking or damaging/ destroying as nowadays maintenance or rehabilitation of utilities works absorbed a big portion from the limited municipality provisions.

Source: Muscat Municipality Website: http://www.mm.gov.om/tabid/608/Default.aspxR etrieved on 9/11/2012

[1] Source: http://www.mm.gov.om/tabid/316/Default.aspx accessed 9/11/2012
[2] Ibid
[3] http://www.haya.com.om/tabid/193/Default.aspx accessed in 21/10/2012

4.2.3.2 Segregated plot and land use policies

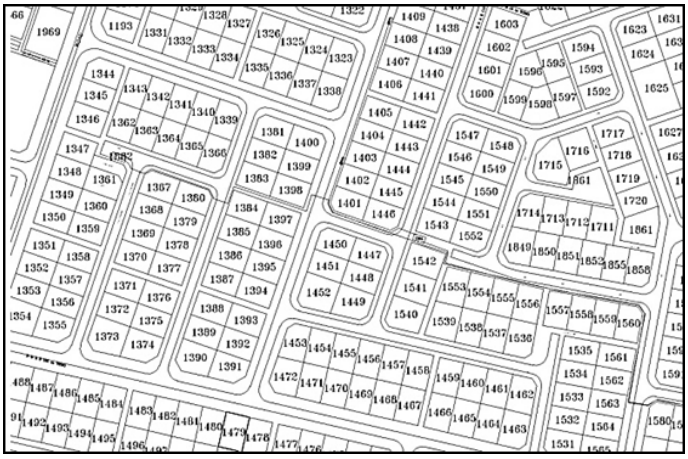


Figure 73: Typical land use planning and land subdivision.

Source: MoH

Land-use policies determine the travel-time pattern, degree of segregation among land uses and therefore the energy required to travel between those land uses. Consequently, the land-use plan is considered as a mechanism that influences the management of natural resources. According to OECD (2010), 'many metropolitan regions have used land-use planning to create "sustainable neighborhoods" or "eco-neighborhoods" that combine transportation, natural resource preservation, building, energy, waste and water policies to respond to climate change and reduce the urban environmental footprint.'[1] However, land-use policies in Muscat and other regions in Oman have been implemented under the huge demand of residential lands. Since the huge change in the economy in the past four decades, multi urban centers have emerged to fulfil the increase in the demand of land and tenure. Every residential district which is seen in Muscat and other parts of Oman is planned and outlined individually without taking into consideration the correlation with other parts in the city. The major target here is to fulfil the increasing demand for land by citizens. In addition to the random plot subdivision, the lack of the impact of land-use policies have contributed to the emergence of patchy and fragmented urban growth which is common in urban and suburban areas in Oman.

According to the survey conducted, nearly 42% of interviewees live in Al Khoad and Al Seeb. Figure [74]. This condition that promotes single land use meets the characteristics of sprawled city in which the living, working and recreation areas are placed apart. For instance, single land uses have emerged in various parts in Muscat, Ruwi as it hosts banks and company headquarters is specified as central Business District (CBD). Al Khuwair hosts the Ministries Headquarters, which houses most of the public sector's employees. Al Seeb is considered the place where most of Muscat's population lives. According to the recent census, Al Seeb leads as the most populated city in Oman with 302,992 inhabitants.[2] The single land-use pattern has resulted in the emergence of areas with fragmentation, de-territorialization and scattering. Hence, people tend to travel more than in mixed land-use areas.

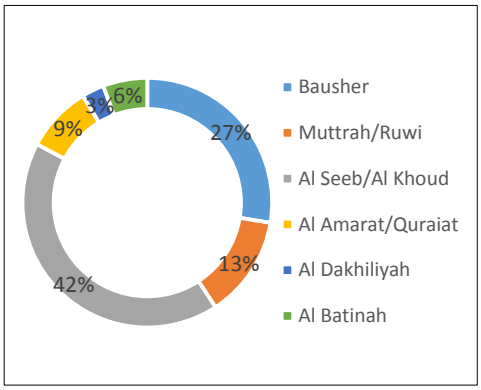


Figure 74: Nearly 42% of interviewees live in Khoad/Seeb areas.

Source: Own calculation based on a field survey

[1]OECD (2010), p.112

[2]MNE, Final Result Report, Census 2010

Figure 75: Single land use urban pattern in Muscat.

Source: The author

As indicated earlier through this thesis, the size of the plot is considered a considerable factor that is to blame for urban sprawl. According to the conducted survey, half of the interviewees occupy plots with areas exceeding 600 square meters, see Figure [76]. Obviously, there is no correlation between the plot size and household size. For instance, a 600 square meters plot-size can be given to a family with 20 members and a 900 square meters plot-size can be given to a family with merely two members or even for a person who is living alone.

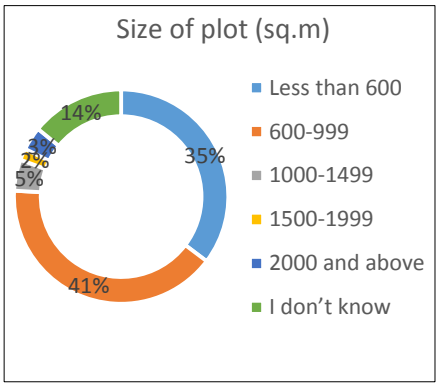


Figure 76: Residential Plot size in Muscat

Source: Own calculation based on a field survey

This is because there is no rule that determines how much area is to be given according to the household size. As a consequence of this poor urban management system, bulky areas are consumed and wasted although there is a scarcity of land suitable for development in Muscat.

As it has been indicated already through this thesis, a single-detached housing unit is one of the main promoters of urban sprawl. However, in Muscat, it is found that people are oriented towards detached single family houses as their preferred built structures for living. According to the survey conducted, about 65% of interviewees live in single detached family houses. Amongst this percentage, villas dominate about 37% of interviewees' housing units, see Figure [77].

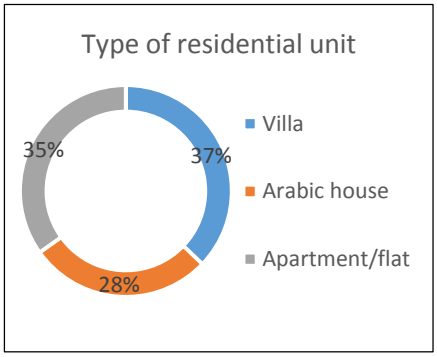


Figure 77: Type of residential units in Muscat

Source: Own calculation based on a field survey

The current building standards for villas not only promoted the consumption of large areas but also the need for lots of energy to cool the inner spaces. The policies that are used to provide services to the planned areas are not clear. Sometimes the development comes before the approach of services. For instance, in some areas, roads arrive earlier than houses, while in other areas houses are developed earlier than roads. See Picture [32].

Picture 32: In some areas, roads take the antecedent in urban development in other areas they become late

Source: www.googleearth.com

4.2.3.3 Inefficiency of public transport policies

A viable public transport system plays a significant role in forming the mobility patterns in cities. In Oman, a notable absence of public transport contributes to the increase of private-automobiles dependency. Our city's design is primarily based for the automobile while the sustainable city is designed for pedestrian and cycling. According to the survey conducted in Muscat, about 42% of the interviewees think that inefficient public transport is a major factor that contributes to the use of private automobiles. The second factor, in their opinion, is that the services and their houses are extremely far away from each other, which forces them to use their own cars to arrive to their destinations. See Figure [78]. About half of the interviewees evaluated the existing public transport as inefficient while 23% of them think that public transport is satisfactory. See Figure [79].

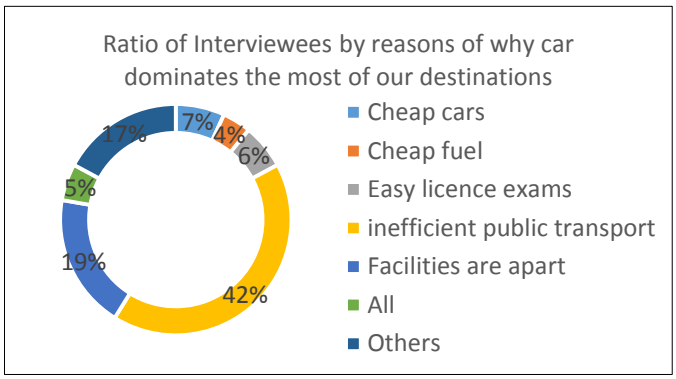


Figure 78: Reason of why cars dominate our destinations.

Source: Own calculation based on a field survey

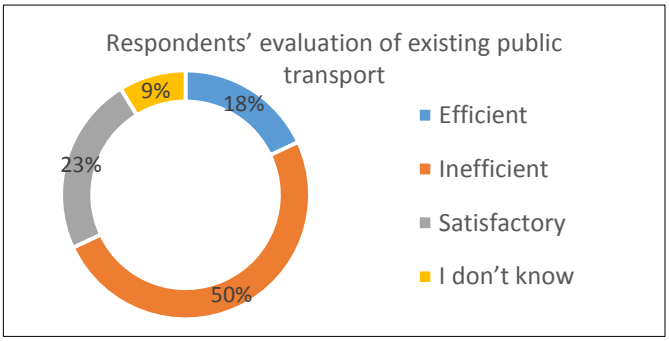


Figure 79: Public transport condition according to the interviewees' evaluations

Source: Own calculation based on a field survey

There are lots of manifestos that have shown the influence of the sidewalks in attracting pedestrians and encouraging people to walk. For instance, Bhatta (2010) stated that 'Walking offers important public health benefits, but safe and attractive sidewalks and footpaths are needed to attract walkers and assure their safety that is often suffered by sprawled development.'[1] The significance of sidewalks extends further than that they are merely tracks that hold pedestrians. Ascher (2005) argued that 'sidewalks are a more important means of transportation than the streets themselves.'[2] 'Pedestrian comfort is measured by how many people are on the sidewalk or waiting to cross at the corner.'[3] Schriener & Kephart (2010) argued that: 'Walkable streets provide pleasant sidewalks uninterrupted by driveways to front-loaded garages.'[4]

However, in Muscat, according to the survey conducted, it is found that half of the interviewees live in neighborhoods which do not include sidewalks for pedestrians and cyclists. In consequence, those neighborhoods are only car-accessible. Despite the availability of sidewalks in the neighborhoods of the other half of the interviewees, 46% of them clarified that those sidewalks are poor in traffic safety. Figure [80]. The dearth of pedestrian sidewalks decreases the social interactions as well as diminishes the physical movements which boost the rate of obesity and diabetes. Consequently, pleasant pedestrian pathways could be utilized as a tool to encourage local inhabitants to walk and cycle and lessen their reliance on private cars.

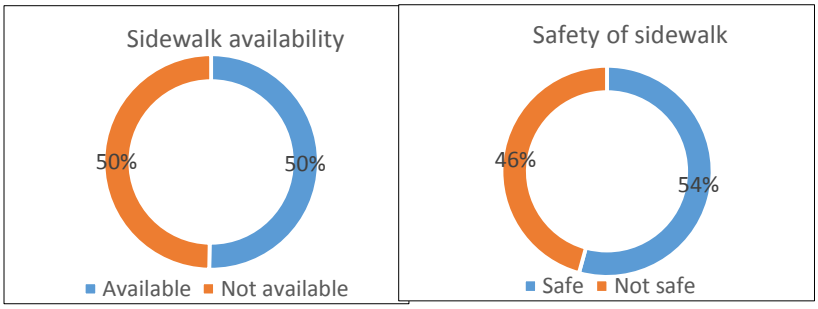


Figure 80: Characteristic of sidewalks in Muscat's residential areas.

Source: Own calculation based on a field survey

Picture 33: Lack of sidewalks encourage car dependency and threaten the pedestrians

Source: The author

[1]Bhatta (2010), p.35
[2]Ascher, K. (2005), p.18
[3]Ibid, p.19
[4]Schriener, J. & Kephart, M. (2010), p.46

4.2.3.4 Failure in executing structural plan policies

Structural plans are long-term policies utilized to shape and orient urban growth and development processes, as well as to assist local authorities and decision-makers in the deliberately execution of current and future projects. Structure plans normally analyze all socio-economic and environmental considerations available in a desired area. It might include the future requirement of housing, public utilities, etc. Structure plans normally set out land use plans and policies that are important to functionally assist developers to alleviate most issues associated with urban growth.

However, the stoppage of executing structural plans might create random urban development and inefficient allocation of public services. Bhatta (2010) argued that 'unsuccessful enforcement of land-use plans is one of the reasons of sprawl in developing countries, since the enforcement is often corrupt and intermittent in these countries'[1] For example, Muscat Structural Plan, Muscat Regional Plan and Muscat Housing studies, which were prepared by Muamir and Weidleplan consultants during period from 1985 to1991 appointed by the Ministry of Housing, have not been executed. Though these plans cost the government plenty of money, they have been shelved for ages.

Muscat Structure Plan 1982

In order to investigate the urban growth pattern in Muscat, Ministry of Land Affairs and Municipalities[2] appointed Llewelyn-Davies Weeks to prepare the Capital Area Structure Plan in 1982.[3] Box [9] highlights the main objectives of the Capital Area Structure plan 1982. Although the Capital Area Structure Plan in 1982 has not been totally implemented it served as good guidelines for certain developments.

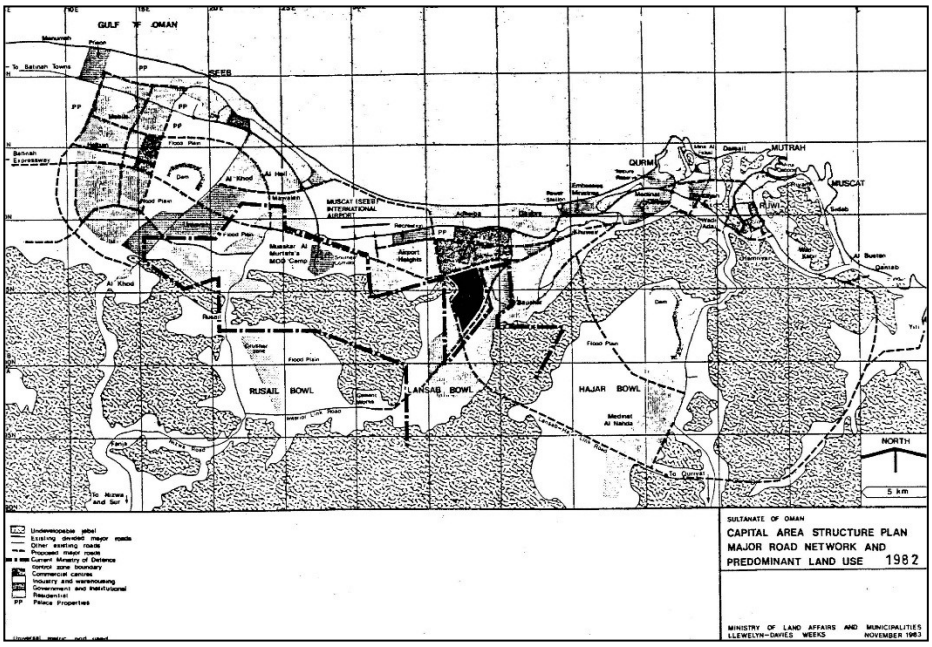


Figure 81: Muscat's Structure Plan 1982

Source: Weidleplan-Muamir, Muscat Area Housing Study

[1]Bhatta (2010), p.26

[2] Ministry of Land Affairs and Municipalities has subdivided into two ministries, Ministry of Housing for Land and housing affairs and Ministry of Regional Municipalities and Water Resources for Municipalities and Water resources affairs.

[3] The name "Capital Area" has changed later to the current name "Muscat Governorate"

Some of the proposals which were indicted in the Capital Area Structure Plan in 1982 are as follows:

- Layout the industrial estates in Rusayl, Mawaleh and Ma'abela.
- Suggested the Sultan Qaboos University campus in Seeb area to be within the junction of most regions of the Sultanate.
- Proposed to develop light industries in the area under airport restrictions to ensure optimum utilization of land.
- Proposed to develop some of the areas under MOD restrictions which have good potential e.g. in Bait Al Falaj, Al Ansab.
- Relocating workshops, warehouse in South Ruwi to another suitable site.
- Allocating the Ministry District in Al Khuwair.
- Prepared a proposal for a large-scale residential and commercial development in Seeb area.
- Improving the existing road network, construction of new links to improve accessibility of some areas to relieve some of the links of access traffic.
- Concept of a compact urban development with an optimum utilization of available land.[1]

Box 9: The main objectives of the Capital Area Structure plan 1982.

- To establish size, distance and functional relationship among old and current development areas.
- To establish an overall regional road network.
- To examine all available land for its development potentials
- To suggest an integrated development policy and implementation programme.

Source: Weidleplan- Muamir (1989), *Muscat Area Structure Plan Phase 1– Survey Report, Vol. 1-Report, p.12*

Unfortunately, most of this structure plan's proposals have not been applied. Meanwhile, on January 11, 1989, Ministry of Housing appointed Weidleplan-Muamir as consultants for preparation of three studies covering all Muscat's areas. These studies were:

- Muscat Regional Plan
- Muscat Structure Plan
- Muscat Housing Study

Muscat Regional Plan

The Muscat Regional Plan (MRP) intended to develop the Muscat Governorate up to the year 2010. Box [10] shows the objectives of Muscat Regional Plan as they were indicated in the Final Report. The final report included a selection of development concepts as follows:

- Development of a distinct centrality pattern in order to optimize the supply of goods and services to the population and to provide suitable conditions for economic conditions.
- Provision of sufficient and unproblematic urban expansion possibilities for the time beyond 2010.
- Reduction of inter-regional disparities by directing the physical and socio-economic development towards the neighboring regions (Batinah and Dakhliyyah).
- Reinforcement of economic sectors with high growth potentials.
- Maintenance and rehabilitation of the ecological balance in order to secure the validity of specific economic sectors and to provide a healthy environment.

[1]Weidleplan-Muamir (April 1989), p.14

The regional plan framework was set out into three different alternatives to develop Muscat Regions:

- Poly-Central Development
- Mono-Central Development
- Densified Ribbon Development

Regarding the above concepts, MRP intended to develop urban centers and urban sub-centers each being equipped with sufficient services and facilities for their respective levels. It intended to keep Matrah and Ruwi as the primary center. More central functions and business of national and international significance would be concentrated here. It intended to serve the municipalities of Greater Muttrah, Bausher and Al Amarat. Seeb would be developed as the secondary center and it would serve areas outside the Muscat Region too.

The Regional Development Plan suggested three alternative concepts. 'The development concepts comprise different spatial development possibilities for specific socio-economic development options of the Muscat Region'[1]

Box 10: The main objectives of MRP

- Mobilization of human resources
- Diversification and intensification of regional economy.
- Reduction of intra- and inter-regional disparities.
- Organization of the land use structure.
- Maintenance and rehabilitation of the environment

Source: Weidleplan-Muamir (December 1989), *Muscat Regional Plan Phase 2 – Strategy Report, p.i*

The first alternative concept 'foresees the independent socio-economic development of urban and semi-urban areas adjacent to the primary or capital centre on the appropriate hierarchal level. These development centres include: Seeb, Fanja and Quriyat. The three secondary centres are self-sufficient in terms of central supply with social and physical infrastructure and oriented towards the primary centre for high central demand.'[2]

The second alternative proposed to 'strengthen of the central service position of Muscat by extending the directly related hinterland and by increasing the socioeconomic dependency of the existing hinterland from the central Muscat Area.'[3]

The third alternative 'focuses on the saturation and densification of the northern coastal areas. By this, a highly condensed and continuous urban ribbon development is achieved which will stretch from Muttrah in the east to the Batinah Region.'[4]

[1]Weidleplan- Muamir (December 1989), p.45

[2]Ibid,p.48

[3]Ibid,p.62

[4]Weidleplan- Muamir (December 1989), p.69

The three alternatives are as follows:

- *Satellite-City-Development:* to the south of present urban areas of Muscat, Baushar, and Seeb to accommodate the anticipated population growth of 400,000 people. The sub-centers will remain highly dependent on the dominant centre of Muttrah which will continue to attract multiple investments.

- *Poly-Central Urban Consolidation*: rounding off and consolidation of existing major urban center, i.e. Muttrah, and simultaneously, the strengthening of secondary urban centers as well as infilling and expansion of existing urban areas. In consequence, development efforts and capital investments will be more decentralized, yet concentrated enough to lead self-sustaining economic growth.

- *Densified Ribbon Development:* this alternative focuses on the saturation and densification of the northern coastal areas, whereby a highly condensed and continuous ribbon of urban development is achieved, stretching from Muttrah in the east to the Batinah Region in the west.[1] Figures [82-84] illustrate those three alternative strategies.

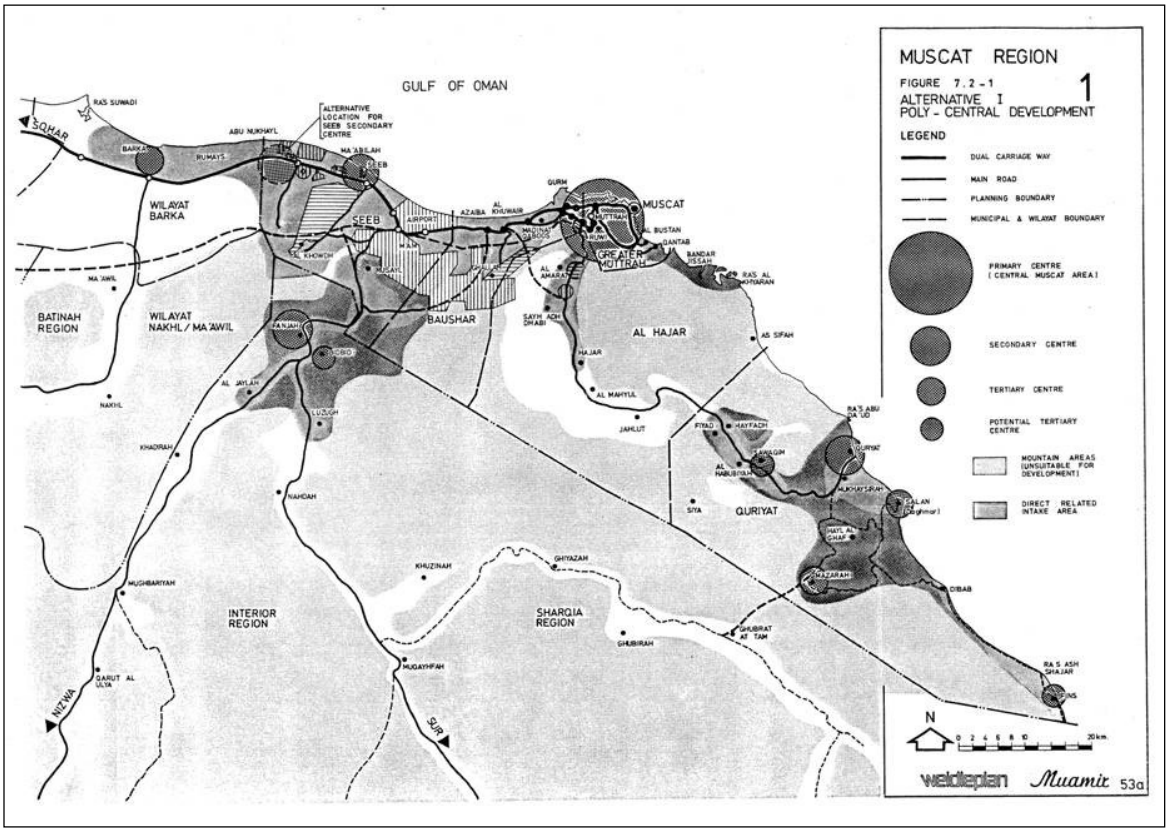


Figure 82: Muscat Regional Study, Alternative (1): Ploy-Central Development

Source: Weidleplan- Muamir (April 1990), *Muscat Area Structure Plan Phase 2 – Strategy*

[1]Weidleplan- Muamir (April 1990), p.93

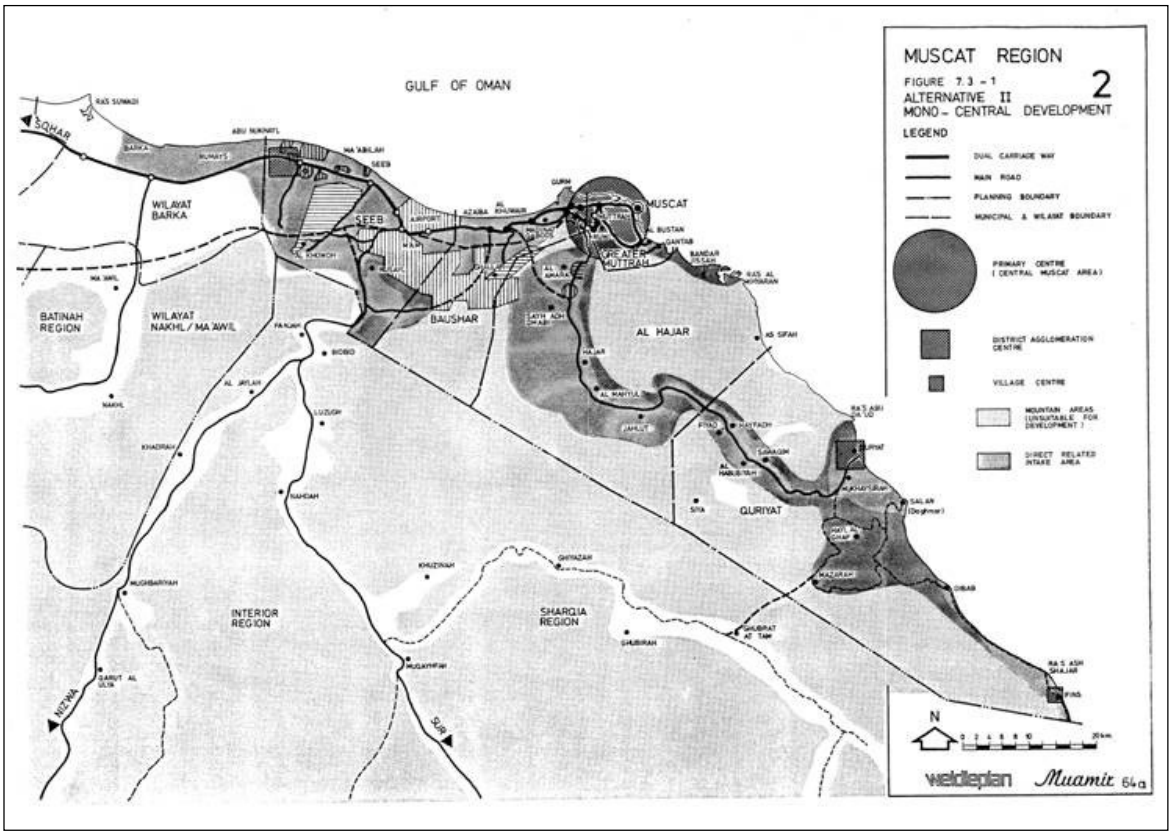


Figure 83: Muscat Regional Study, Alternative (2): Mono-Central Development

Source: Weidleplan- Muamir (April 1990), *Muscat Area Structure Plan Phase 2 – Strategy*

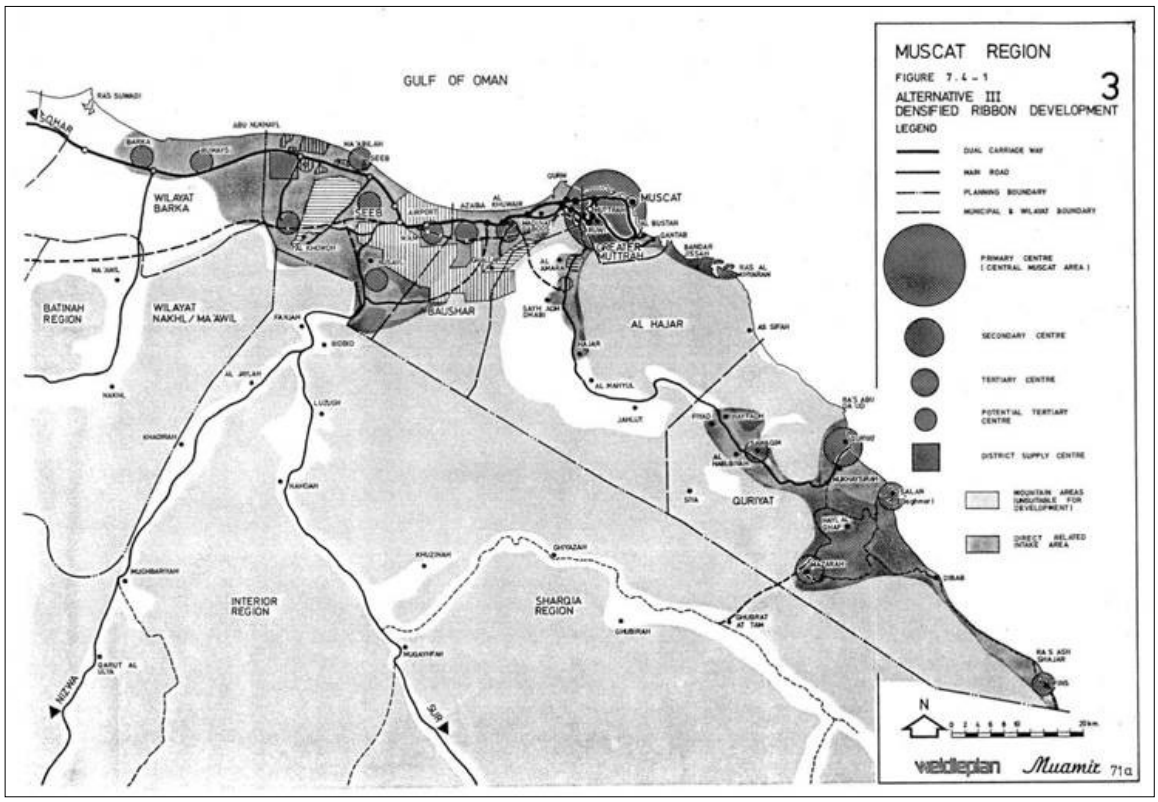


Figure 84: Muscat Regional Study, Alternative (3): Densified Ribbon Development

Source: Weidleplan- Muamir (April 1990), *Muscat Area Structure Plan Phase 2 – Strategy*

Muscat Structure Plan1990-1992

The final report of Muscat Structure Plan included three phases. **Phase one:** Survey Report which includes the existing context and the issues that needed to be addressed. **Phase two:** Strategy Report which proposed three alternative strategies for developing Muscat as a guidance for future urban growth. **Phase three:** Draft Final Report which includes the preferred development strategy that is translated into sectoral requirements, development policies and physical land use plans.

It seems that Muscat Structure Plan1990-1992 intended to guide urban development in a comprehensive way. The main purposes of the project are shown in the consultant's report handed over in April 1990; they were as follows:

- Serving as a long-term strategic development guide for the planning area.
- Serving as a physical plan to define major land-use areas, roads and utility corridors, town, districts and local centers and other public facilities.[1]

The Structure Plan was designed as a basis for coordination and decision-making which related directly to physical development. Hence, the plan attempted to identify the existing development, its problems, constrains and potentials. It also attempted at indicating areas for future growth and defining limits of development where necessary. 'The scope of work dealt with the following issues:

- Re-evaluation of objectives and analysis of major planning determinations.
- Proposal of three alternative strategies for long term plans with 5-20 year development program.
- Evaluation of strategies and recommendation of a preferred strategy.'[2]

The final report of the Structure Plan indicated the major problem associated with the existing urban development in that time. For instance:

- *land-use conflicts* which lead to disturbances to residential areas and related activities,
- *mis-location of land-use* which leads to uneconomical use of land;
- *isolated developments* which lead to high cost of infrastructure;
- *non-utilization of land* which leads to availability for future development;
- *under-utilization* of land which leads to potential for infill development;
- *unorganized development* which leads to lack of coherent/compact development; and
- *upgrading areas* which makes urban renewal programs necessary.

The Structure Plan also assumed to three key factors for managing the urban development. These are as follows:

- To promote people's participation in the planning and development process.
- To involve both public and private institutions to achieve the tasks more efficiently.
- To establish inter-sectoral coordination and avoid inconsistent, divergent and redundant activities.[3]

[1]Weidleplan- Muamir (April 1990), Muscat Area Structure Plan Phase 2 – Strategy Report, p.1
[2]Ibid, p.2
[3]Source: Weidleplan- Muamir (April 1991), Muscat Area Structure Plan Phase 3 – Draft Final Report ,Vol. 1 Report, p.VI

The Structure Plan Report expected the quantity of plots needed for future according to assessment of land availability for future development in each Wilayat. The urban development strategy was based on an estimation of population growth up to 2010 as indicated in Table [19].

The most important piece was that the proposals of structure plan and regional plan were timely scheduled, compiled and sorted up to 2010 to ensure the comprehensive implementation. The implementation phases were based on 'prioritization' as follows:

- To improve supply wherever deficits have been identified.
- To avoid the dispersal of public investments.
- To generate homogeneous spatial units emphasizing an improvement of favorable conditions for economic development.
- To encourage a smooth transformation from existing mono-central structure to anticipated twin-center development.[1]

The first three points were indicated the significance of orienting the development of spatial and economic.

Municipality	Existing population 1990	Additional population potential	Forecast share (%) realization	Additional population in 2010	Total population in 2010
Muttrah	160,705	34,260	45.0	15,417	176,122
Baushar	108,110	129,305	70.0	90,514	198,624
Seeb	113,119	349,045	55.0	119,975	305,094
Al Hajar	35,480	15,000	100.0	15,000	50,480
Total	417,414	527,610	59.3	312,906	730,320

Table 19: Projected population distribution in Muscat in the year 2010

Source: Weidleplan-Muamir (April 1990), *Muscat Area Structure Plan Phase 2 – Strategy Report, p.3*

As it was shown in the Structure Plan Final Report, submitted in 1990, Muscat's population estimation in 2010 was very close to what is reported in Census 2010. The 2010 census found Muscat's population to be 775,878 while the structure plan estimated the population 2010 at 730,320 people. Seeb's population in the Structure Plan Final Report was estimated as 305,094 people while the 2010 census reported it at 302,992 people. This is an indication of how the Structure Plan is crucial to trace the urban growth.

The report has pursued three variables in estimating the demand for plots and the respective residential areas. They are: 'dwelling mix of future demand, number of units per plot and plot size for different house-types.'[2] These variables tried to achieve a sort of land management that ensures better utilization of residential areas.

[1]Ibid, p.37

[2]Weidleplan- Muamir (April 1990), Muscat Area Structure Plan Phase 2 – Strategy Report, p.37

The Muscat Structure Plan proposed three alternative strategies for future urban growth and development. The main target for these alternative strategies is 'to accommodate the substantial increase in population expected in the year 2010.'[1]

The report has shown three main variable elements that 'differ quite visibly in the major concentration and direction of future urban development. These variable elements are:

- Location, size, and quality (suitability) of land earmarked for future development. i.e. total area of urban expansion;
- Proposed residential densities, both in existing urban areas (redevelopment/ improvement) and in new areas.
- Achievement rate, i.e. the degree to which allocated and developed land is actually built-up and occupied.'[2]

The report also indicated that these three strategies will also differ in respect of the degree to which existing and accepted forms of land control, land distribution, and land use are replaced by new procedures and regulations. The physical consequences of such changes are far-reaching and will allow a genuine choice of strategies for urban growth and expansion on the municipal level'[3], Figure [85] indicates the three ranges of alternatives.

The Muscat Structure Plan's Final Report also included some proposals that cope with future growth of population and the increased demand on land in Muscat. The guidelines for the future development have been laid down previously in the Muscat Regional Plan. The rationale of the selected development concept is its ploy: central supply structure combined with an extroverted orientation towards the neighboring regions.

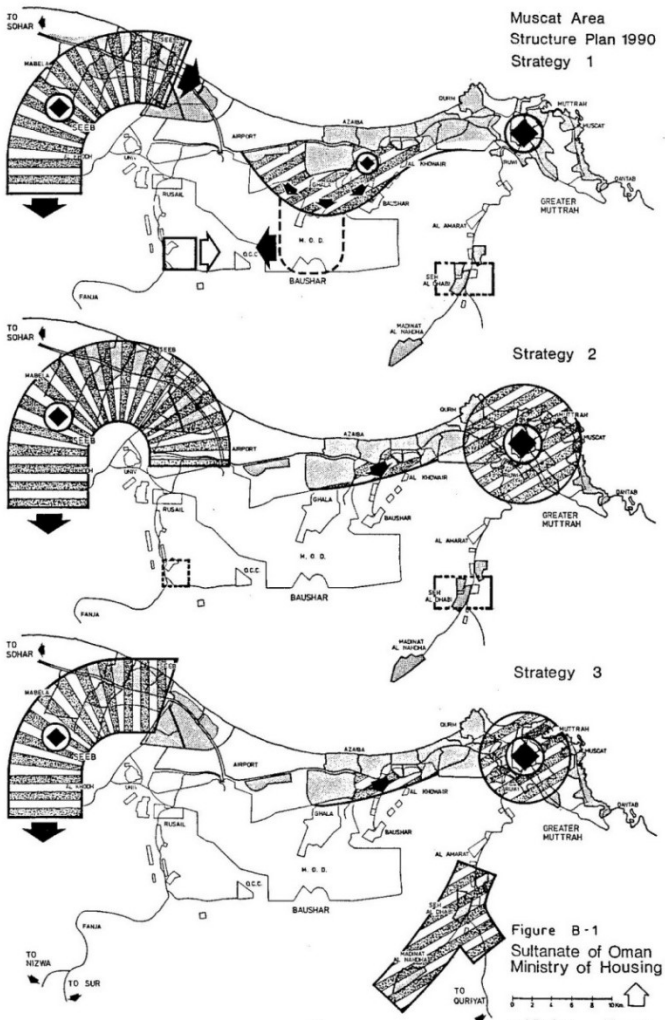


Figure 85: Three alternative strategies proposed by MSP for future urban development.

Source: Weidleplan- Muamir (April 1990), Muscat Area Structure Plan Phase 2 – Strategy Report, p.94

[1]Ibid, p.93
[2]Ibid, p.95
[3]Ibid

As it mentioned in the report, the objectives of the selected development concept can be summarized as follows:

- Development of a distinct centrality pattern in order to optimize the supply of goods and services to the population and to provide suitable conditions for economic conditions.
- Provision of sufficient and unproblematic urban expansion possibilities for the time beyond 2010.
- Reduction of inter-regional disparities by directing the physical and socio-economic development towards the neighboring regions (Batinah and Interior).
- Reinforcement of economic sectors with high growth potentials.
- Maintenance and rehabilitation of the ecological balance in order to secure the viability of specific economic sectors and to provide a healthy environment.[1]

The Structure Plan proposed 'to develop urban centres and sub-centres in order to serve the resident population. Each will be equipped with sufficient services and facilities for their respective levels'[2] Figure [86].

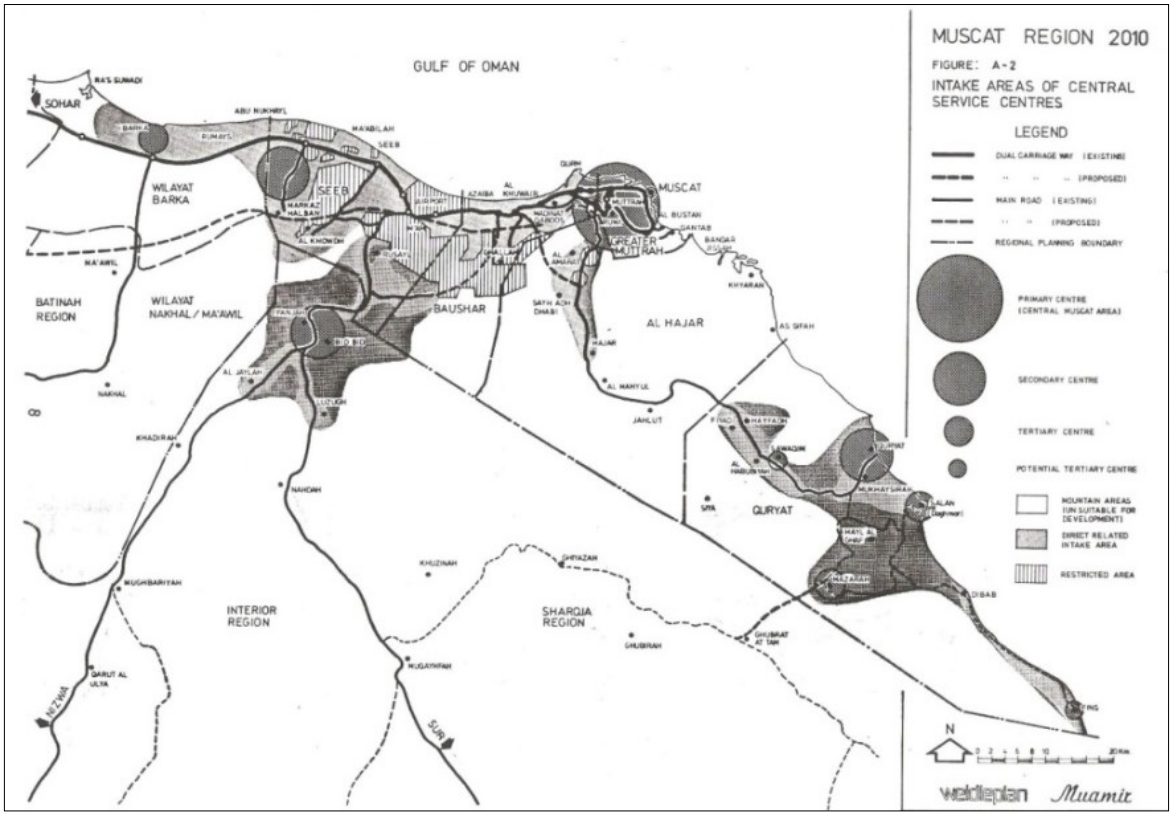


Figure 86: Intake areas for central services centers.

Source: Weidleplan- Muamir (April 1991), p.8

[1]Source: Weidleplan- Muamir (April 1990), Muscat Area Structure Plan Phase 3 – Draft Final Report ,Volume 1 Report, p.6

[2]Ibid

This concept might disparate urban population from existing development but in contrast it tries to provide polycentric mixed-use urban development to cope with the increasing demand of land and residential units. The proposal tried to achieve the hierarchal urban development when it set up Muttrah (the oldest part in Muscat) to remain as the 'Primary Centre' with more functional and significant place while Seeb will be developed as the 'Secondary Centre'. Figure [87].

The structure Plan Final Draft Report suggested that 'each municipality was subdivided into several "Urban Areas" with potential future catchment population of approximately 50,000 residents per Area to facilitate the assessment of future requirements for various facilities. The Urban Areas were in turn subdivided into smaller Urban Districts with a projected population of about 15,000 residents by the year 2010.'[1] Figure [88].

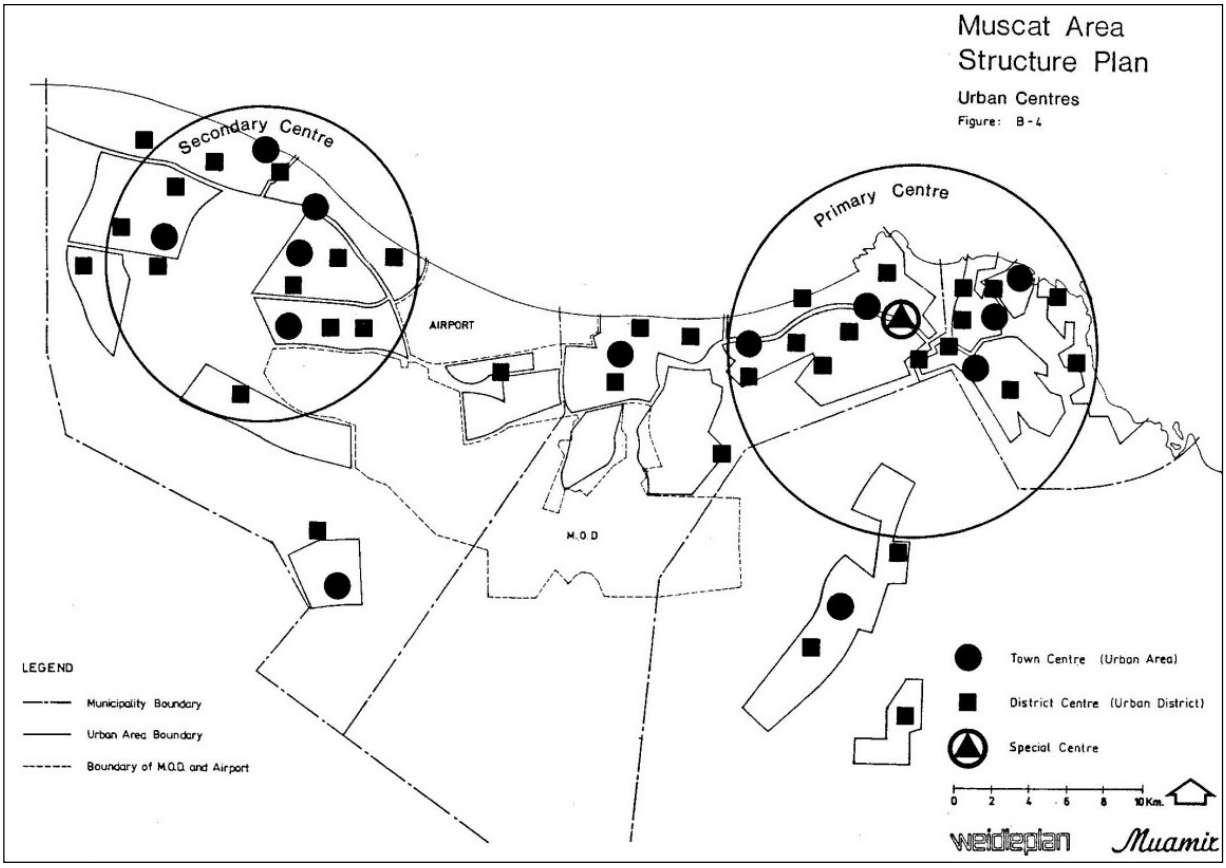


Figure 87: Suggested urban Centres

Source: Weidleplan- Muamir (April 1991), Muscat Area Structure Plan Phase 3, p.53

[1] Ibid, p.6

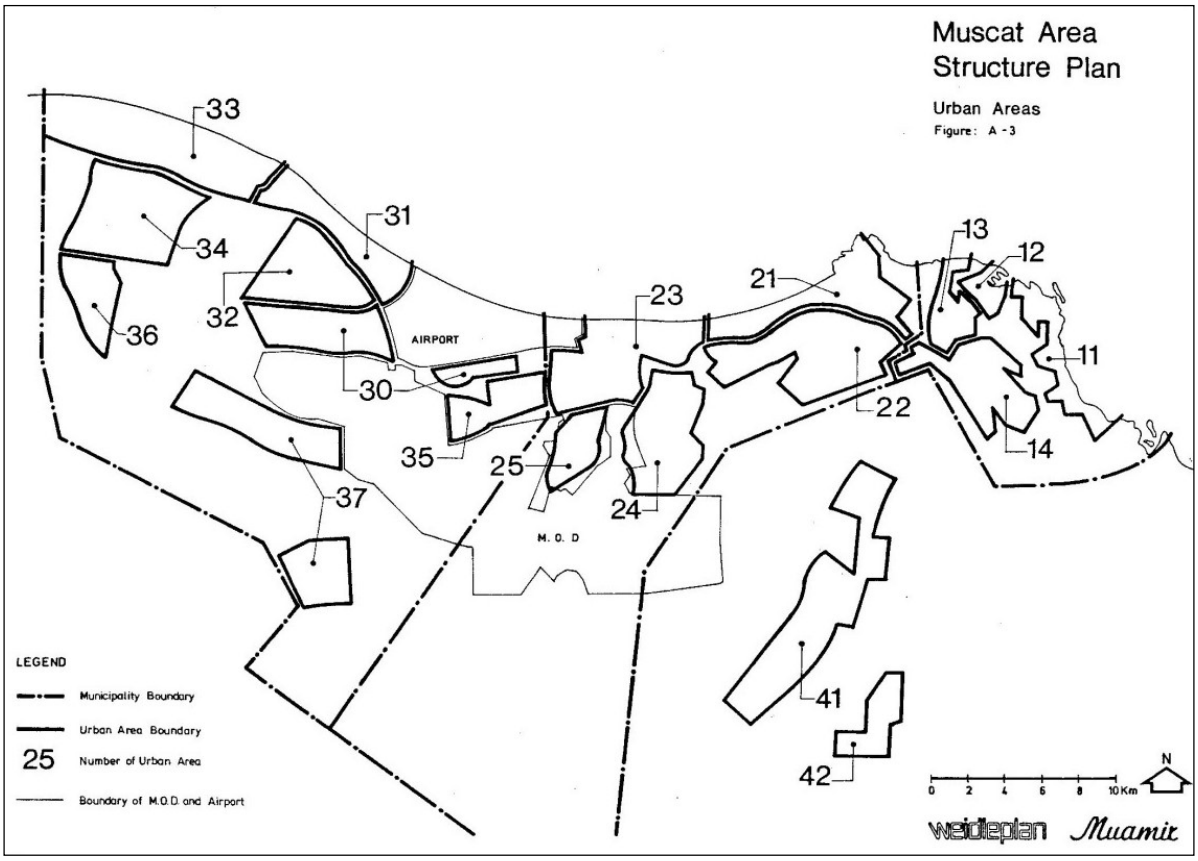


Figure 88: Urban Areas that were set out by the Muscat Structure Plan

Source: Weidleplan- Muamir (April 1991), *Muscat Area Structure Plan Phase 3 – Draft Final Report, Vol.*

The emergence of a secondary urban center in Seeb has notably reduced the significance of Muttrah. Muttrah has no longer considered a primary center as most of its inhabitants desire to move to other areas. In contrast, Seeb has been receiving the influx of people who change their living places because the size of lands are much larger and the price of purchase and lease is much more affordable for middle- and low-classes. According to the Weidleplan-Muamir (1990), 'due to the over-dimensional growth which took place at Seeb, it is desirable to shift regional central functions there in order to relieve Muttrah and to increase the efficiency of the necessary public investment at Seeb... it seems unrealistic that only "one supply centre" for central services will be sufficient in the future, thus, Muttrah and Seeb will have to share this responsibility.'[1]

According to the report 'the development of the Secondary Centre in Seeb is to be encouraged and supported by the proposed pattern of urban growth. Existing infrastructure should be efficiently utilized to allow more people to benefit from facilities.'[2] The report also was aware of the scarcity of appropriate land in the future when it stated that 'it is important to maintain a reserve of developable land for the time period after the year 2010 as it is quite unlikely that population will cease to grow thereafter.'[3]

[1] Ibid, p.9
[2] Ibid, p.15
[3] Ibid

This has become obvious and even more critical because land has become extremely scarce, particularly since women have taken the right to have land equal to men. The Report also was aware about the scatter development when it stated that: 'the direction of future urban growth should be seen in conjunction with the location of job opportunities, i.e. residential areas should be directly linked to the development of industrial/commercial areas and long-distance commuting is to be avoided as far as possible.'[1] This orientation certainly works with sustainable urban pattern which encourage mixed-use development. The report also was aware of impacts that might emerge due to non-sustainable policies of transport management when it mentioned that: 'land use planning reduces the necessity of motorized transport to a minimum.'[2]

At the economic level, the Structure Plan alerted local authorities and decision-makers about the risk of oil-dependency on the national GDP. It stated that 'the national economy of Oman, characterized by this imbalanced structure together with overwhelming dependency on oil, includes many risks of destabilization.'[3] It suggested that 'the actual dominance of tertiary sector will last beyond the year 2010 although many projects to strengthen the productive secondary sector are anticipated to be implemented within the planning period.'[4]

Since Seeb Municipality was expected to grow very fast, the Structure Plan Report stimulated the local authorities to 'urgently prepare a detailed urban design concept, the reorganisation of its structure and the preparation of expansion areas for future growth.'[5] The report focused on creating public investments that can motivate the local economy for growth, for instance, 'the creation of jobs opportunities for future inhabitants. Unfortunately, this concept has not taken place up-to-date because major areas in Seeb area particularly Khoad and Mubaila remain as residential use while jobs and work places are mostly still in Ruwi for companies and Khuwair for governmental sector.

- The Structure Plan Final Report also included general policies for the provision of major utilities such as transport, power supply, water, sewage, waste disposal, telecommunication and drainage and food protection. These policies include:
- All infrastructural provisions should be made after a detailed technical and economic feasibility study.
- Technical standards should be respected in design and execution of all infrastructural networks.
- A comprehensive information system should be developed for all existing/anticipated utility networks in all areas to avoid any damage due to ignorance.
- The priorities indicated by the structure plan should be observed strictly and feasibility at micro-level should be confirmed early enough to meet the anticipated demand.
- Corridors for all utility lines should be respected to avoid danger, confusion, and casualties.
- The whole population shall be sufficiently served by the utilities by the end of 2010.[6]

[1] Ibid, p.15
[2] Ibid
[3] Ibid, p.18
[4] Ibid, p.18
[5] Ibid, p.22
[6] Weidleplan- Muamir (April 1990),Draft Final Report ,Vo.1 Report, p.111

Muscat Housing Study

This study is conducted by Weidleplan-Muamir as a part of the three major studies which were appointed by the Ministry of Housing.
The main objectives of the study were shown in the Report that was handed over to the Ministry of Housing in July, 1991.[1] They are summarized as follows:

- Description and assessment of the actual housing situation in Muscat Area.
- Assessing the demand for housing and respective areas up to the year 2010.
- Formulating a guideline for the future housing policy.

Muscat Area Housing Study was based on four field surveys, Land Use/Building Survey, Household Survey, Labour Accommodation Survey and Village Settlement Survey. It covered the whole areas in Muscat which were subdivided into four Municipalities, Greater Muttrah, Baushar, Seeb and Al Hajar. 'The Consultant recommended to the upper path of the envelopment corridor" for the future planning process, they argued that by this the planning would guarantee a sensible base even for the time after the planning horizon being 2010.'[2]
The proposal includes the following headings:

- ***Plot distribution/planning of residential areas***
- Increase densities of future residential development.
- Improvement of the plot distribution system.
- Offering plots outside the Muscat Area (without building commitment).
- Coordination of sectoral planning (ref. To residential land use).
- Plot provision according to demand.
- ***Land monitoring ad acquisition***
- Installation of a 'plot monitoring system' for the Muscat Area.
- Building up of a strategic governmental land reserve.
- ***Provision of infrastructure***
- Charging50% of average infrastructure development cost on the plot owners.
- Coordination of sectoral planning.
- ***Rehabilitation program for existing residential areas***
- Identification of 'action areas'
- Carrying out of improvement measures in the 'action area'
- Providing incentives and technical assistance (inside and outside the defined 'action areas') putting special emphasis on low-income household
- Special loan program for rehabilitation/modernization (Oman Housing Bank)
- ***Housing for low-income people***
- Continuation and expansion of the 'Housing Aid Scheme'
- Installation of 'public housing allowance system'
- ***Oman Housing Bank***
- Increase the budget available for loans distribution
- Promoting of private saving accounts
- Installation of 'building society'

[1] Weidleplan- Muamir, Muscat Area Housing Study, Phase 3 Report No.4, Final Policy and Implementation Strategy Report and Executive Summary, July 1991
[2] Ibid, p.J

- Promotion of 'self-help'
- Establishment of 'Advice Centre' which provides information in all fields related to housing
- Development of 'turn-key' housing projects
- *Private sector activities*
- Promotion of projects carried out by private developers
- Fostering the rental housing market
- Promoting of private mortgage market[1]

Despite this range of studies that attempted to investigate and project the urban growth, the government has struggled in implementing even the major proposals. The researcher believes that the current fragmentation of urban growth pattern is a result of lacking the harmonious responsibilities among the local authorities which are associated with the urban development. The Muscat Area Housing Study pointed out the need to modify the Land Distribution System which is based on granting land to citizens.

4.2.4 Environmental and institutional restrictions

As it was indicated earlier through this dissertation, environmental and institutional conditions are considered prominent factors that influence the urban pattern. These factors, such as mountains, valleys, etc, have largely disconnected the urban development. 'This often creates leap-frog development sprawl.'[2] In Muscat, where mountains and other geographical conditions represent the majority of its land, lands for residential and public utility purposes seem very scarce. Urban growth patterns in some areas in Muscat Governorate such as Sidab Wadi Oday and Darsait are largely influenced by natural conditions such as wadis and rigid terrain. See Picture [34].

Picture 34: Unsuitable physical terrain hinders continuous development.

Source: www.googleearth.com

[1]Weidleplan- Muamir, Muscat Area Housing Study, Phase 3 Report No.4, Final Policy and Implementation Strategy Report and Executive Summary, July 1991, pp.J-k
[2]Bhatta (2010), p.22

Huge areas in Muscat are considered as restricted areas, which means not suitable for development due to natural conditions or governmental regulations. Some restrictions are related to natural conditions such as uninhabitable mountains, valleys (wadis), sand dunes and flood prone areas. Some are related to environmental restrictions such as dam protection easements, natural conservation areas and coastal easement. Others are related to institutional restrictions such as Ministry of Defense easements (MOD), Muscat Airport, Refinery, Sultan Qaboos University (SQU), Diwan and Palace properties, Petroleum Development of Oman Co. (PDO), etc. According to Weidleplan- Muamir (1990), 'these institutions occupy a total of 3,164 hectares, of which 74% are located in Seeb and 23% are located in Baushar.'[1]

The reason why Seeb dominates the larger share of the institutional restricted area is because of 'the big tracts of land to which restrictions apply, particularly land reserved for MOD.'[2] These enormous areas of reserved land tear up the urban development and disconnect major land uses because they are normally left vacant for ages. Figure [89] show the Major Land Use Restrictions in Muscat.

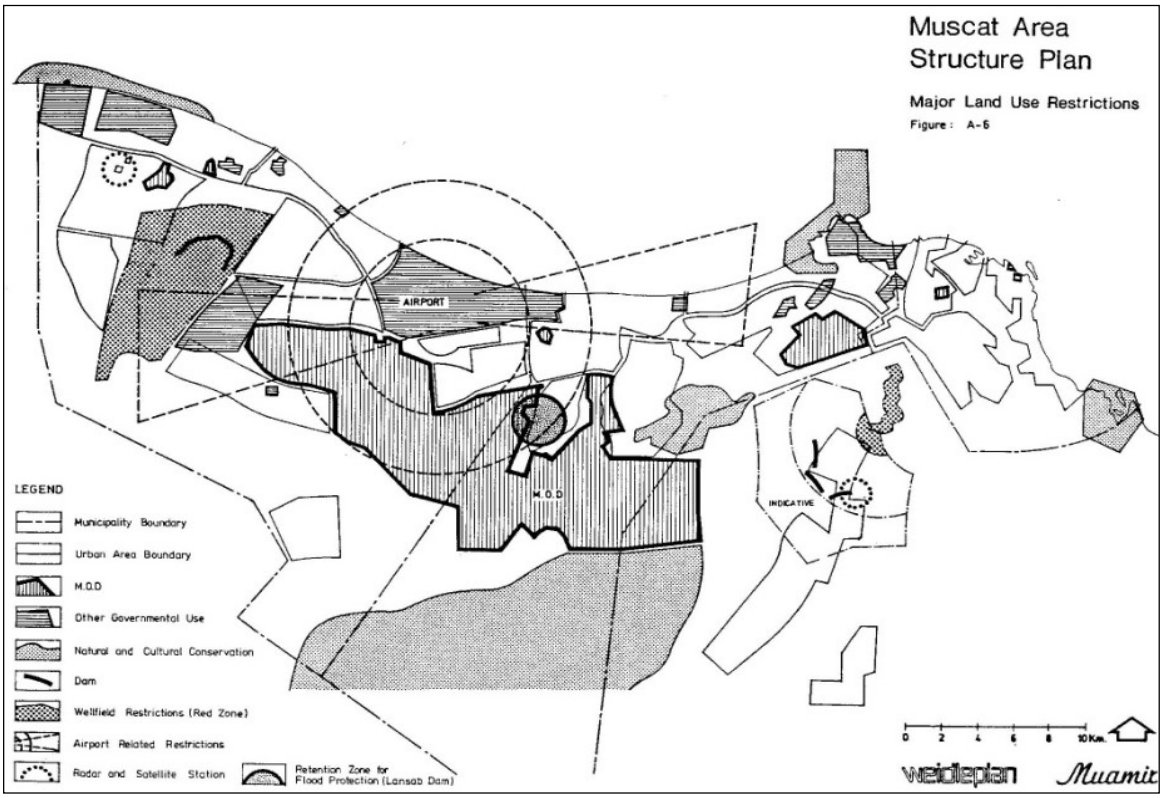


Figure 89: Major Land Use Restrictions in Muscat

Source: Muscat Structure Plan, Muamir, weidleplan, 1991

[1]Weidleplan- Muamir (April 1990), Muscat Area Structure Plan Phase 2 – Strategy Report, p.19
[2]Ibid

Rigid mountains are considered one natural factor that influences the urban growth and development pattern. Muscat is considered as the most mountainous capital city in the Arabian Peninsula. The eastern part of Al Hajar Mountains creates a rigid topography in Muscat. The mountain series stretch from west to east forming a physical barrier between Muscat and Batinah and other interior parts in Oman. Despite the fact that mountains with their dark colors add a particular natural character to the city, they largely influence the general urban form of the city. Almost the entire urban development may take the mountain foot-line as a natural outline. See Picture [35].

Picture 35: physical terrains outline some urban developments in Muscat

Picture's source: Oman Newspaper Ed. No. 11218 date 18/2/2012 Sport Ed., p. 12

Wadis (valleys) and natural runoff channels are considered as powerful contributors to creating patchwork and disconnected developments. Unfortunately, wadis and water runoffs occupy huge areas in Muscat, see Figure [90]. Obviously, many of them are considered as obstacles to major urban development and they disconnect many urban settlements. Many wadis, particularly those that have not been intelligently drained[1], have largely influenced the urban development, particularly when it is flooding. The scarcity of lands and lack of vivid system for wadis' boundaries forces local authorities to allocate land closer to wadis and water runoff.

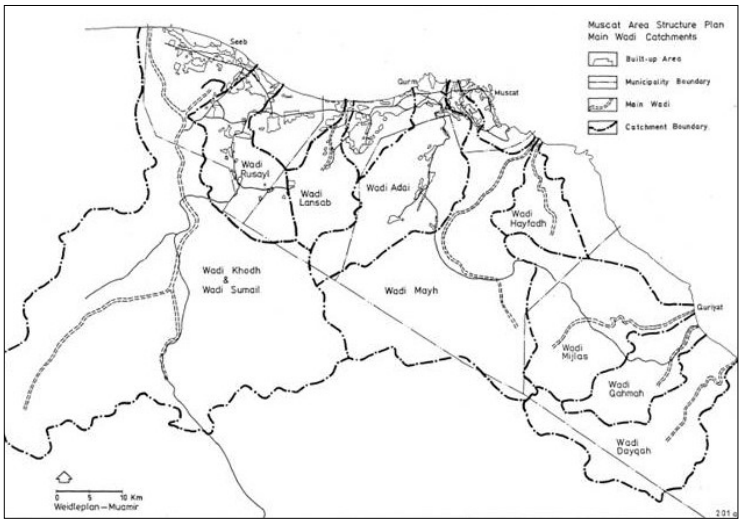


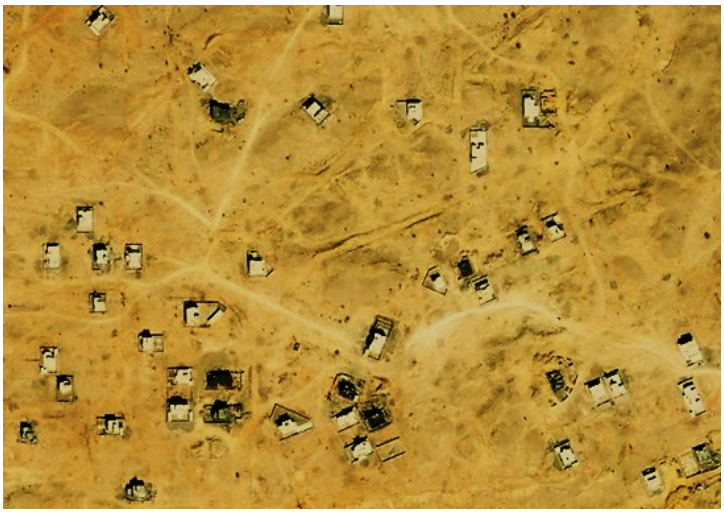
Figure 90: Main Wadi (valleys) Catchments in Muscat.

Source: Muscat Structure Plan, Muamir, weidleplan, 1991

[1]The government built water catchment and dams to many wadies in Oman such as Wadi Deeqah Dam in Muscat Governorate where it can reserve multi million cubic meters of water.

4.3 Impacts of rapid urban growth in Muscat
4.3.1 Low density scattered development

The land granting system based on the public lottery and the lack of clear policies of managing urban growth has led the emergence of low-density, patchy and scattered development in Muscat. Despite the high rate of land distribution and the high rate of building permissions, the building density is extremely low. Muttrah, the oldest part in Muscat, holds the highest population and building density. However, in Seeb, though it holds more than 39% of Muscat's population, the density is modest. This is because, the development in Seeb-- particularly Khoad, Hail and Mubailah -- is based on single detached villa type while in Muttrah, the development is based on higher-density mixed-use developments, see Figure [91] that indicates various areas in Muscat and their residential densities in 1990.



Picture 36: Scattered and low density urban development in Al Ansab, Muscat

Source: www.googleearth.com

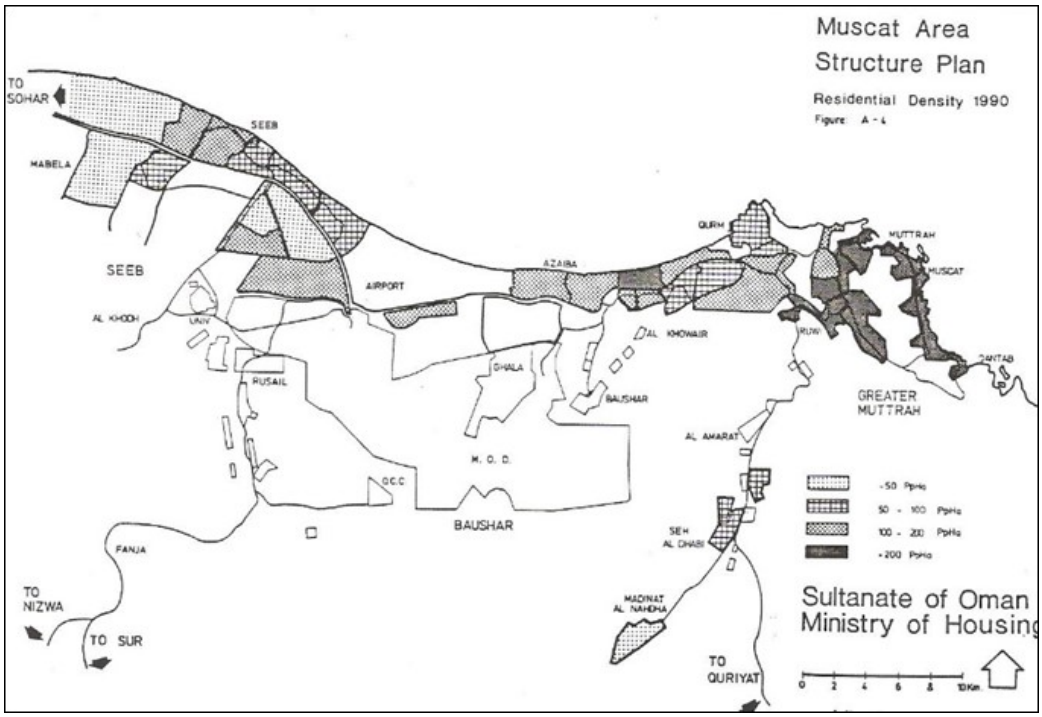


Figure 91: Residential Density in Muscat in 1990.

Source: Weidleplan- Muamir (1991), p.12

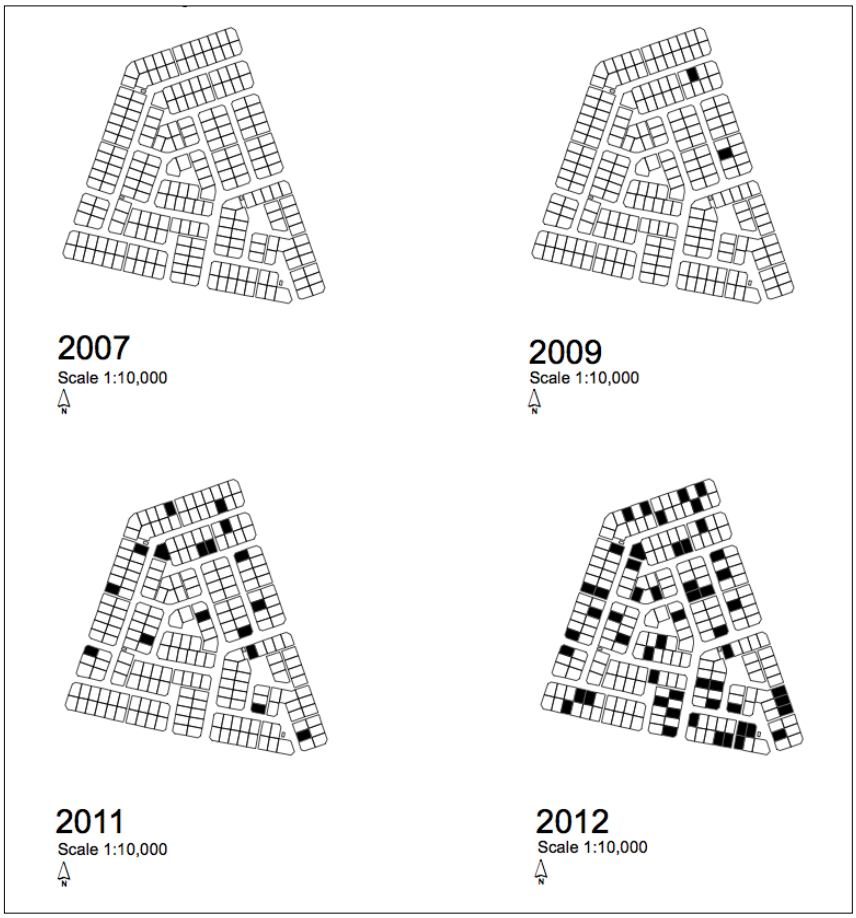


Figure 92: Development over time in Khoad District 8

Source: TRC research project

Figure 93: Density rate in Disrict 8 in Khoad is extemely low.

Source: TRC research project

4.3.2 Dissipation of public money

As indicated earlier, Muscat holds nearly 30% of Oman's total population and it consumes more than 50% from the entire country's budget for the development of basic infrastructure. For instance, in Budget 2012, every Wilayat in Muscat received OMR 7 million which is five times more than what every regional Wilayat gets for developing the basic infrastructure. It has become evident that 'auto cities have per capita transport costs of 12 to 17 per cent of their city wealth, compared to 5 to 8 per cent in transit and walking cities.'[1]

Furthermore, at the urban level, cars consume huge amounts of valuable land for corridors and parking lots. In Oman, for instance, setting up of the 260 kilometer long *Batinah Coastal Highway,* which runs close to the whole coastal line of Oman's Sea, from Muscat up to the last northern Wilayat in Batinah Governorate, has had a drastic impact not only on the economic level due to its high budget but it has direct social and environmental impacts. The economic impact includes the fund that is paid to the owners as compensation for their properties that the highway passes through. The compensation budget also includes relocating and residing of those people in new housing areas.

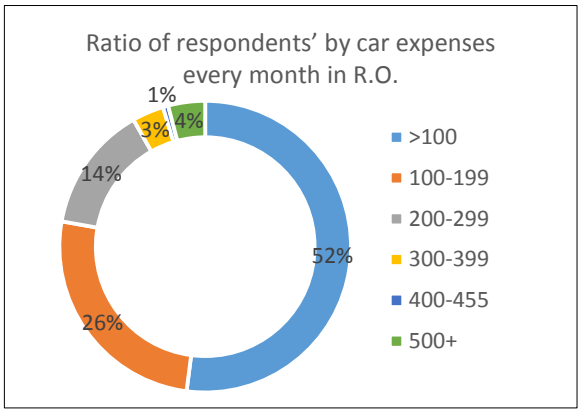


Figure 94: Car expenses per month in Muscat

Source: Own calculation based on a field survey

At the household level, according to the Ministry of National Economy Survey, 2009, transport and communication expenses consumed one quarter (R.O. 142) of the Omani family budget. However, according to the conducted survey, although 52% of Muscat's interviewees spend less than R.O.100 for car expenses, 40% of them spend from R.O.100 up to R.O.299 which is considered as a high expense. By calculating the average it is found to be R.O. 140.25.

4.3.3 Loss of productive land

The rapid urbanization which occurred in Muscat during the past four decades has led to extreme consumption of fresh water and overuse of available natural resources. Consequently, plenty of acres of arable land have deteriorated. The extreme consumption of fresh water has not only led to destruction of the majority of productive farmlands but also caused water salination and drought in most areas in Muscat. Currently, fresh water is provided through the desalination plants in Ghobrah. The huge energy used in desalination processes works in a counter-sustainability orientation.

[1]Newman and Kenworthy (1999) (quoted by Newman, P. and Jennings, I. (2008), p.128)

As indicated earlier through this thesis, local production is considered an essential factor to attain sustainability. However, currently in Muscat as well as in many other regions in Oman, most agricultural productions have been imported from other countries. The local agricultural productions have become scarce. According to the survey conducted in Muscat, when interviewees have been asked to evaluate the availability of local products in the market, more than 40% of interviewees responded that they are not adequate, Figure [95].

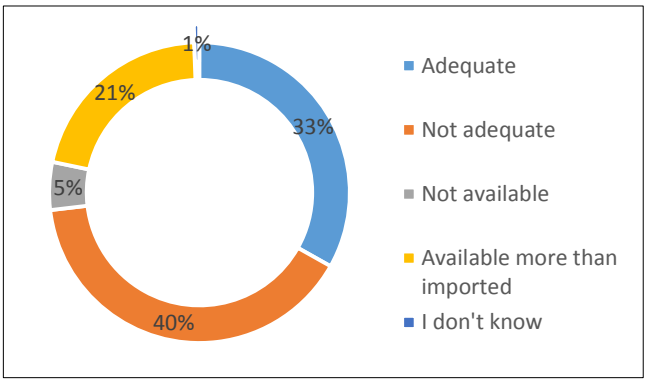
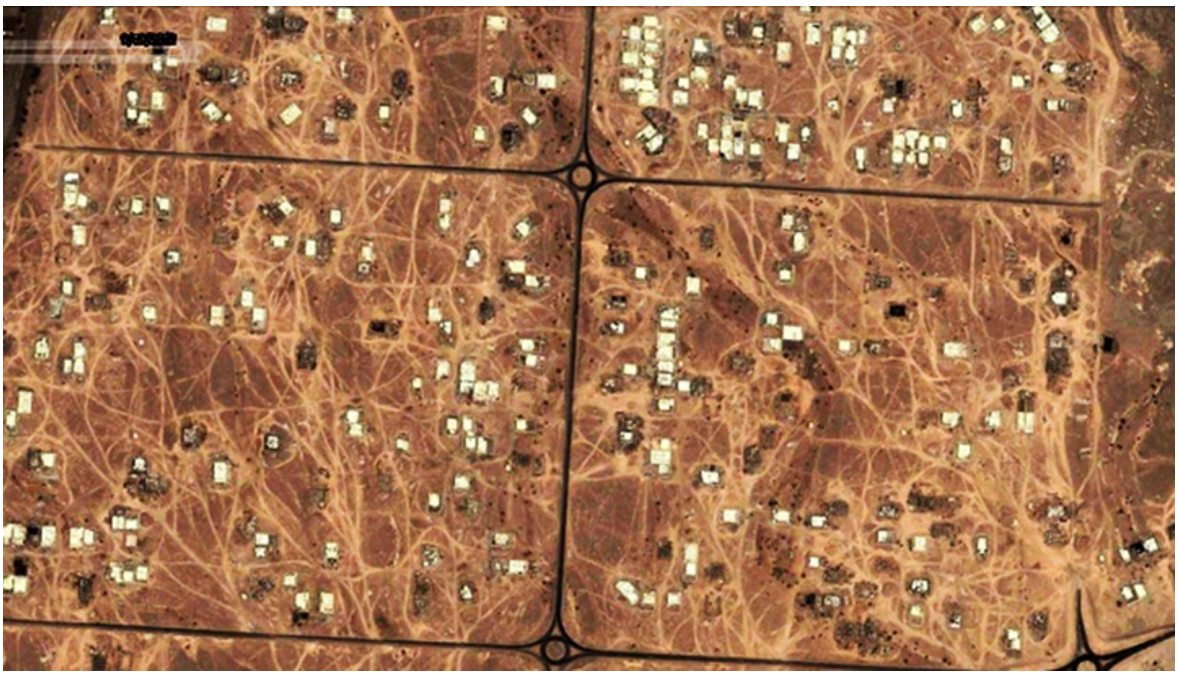


Figure 95: Evaluation of the availability of local products

Source: Own calculation based on a field survey

The demand for residential, commercial and industrial spaces has pushed owner-occupiers to change the agricultural use to these more profitable uses. Some owners have tended to abandon their cultivated areas to obtain an official authorization to change the land use of their agricultural lands. This has become obvious in Muscat from the erosion of cultivated areas against urban expansion. The rapid urbanization has not only led to deforestation but also caused many environmental phenomena such as desertification. The removal of green cover via the construction of buildings and transport infrastructure has largely led to desert crawl. As shown earlier in this part, the low-density scattered developments add a negative impact on the local environment. For instance, the lack of asphalted roads forces people to drive on multiple routes to reach their houses resulting in rarefication of the soil, Picture [37].



Picture 37: Scattered development and lack of asphalted roads in Um Abailah force people to line up random tracks.

Picture source: www.googleearth.com

Picture 38: Water Degradation is a result of urban growth

Source: The author 3/5/2008

Picture 39: Deforestation

Source: www.googleearth.com

Picture 40: Drought.

Source: The author 3/5/2008

Picture 41: Desertification

Source: The author 3/5/2008

4.3.4 Destruction of local habitat

As mentioned earlier in this thesis, the Land Granting System which is based on random lottery creates scattered low density developments. Consequently and because asphalted roads normally take ages to be implemented, drivers are forced to line up random tracks to reach their home places. This phenomenon becomes obvious not only in Muscat but in all the current urban and suburban areas in Oman. Driving cars on these tracks not only leads to soil compression and erosion but it also largely leads to the destruction of the local wildlife and vegetation cover, and it arouses dust which deteriorates the quality of air and the local habitat, refer to Picture [37].

4.3.5 Lack of the sense of place

Neighborhood condition is an essential factor that contributes to the urban pattern such as the mobility pattern, social interactions, etc. While the old neighborhood *(Hara)* was a unique system in relation of to its integration of socio-economic functional aspects into the urban fabric, the current form seems lacking in the sense of community. Box [11] highlights six fundamental rules that distinguish a traditional neighborhood pattern from sprawl according to Duany *et al.* (2000). However, in Muscat's contemporary planning areas, as well as other regions in Oman, the neighborhood with its ordinary form cannot be verified. The repetitive land subdivisions, which are based on residential land use only, add disorientation and lack a sense of place. Commonly, the area is based on car-accessibility while the pedestrian accessibility is not visible. For example, the area of Mubailah-S1-Phase 8 with its ten-meter street width is totally based on vehicular users and inhabitants have no choice other than using cars for their mobility. See Figure [96].

Box 11: six fundamental rules that distinguish traditional neighborhood pattern from sprawl

1. The centre. Each neighborhood has a clear centre, focused on the common activities of commerce, culture, and governance.
2. The five-minute walk. A local resident is rarely more than a five-minute walk from the ordinary needs of daily life: living, working, and shopping.
3. The street network. Because the street pattern takes the form of a continuous web—in this case, a grid—numerous paths connect one location to another.
4. Narrow, versatile streets. Because there are so many streets to accommodate the traffic, each street can be small, wide sidewalks, shade trees and pleasant and safe to walk along.
5. Mixed Use. In contrast to sprawl's single-use zoning.
6. Special sites for special buildings. Finally, traditional neighborhoods devote unique sites to civic buildings, those structures that represent the collective identity and aspirations of the community.

Source: Duany et *al* (2000)

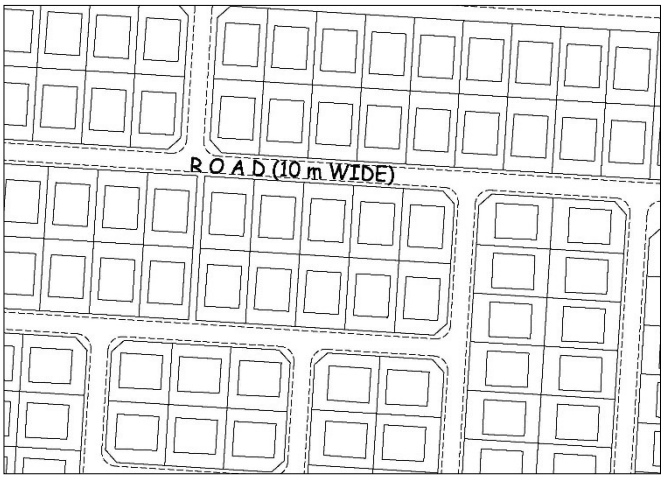


Figure 96: Mabelah-S1-Phase 8 expresses single use car-accessibility urban pattern.

Source: MoH

According to the field survey that has been conducted in Muscat, nearly 65% of the interviewees live in very modern areas which do not exceed 24 years of age. About 32% of them live in areas that are 5-14 years old and 28% of them said from 15-24 years, whereas 7% of them said less than 5 years. This indicates how rapid the urban growth in various parts in Muscat is, because the average age of the residential areas in Muscat is merely 13.6 years. Figure [97].

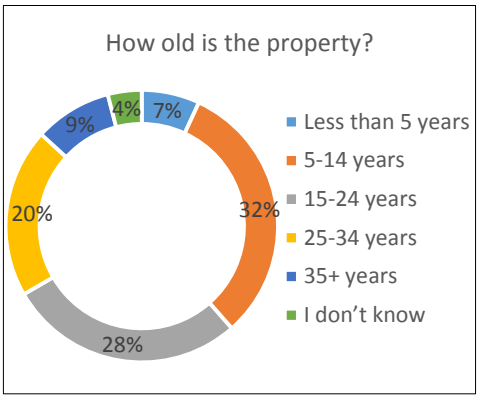


Figure 97: Age of interviewees' residential properties in Muscat.

Source: Own calculation based on field survey

Generally, urban growth in Muscat is characterized by extreme low-density, isolation and scattering. A low-density, patchy urban pattern has emerged in the outskirts of the existing development. Those areas normally remain lacking in infrastructural services until a reasonable housing development is observed. Since services such as electric power, water, roads, etc. require a lot of time to be executed, the housing development in those areas remains modest for a long time. The lack of basic infrastructure in most of the urban areas weakens the quality of the place and life in general. The infrastructure services including streets, pedestrian and cycling sidewalks and street furniture are not developed at one time. Every portion of these services is executed gradually once approved from the authority in charge. For instance, a street gets approved by the local municipality or Ministry of Transport and Telecommunication and Electricity and water is approved from General Authority of Electricity and Water. These services are not executed in comprehensive ways. Each of them may take several stages in multiple periods to be totally implemented depending on the housing development and the insistence from the local inhabitants. Therefore, a street may not take its final shape for ages. Figure [98] shows Al Ansab Planning Area in Muscat where the street network took several stages over ten years to be reasonably allocated in the area.

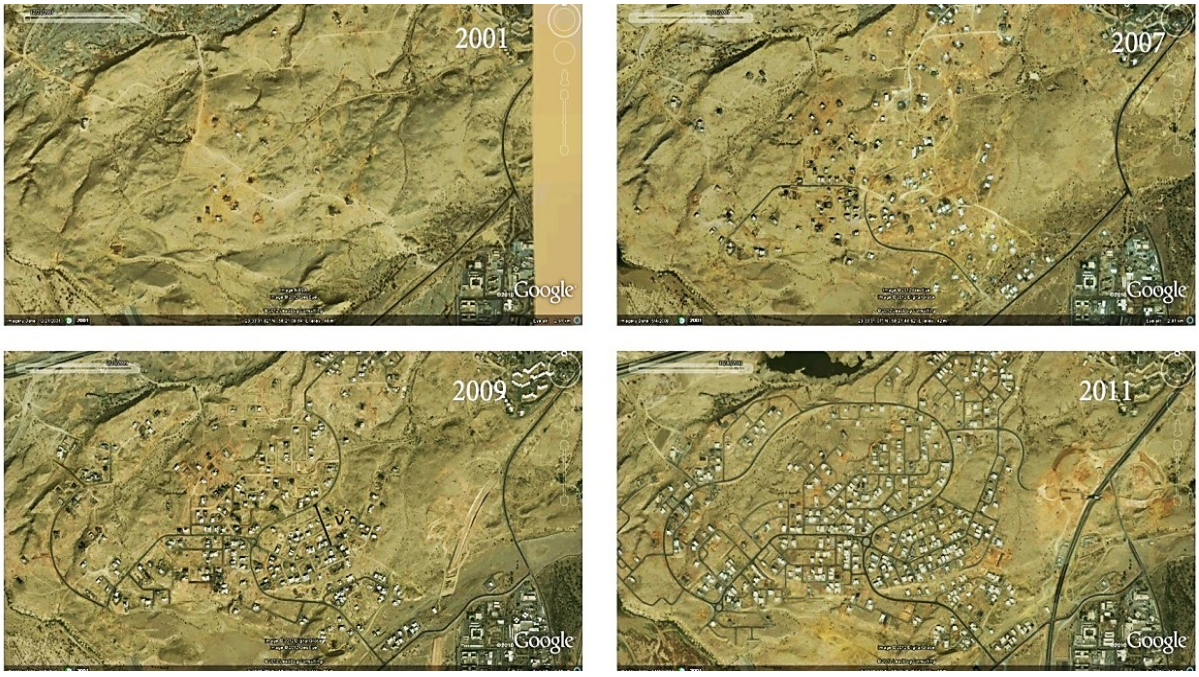


Figure 98: Al Ansab Planning Area where street network took several stages over ten years to be reasonably allocated in the area. Pictures source: www.googleearth.com

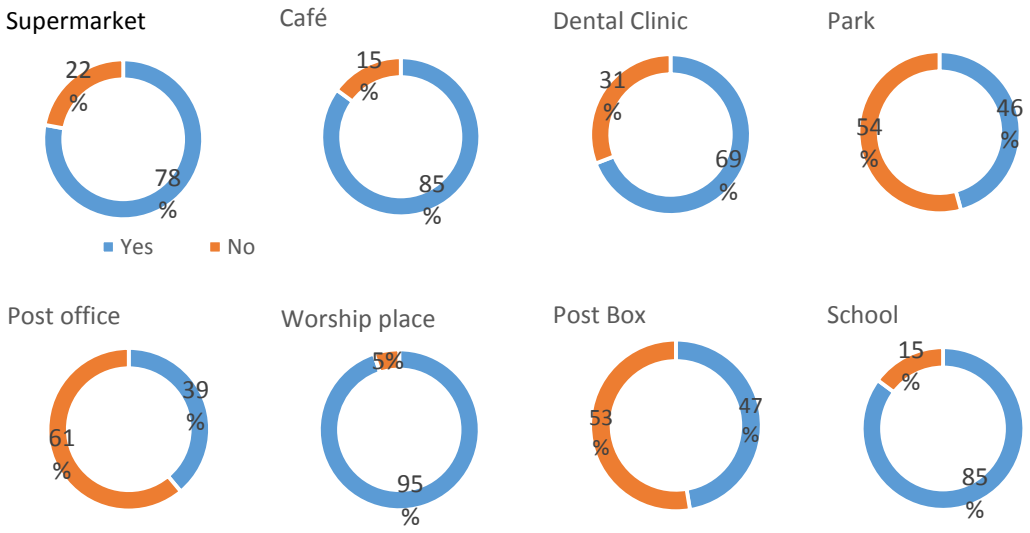


Figure 99: Ratio of respondents by availability of facilities at their neighborhoods

Source: The author based on a field survey

The lack of nodes in Muscat's urban areas reduces the quality of space and contributes to spatial disorientation. Generally, urban patterns in Muscat lack certain points that can be clearly observed and which can be recognized for its value. Normally, the nodes which work as transitional anchors between districts do not exist in most of Muscat's urban areas. In contrast, the heavy traffic wipes out the role of the node as a key value for the urban transition. In addition, the lack of landmarks in Muscat's urban areas also reduces the quality of the place.

Commonly, in Muscat the scattered and fragmented urban areas which contain the physical structures or natural elements, that can be observed as unique and vivid figures and used as reference spots, are very rare. Buildings and structures as prototypes in Muscat are observed comparably and cannot be distinguished by their distinct form or height or other sole elements. Consequently, these man-made landmarks are seen as vague and cannot be relied on as reference figures. Most of them are hidden by compound walls and cannot be used to re-orientate the car drivers to certain places.

4.3.6 Car dependency

Most debates designate cars as the principal promoter of urban sprawl. Newman and Jennings (2008) argued that 'car-dependent cities are characterized by low densities of between ten and twenty people per hectare. They are typically much bigger in area than transit cities and much more spread out, with people able to travel fifty kilometers in the average travel-time budget.'[1] In relation to its ecological and economic impacts, Newman and Jennings (2008) indicate that 'car dependence in automobile cities is associated with high ecological footprints and high economic costs. Automobile cities typically use more than 1,000 liters of gasoline per person per year on mobility [while] transit cities use around 300 to 500 liters and walking cities use less than 100 liters per person per year.'[2]

[1]Newman and Jennings (2008), pp. 128-129

[2] Ibid., p. 128

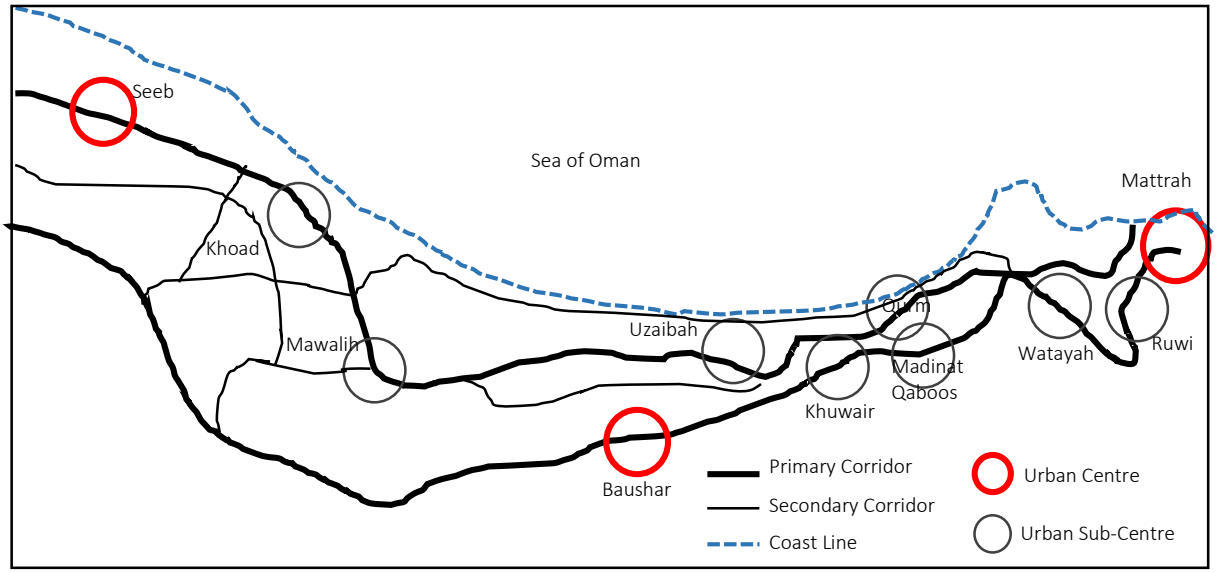


Figure 100: Muscat imitates the car-dependent urban form. Source: The author

On social levels, cars encourage the fragmentation of families as people do not care whether they stay near or far from their parents and relatives. With all of this, cars also have higher external economic and social impacts, particularly due to road accidents. In 2005, Muscat's statistics indicate that there were about 38,608 private vehicles for every 100,000 persons and this high rate of private car ownership resulted in 731 accidents for every 100,000 persons. The car is also considered as a phenomenon factor which played an import role in sprawl in Muscat. Since oil production, people have been encouraged by the automobile industries and by the financial companies to acquire their life's dream. Cars now dominate the short and long trips not only in Muscat but in the whole of the Gulf Region. Figure [100] summarizes the urban pattern in Muscat which reflects the car-dependent urban form.

The quantity of cars is a principal factor that determines how much our cities rely on private transit. Unfortunately, the car has become an essential object at our homes to a degree that if it is missing, our life is impeded. According to Weidleplan- Muamir (1990), 'overall vehicle availability in Muscat in 1989 was found to be 1.34 cars per household increased by approximately 10% since 1985.'[1] However, according to our conducted survey in Muscat in 2011, vehicle availability has doubled to be 2.8 cars per household. According to the conducted survey, about 95% of interviewees have at least one car in their household and about 34% of them own two cars. See Figure [101]. Furthermore, about 52% of them do not share their trips with other commuters.

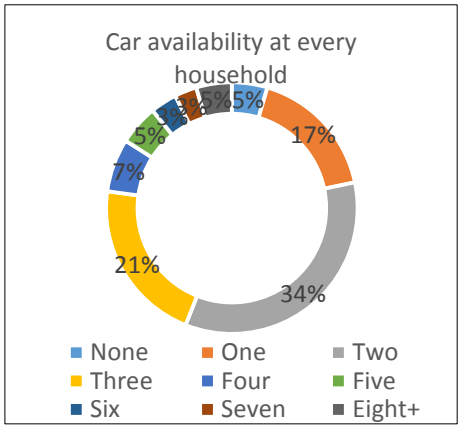


Figure 101: Car availability in every household.

Source: Own calculation based on a field survey

[1] Weidleplan & Muamir (April 1990), Muscat Area Structure Plan Phase 2 – Strategy Report, p.25

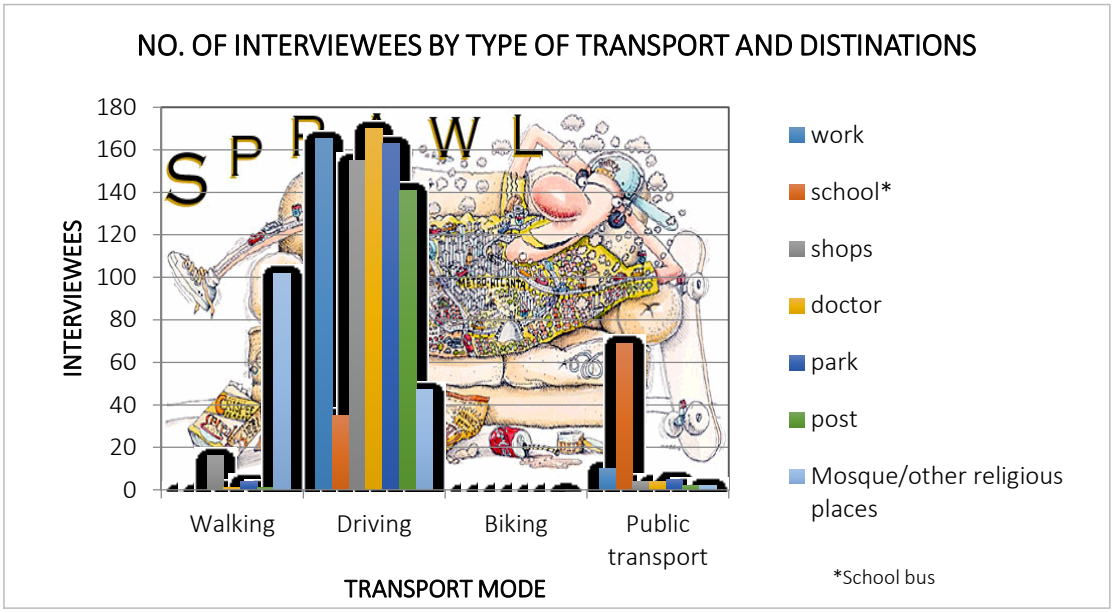


Figure 102: Type of transport and destination in Muscat.

Source: Own calculation based on field survey

The survey demonstrates that the majority of the interviewees use their private automobiles to get to their regular destinations. There are very little who walk and none of them use bicycles. Figure [102]. Commuting to the workplace is considered the most common type of daily journeys. According to the survey, about 94% of interviewees use their own private automobile to get to their workplaces, whereas only 6% of them use the public transport. It is noted that none of them walk or use bicycles to get to their workplaces. Now it is obvious that the car dominates our trips to workplace destinations. See Figure [103].

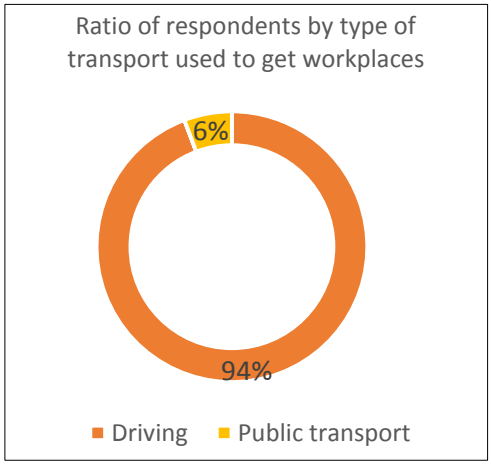


Figure 103: Type of transport used to get workplace by Muscat's population.

Source: Own calculation based on a field survey

Alexander (1979) in his book *A Pattern Language* argued that 'the person who uses the car occupies an area of 100 times larger than the person who is using pedestrian path.'[1] While Hart, (1993) argued that 'the average employer provides more room for employee parking than for office space.'[2] Consequently, imagine how much land in Oman has been given for car utilities and how much land will be handed over in the future if the current urban management remains.

[1]Alexander, C. (1977), p.65
[2].Hart, S. (1993), p.31

4.3.7 Time consumption in transport

One of the considerable impacts of urban sprawl is the loss of time in traffic. Muscat holds more than half of the quantity of cars in the Sultanate. Despite the tremendous street network that has been executed in the past four decades, problems associated with traffic have been augmented dramatically. The government has failed to find a definite solution for lessening the number of car accidents and associate fatalities. According to the survey that has been conducted in Muscat, the interviewees consume plenty of time to get to the workplace. The average time consumed by the interviewees is 35.7 minutes which in comparison to a sustainable city model is too much. Sustainable cities reduce distances between workplaces and living places to make journeys shorter. More than half of them take more than half an hour to get to the workplaces whereas 19% take more than an hour. This proportion is considered as a high ratio when compared with other developed cities. Figure [104] indicates the percentage of interviewees and time they consume to get to their workplaces.

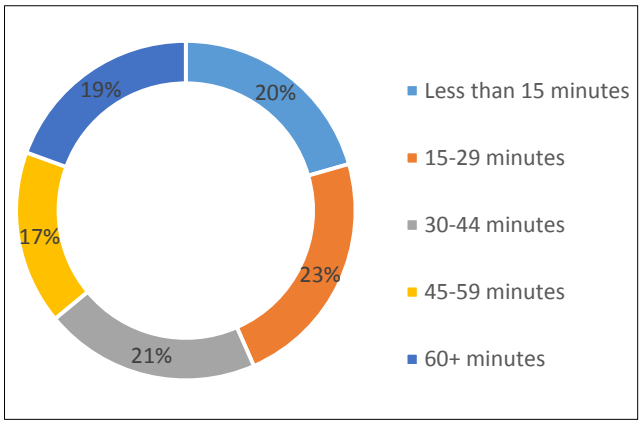


Figure 104: Time consumed to get to workplaces by the interviewees .

Source: Own calculation based on field survey

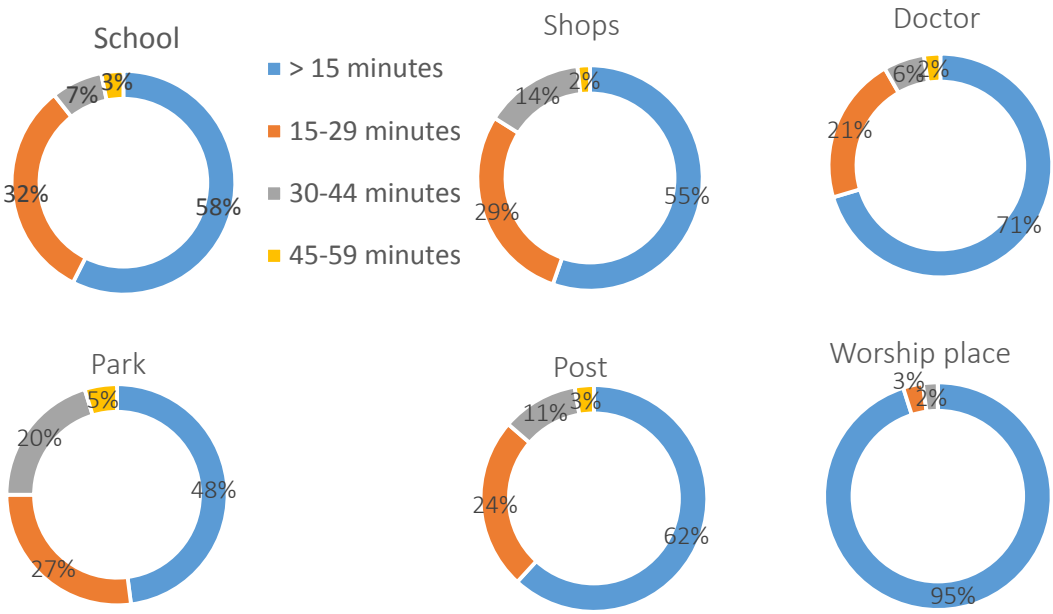


Figure 105: Time consumption by interviewees (%) to get to common destinations

Source: Own calculation based on field survey

The mobility behaviors also include other common destinations such as worship places, schools, shops, doctors, parks, and post offices. Despite the fact that more than half of the interviewees indicated that they take less than 15 minutes to reach those destinations, it is still much time lost as the general mean of transport is the private automobile, see Figure [105]. The mobility of cars is more complicated than other types of transport. The car-corridor is not always easily accessible. Mostly, car accessibility and time consumption is affected by the overall traffic and street conditions. In a city like Muscat where public transport is inefficient, time consumption in cars is high. The gridlocks in minor and major highways have reached an intolerable level. The ribbon development makes reaching major destinations a difficult task. In areas with a lack of convenient and safe pedestrian pathways, a destination of half a kilometer may require more than half an hour to reach by car.

For instance, a car in front of the Supreme Committee of Town Planning in Khuwair requires more than 2.5 kilometers of driving and consumes more than a quarter of an hour to reach an adjacent car-parking in front of the Ministry of Housing though the two points are merely less than 50 meters apart. In addition to an expected gridlock in certain positions, four points of traffic lights consume a recognized amount of time, see Figure [106]. This example not only signifies a way of wasting time but also a way of wasting energy and money. For instance, a Muslim performs five prayer per day. Thus, he/she needs ten journeys from home to Mosque and from Mosque to home. Therefore, imagine how much time and energy is needed to perform this daily activity.

Figure 106: Time and distances required to reach two points 50 meters away from each other.

Source: The author

4.3.8 High rate in land consumption

Previous research performed by *Al Awadi* aims to measure and to model the urban expansion of Muscat Governorate using the combined technologies of Geographical Information Systems (GIS) and Remote Sensing (RS) and determining the sequence of rates of urban growth of Muscat area from 1960 to 2003. Figure [108] indicates the urban growth trend from the 1980s to 2003.[1] Al Awadi indicated "that the major increase in urban growth has taken place in the decade 1970 to 1980 and amounted to more than 3.5 times the previous extension. At the same time, a significant increase in residential land has taken place in the same period. In comparison, the agricultural acreage barely changed from 1960 to 1970. A large number of dynamic enquiries can be made of this dataset concentrating on the different land use categories and the extensive time periods afforded by the data. For example, Public building category has the largest share of the built-up area especially in period of 1980 and later. It formed about 29.8 % in 1980 and rose to 30.2 % in 2003.[2] Table [20] below shows the percentage and area-wise changes in between 1960-2003.

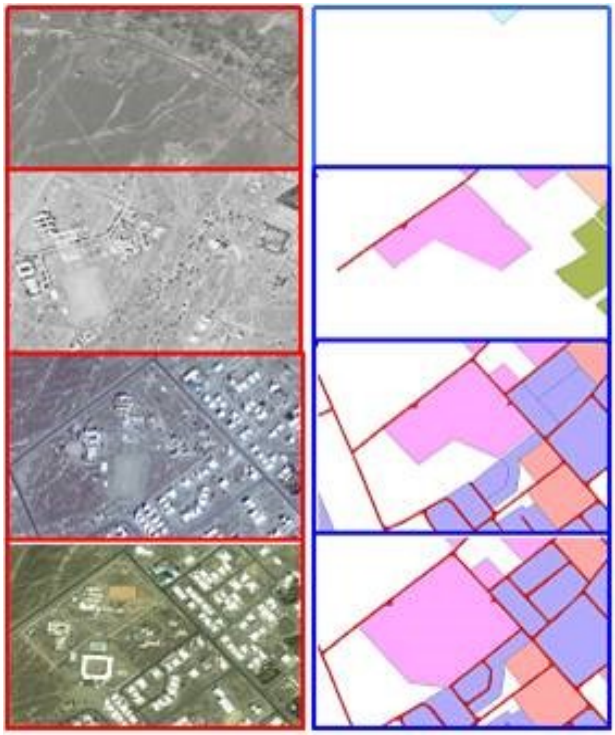


Figure 107: The sequences of land use acquisition (From top: 1980s, 1990s, 2000s, & 2003

Source: Al-Awadhi & Azaz (2005) quoted by Al-Awadhi T. (2008)

Year	M^2	Km^2	Percentage of change	Annual change Km2
1960	23189721.98	23	0.0	0.0
1970	23031628.74	23	0.0	0.0
1980	75831643.42	76	230.4	5.3
1990	145024434.20	145	90.7	6.9
2000	189735373.24	190	31	4.5
2003	193640171.05	194	2.1	1.3

Table 20: Total built-up area (1960 - 2003)

Source: Al-Awadhi T., 2008

[1]Al-Awadhi T. (2008)
[2]Ibid

Land Use Class	1960	1970	1980	1990	2000	2003
1.1 Residential	514	524	1823	3169	5431	5594
1.2 Commercial	28	30	741	930	1056	1053
1.3 Industry	10	10	597	1291	1667	1679
1.4Public Building	38	38	2783	3650	4975	5818
1.5 Transport	3	12	1558	2219	2735	2803
2.1 Agriculture	1695	1690	1614	1801	1633	1652
2.2 Recreation Area	4	4	95	346	521	460
2.3 Dam	0	0	0	37	37	37
2.4 Lake	10	10	134	138	138	138

Table 21: Total areas in hectares for each land use category in each period

Source: Al-Awadhi T. (2008)

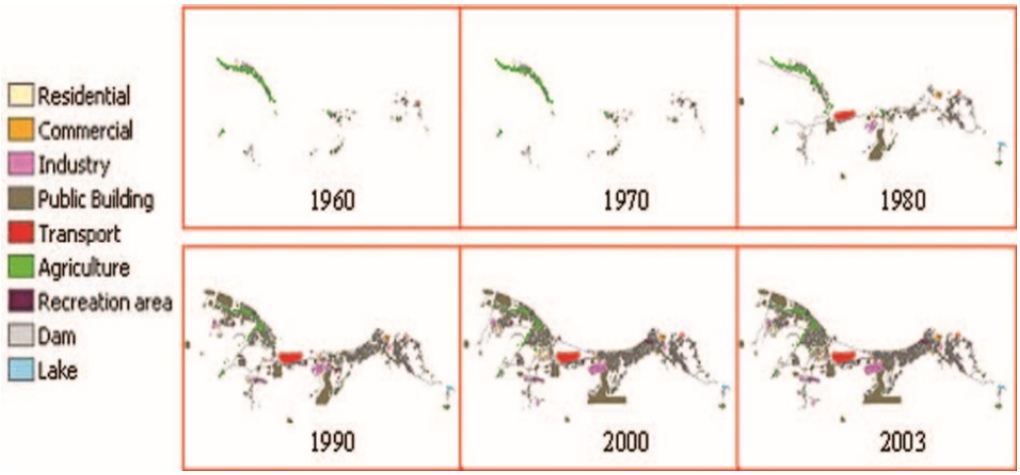


Figure 108: Land use map change between 1960 and 2003

Source: Al-Awadhi T. (2008)

Though the land distribution system in Muscat has largely contributed to the rapid urban expansion, according to the Ministry of National Economy statistics, Muscat possesses the largest rate of granted lands in the Sultanate. See Figure [109].

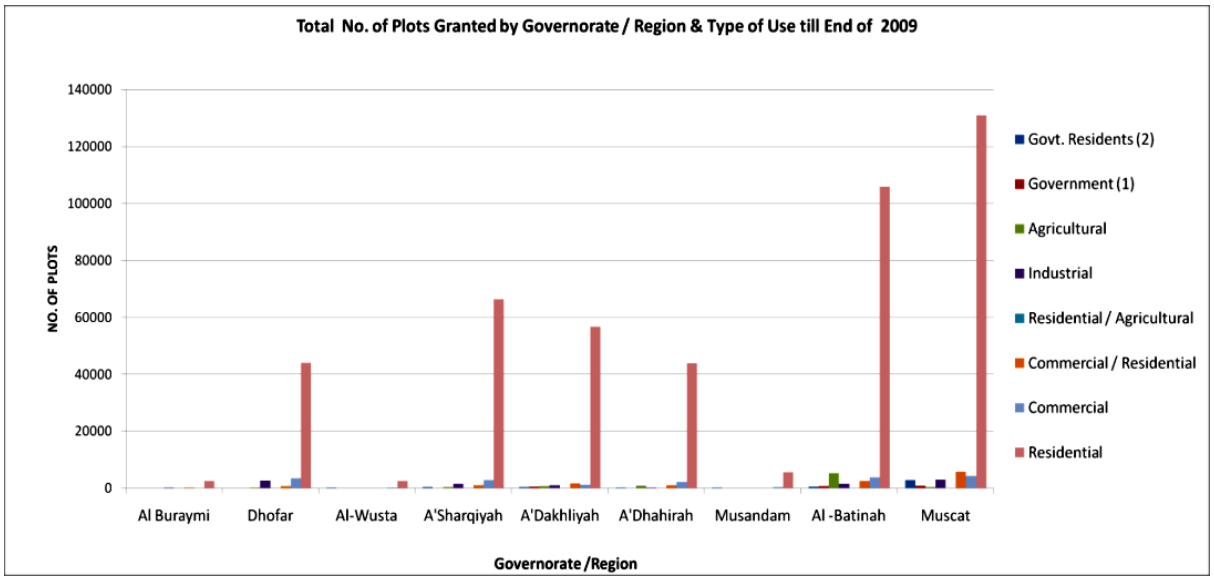


Figure 109: Muscat possesses the highest rate of granted lands in the Sultanate.

Source: Own calculation based on MNE Annual Report, 2009

According to Ministry of National Economy statistics, 492,642 plots of all uses have been granted in all Oman up to 2008. Amongst this amount, 433,187 plots (approx. 88%) are for residential uses. Muscat has dominated about 30% of the total amount of distributed lands in Oman by 146,010 plots. See Figure [110]. The residential plots that have been granted in Muscat up to 2008 is estimated to be 128,816 plots, which also represents about 30% of the total granted plots in the whole of Oman, see Figures [111-112].

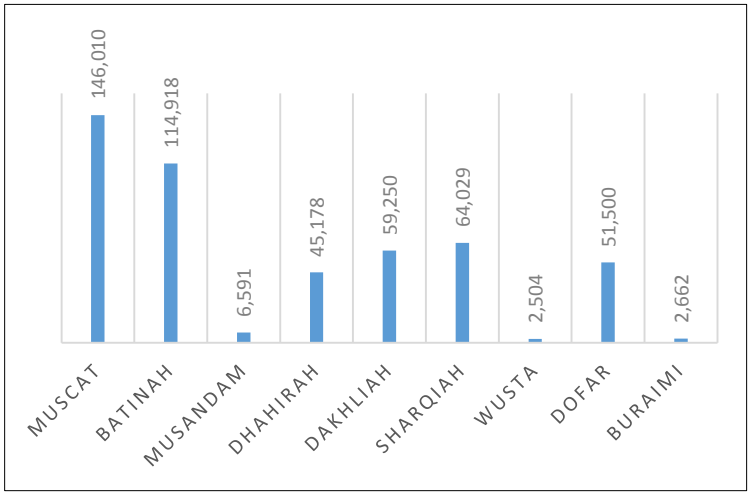


Figure 110: Total of lands with all uses that have been granted to citizens in all regions up to 2008. Source: MNE Annual Report, 2009

Obviously, this amount of land has been granted up to 2008 which is prior to women's eligibility to acquire land. Royal Decree 125/2008 issued in November16, 2008, that allowed women to have granted lands as men, has broadened the problem of extreme consumption of land. The problem in Muscat is more critical than other areas in Oman. As indicated already through this thesis, Muscat holds nearly one third of Oman's population while its area represents merely 1.3% of the country. This tiny ratio includes many geological and institutional restrictions that significantly minimize the amount of areas that are proper for urban development. Ministry of Housing becomes unable to fulfil the increasing demand for convenient residential lands particularly from women. Although distribution of lands for women commenced in late 2009, according to the Ministry of Housing statistics, more than 120,000 land applications in Muscat are waiting for the land lottery; more than 80 percent of those are from women applicants.

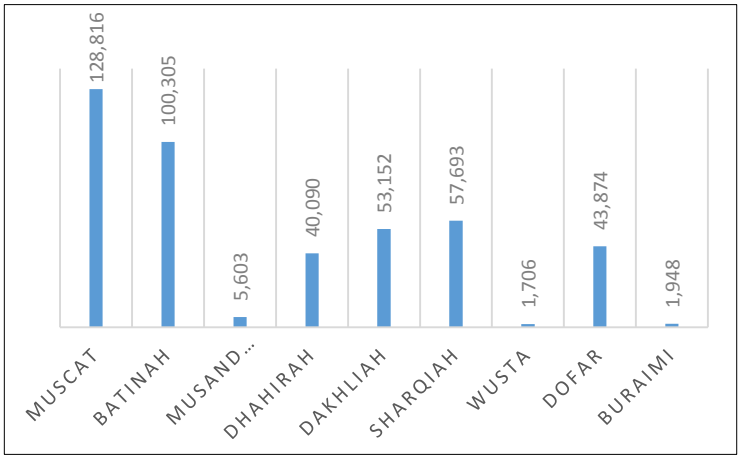


Figure 111: Total of residential land granted to citizens in all regions up to 2008. Source: MNE Annual Report, 2009

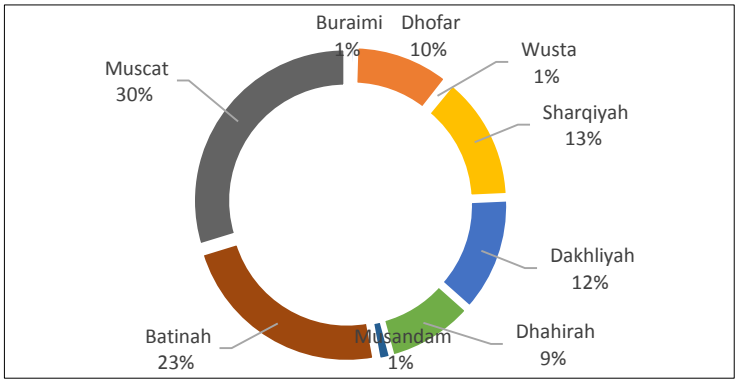


Figure 112: Percentage of total granted residential-plots by regions up to end 2008.

Source: MNE, Statistical Year Book 2009 based on MoH Statistics

A high proportion of agricultural lands have been given for the increasing demand on residential, commercial and industrial uses. This indication drives us to an obvious question, what about the coming generations? Do they note have the right to have convenient and safe housing? The scarcity of appropriate housing areas becomes obvious in consequences of pursuing the current land management system. Unfortunately, the existing land granting system and building regulations promote the extreme consumption of land and energy alike. According to Al Awadhi (2008), in Muscat 'the total urban expansion reached more than 650% between 1960 and 2003, with an annual growth rate of approximately 20%.'[1] Al Awadhi has shown a simulation of the consumption of lands to the year 2050 based on the annual rate of land consumption. Figure [113].

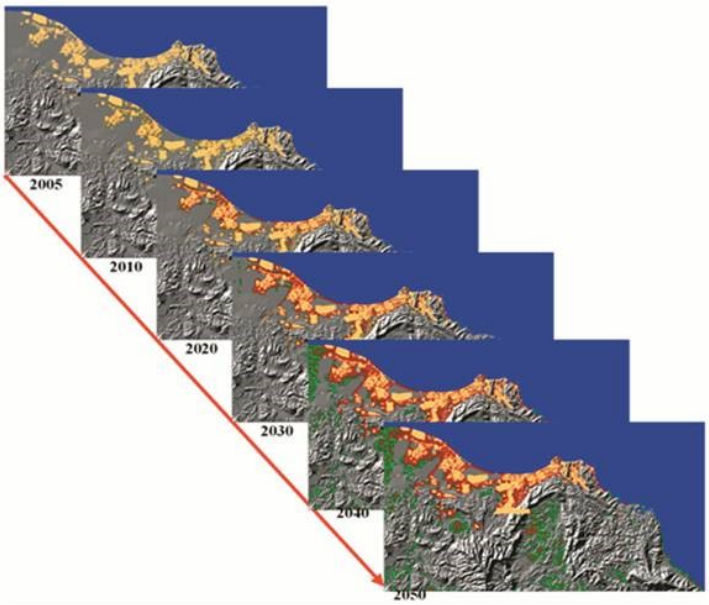


Figure 113: Small GIS datasets simulate urban growth overtime (2005-2050).

Source: Al-Awadhi (2008)

Picture 42: Khuwair Crossroads consumes as much area as a residential area in Muttrah.

(Note that both picture are on the same scale)

[1]Al Awadhi (2008)

Pictures source:
www.googleearth.com

4.3.9 High rate of energy consumption

Energy consumption is always an impact of human behavior. The rate of energy consumption varies from country to country, or even from person to person. Since the oil revelation in Oman, energy consumption per capita has increased gradually. The prosperity in consequence of increasing the GDP per person has boosted the demand in energy. The automobile and air-conditioner trends are the two significant factors that have contributed to boosting the energy consumption in the country during the past four decades. The urban form has largely influenced the mobility pattern. In Muscat's car–dependent lifestyle, the low-density, fragmented and single land-use urban patterns have contributed to increasing the time and quantity of mobility which has led to increasing the energy consumption. It is not an exaggeration if we say that Muscat represents the worst case for energy consumption in Oman.

Air-conditioners represent the most energy consumptive devises in houses, and cars alike. The poor urban management, structural built-form and the building materials are the most substantial factors that boost the consumption of energy in Muscat, as well as other areas in Oman. According to the interviews conducted, most of the interviewees live in single detached housings. Because thermal insulation is not compulsory, most of these structures do not include thermal insulation. The general freestanding nature of structures and lacking use of thermal insulation or resistant materials are major factors that lead to the intensive consumption of energy. As it was shown earlier in this thesis, the housing sector consumes 55% of total energy in Oman as a result of the aforementioned factors. Air-conditioning systems represents the major electric devise of energy consumption. According to the survey conducted in Muscat, the majority of interviewees use air-conditioning in their homes for an average of 17.5 hours per day in summer and nearly four hours in winter. Figures [114-115].

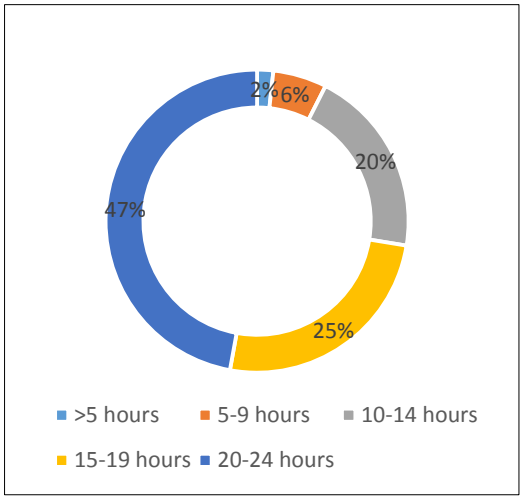


Figure 114: Percentage of time using for A/C per day in summer, mean=17.5 hours.

Source: Own calculation based on a field survey

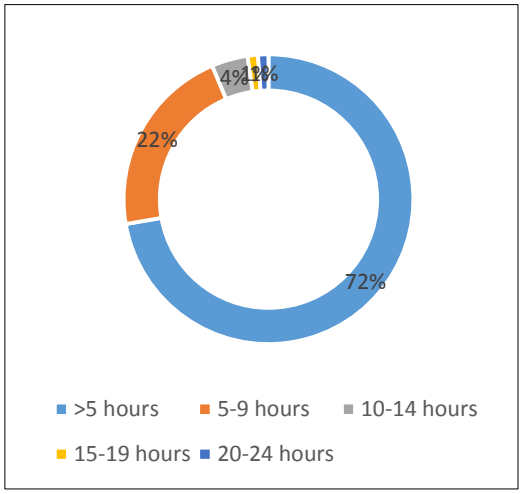


Figure 115: Percentage of time using for A/C per day in winter, mean=3.9 hours.

Source: Own calculation based on a field survey

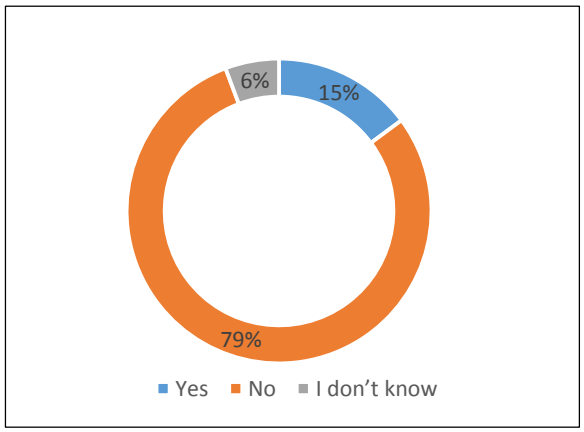


Figure 116: Availability of thermal insulation at residential unit.

Source: Own calculation based on a field survey

Picture 43: Low-density built form contributes to extreme consumption of energy.

Picture source: www.googleearth.com

4.4 Summary

This part initially indicated the urban growth pattern in Muscat in the period prior to the oil-age and the major transformation of urban growth which began since the production of oil. It is found that many problems have emerged in Muscat as a consequence of poor urban management since the oil production period at the start of the Seventies. Multi urban centers and sub-centers have emerged to cope with the rapid demand of land. Many dispersed areas have been created without any consideration to proximities from the existing developments.

These urban patterns, with the notable absence of public transport, have led to emerging a fully car-dependent society. The land allocating system has also contributed to creating wide gaps between development and scattered overall appearance. The planning policy has largely contributed the emergence of single land use and villa housing type as a common built-up structure for residential purposes. It has also found that huge areas in Muscat have been consumed for asphalted corridors and parking lots for car.

This part found many aspects that contribute to creating sprawl and fragmentation in Muscat's urban form. The interviews which were carried out with 175 Muscat inhabitants have shown many implications that have largely influenced the overall urban pattern and general lifestyle in Muscat. It found that our community is totally dependent on automobiles as 95% of Muscat's population has at least one car in their household. In addition to the obvious absence of public transport, the fragmentation of built form has largely encouraged people to use their automobiles for long and short journeys. Currently, cars dominate our lives. Socially, it has largely contributed of the fragmentation of family. Cars are not only a time and money drain but also represent the main reason for increases in the rate of death and injury in Oman.

In our community, a car is not merely a transit mean; it represents a source of pride and wealth indicator. Commonly, a person can be identified by the sort and color of the car he/she owns. It has been found that despite the highly increasing population is not the only blame of urban sprawl in Muscat. The consumption of land exceeds the population growth many times over. Urban management that involves land allocation and land use planning has not succeeded in promoting programs that ensure the conservation of natural resources and energy efficiency. The current affordable energy has largely contributed to creating dispersed land use and patchwork urban patterns.

The failure of executing Muscat's structural plans and housing studies that were executed from the early Eighties to the early Nineties have largely contributed to the emergence of the current scattered urban development. Although the structure plans involved many useful strategies and policies to manage the future urban growth, it ignored some more viable initiatives. For instance, the Structure Plan focused on the construction of new roads and the widening of existing roads to bear the expected traffic growth in Muscat. However, it neglected other efficient solutions such as boosting pedestrian pathways or improving the public transport system. The structure plan lacked viable policies or maps that include guidance for reducing the car-dependent attitudes.

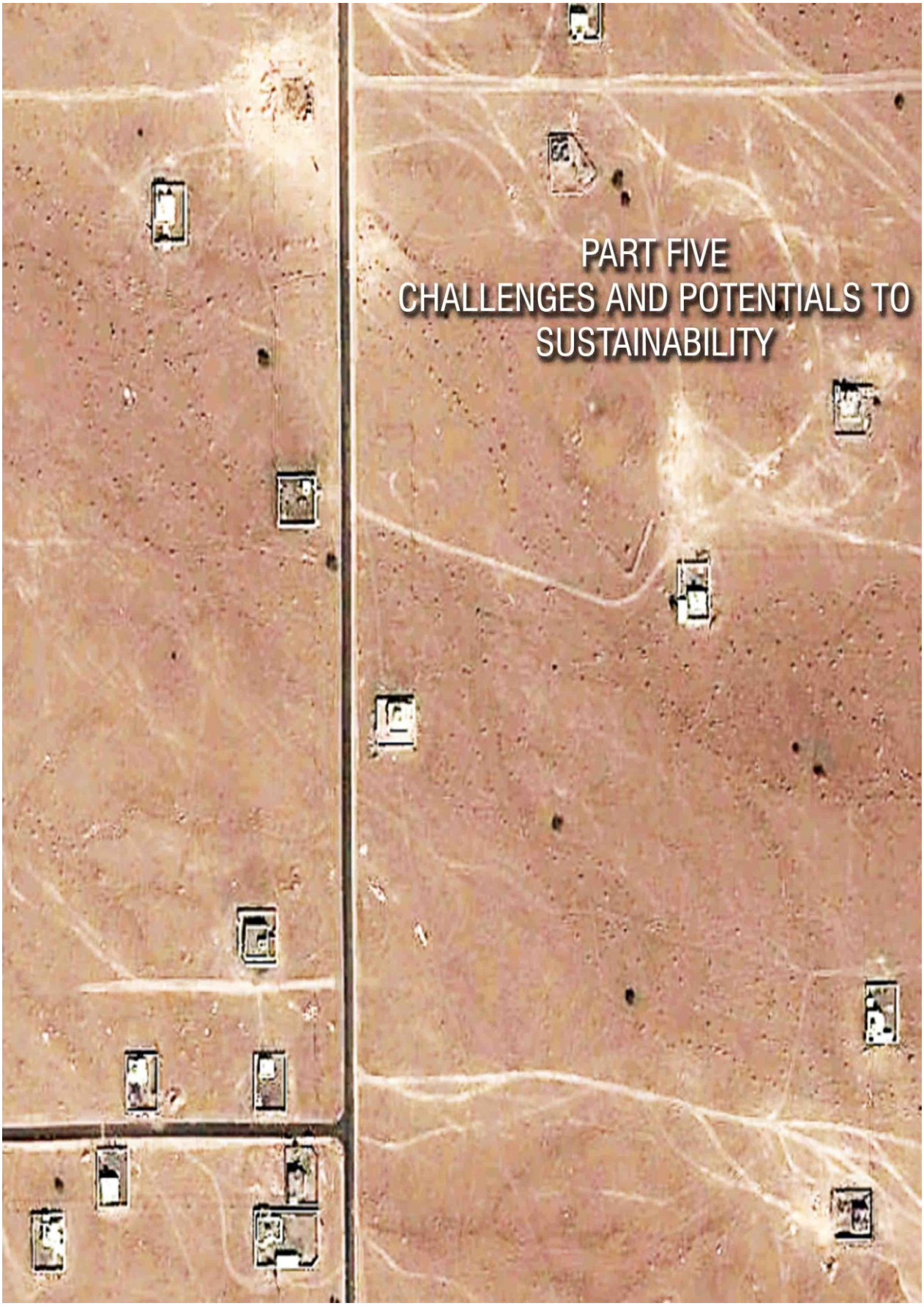
The absence of sustainable urban management has led to the emergence of many socio-economic and environmental problems. This part designates to what extent these problems have influenced the progress of urban development, the burden on natural resources as well as the comprehensive lifestyle patterns. It also explores these problems which can be labeled as the driving forces for urban sprawl phenomena in Muscat. Although the rapid population growth in Muscat (currently it holds about one third of the total population in Oman) is counteracted with the scarcity of appropriate land for housing development, the policy that determines land use, distribution of land and construction methods is not different than the rest of the Sultanate. Granting citizens a piece of residential land with an area of 600 square meters in Muscat where population is much denser and land is scarce, and in the same way gives another citizen in another area like Adam in Dakhliyah Governorate where population is low, an area of the same size, is not sustainable land distribution policy.

Villa construction as a type of residential building is practiced all over the Sultanate population without consideration of local demographic, geographical, social and climatic conditions. Table [22] summarizes the driving forces and the impacts of this in Muscat's current sprawled urban pattern.

Pillar	Driving forces	Impacts
Economy	▪ Muscat becomes a business hub due to economic growth.	▪ Decline of agro-fishing sector. ▪ Huge subsidies for transport infrastructure and public utilities ▪ Discontinuous and uncorrelated developments.
Social	▪ Rapid population growth due to natural population growth, internal and external immigration.	▪ The burden on natural resources is increased, i.e. lands, energy, water
	▪ Nuclear families.	▪ The demand on land for housing spaces is increased.
Governance	▪ Independence of decision making.	▪ Public feel unsatisfied
Urban management	▪ Lack of proper planning policies.	▪ Uncontrolled urban growth
	▪ Land Granting System based on random lottery. ▪ Lack of affordable housing in urban centers. ▪ Retardation of executing asphalted roads.	▪ Scattered low-density urban development in the city's outskirts. ▪ Destruction of natural habitat.
	▪ Failure of executing structural plan policies.	▪ Patchwork development
Urban form	▪ Multi urban centres.	▪ Fragmented development ▪ Increase transit time ▪ Spatial disorientation. ▪ High subsidy paid for infrastructure
	▪ Single use developments based on villa built on large lot size.	▪ Houses and services are disconnected.
	▪ Huge land reserved for governmental Institutions.	▪ Low density developments
	▪ Isolated strip and shopping malls.	▪ Excessive consumption of land and energy
	▪ Retardation of executing the basic infrastructural services.	▪ Lack of quality of place
Transport	▪ Private car dependency.	▪ Long transit time. ▪ High land consumption for car utilities (i.e. roads, parking). ▪ Large rate of footprint and pollution.
	▪ Lack of efficient public transport.	▪ High rate of gridlock, car accidents, deaths and injuries.
	▪ Lack of pedestrian and cycling pathways.	▪ High rate of non-communicable diseases (i.e. obesity, diabetes).
	▪ Wide corridors for car accessibility.	▪ High quantity of cars.
Environment condition	▪ Geographical factors (i.e. rigid terrain, valleys).	▪ Land becomes scarce.
Technology	▪ Lack of thermal insulation in buildings. ▪ Lack of utilizing energy-efficient building materials.	▪ Increase in energy consumption.

Table 22: Summary of driving forces and impacts of Muscat's current urban pattern

Source: the author



PART FIVE
CHALLENGES AND POTENTIALS TO SUSTAINABILITY

5. PART FIVE: CHALLENGES AND POTENTIALS TO SUSTAINABILITY

5.1 Introduction

Transforming the current urban areas from fragmentation and patchwork to sustainable urban patterns is a great challenge for all related parties of the future urban growth in Oman. 'The word sustainability brings essential social, ecological, and economic objectives together into one imperative.'[1] According to Towers (2005), 'for future urban growth, what is important is to create cities that provide a good environment for people to live, work and take their leisure; which have effective systems of servicing and management; and that are in balance with the natural environment.

If sustainability is to be achieved, it is necessary to draw from this diversity of contemporary cities the elements of urban form and function which can address both population change and environmental challenges.'[2] Towers also showed that 'urban growth continues to pose a challenge. There will still be a need to try to get human settlement in balance with the environment and with scarce resources. This means we will still need more dense urban development. We will still need housing forms which work well and which create successful and attractive urban neighbourhoods.'[3] These principles are crucial to conquer all the aforementioned challenges to reach the 'smart growth' notion which Walters and Luise (2004) identified as 'developing in ways that are environmentally responsible, economically viable, and well designed.'[4]

This part aims at detecting the potentials, including preconditions or resources that are considered as motivators to sustainability in the Sultanate and the challenges that might be faced in attaining this target. Economy Vision 2020 leads the government's efforts to eliminate the dependence on oil to the national economic revenue. In regards to the urban level, Oman National Spatial Strategy (ONSS) is a promising long-term strategy that attempts to achieve the sustainability in socio-economic levels to enhance the quality of life.

This part detects the ongoing experiences in the other Gulf Cooperation Council (GCC) countries in relation to transforming their socio-economic conditions towards the post-oil age. In other words, it provides significant schemes that have been experienced by other GCC countries that might be valuable as references for Oman to trace a similar route to assure transforming its society to the inevitable post-oil era. Therefore, this part intends to answer the third question of how to guide future urban development towards sustainability. Diagram [12] below highlights the state of sustainability in Oman.

[1] Condon (2008), p.5
[2] Towers G. (2005), p. 184
[3] Ibid., p.204
[4] Walters, D. & Luise, L. (2004). p.66

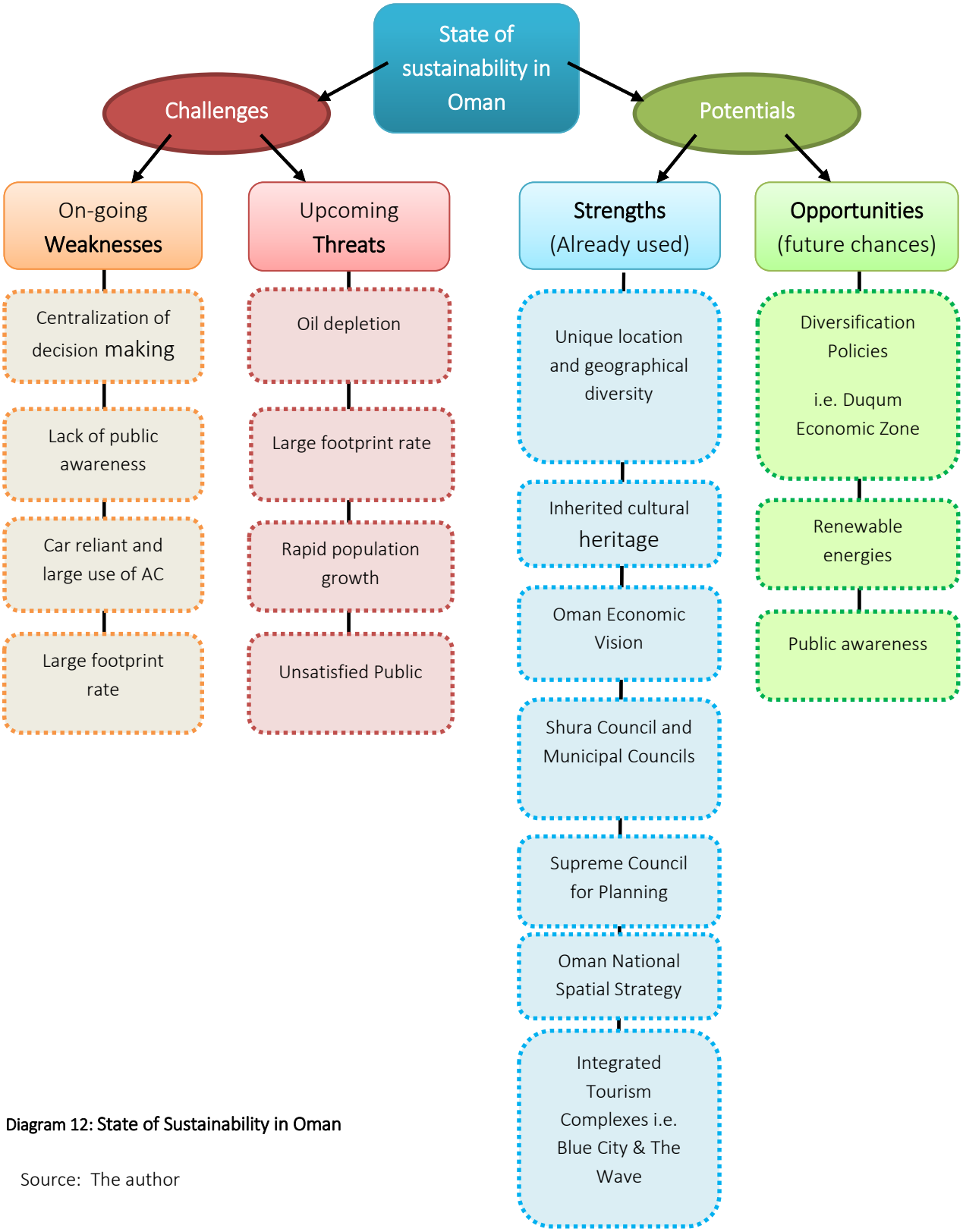


Diagram 12: State of Sustainability in Oman

Source: The author

5.2 Challenges

5.2.1 On-going Weaknesses

5.2.1.1 Oil dependency

It has already been mentioned in this thesis, since the four decades of oil production, Oman has become largely reliant on oil revenues. It seems that most strategies and policies that were adapted to diversify the income sources have not succeeded. That is obvious from the General National Budget 2012 which indicates that 81% is derived from the oil sector, and 84% in the Budget 2013. This represents a weak factor for how national resources are managed. This demonstrates that there is a big challenge for the local authorities in a time that the ongoing policies of diversification make it difficult to find reliable alternatives that might substitute oil revenues.

5.2.1.2 Centralization of decision-making

The current policies that are largely dependent on unilateral decision-making represent a source of weakness. Centralization of decision-making also includes all authorities associated with preparing the planning policies and those associated with executing the services and basic infrastructure. The current urban governance is blurred to a degree which largely influences the overall urban pattern. The authorities which are in charge of urban development are not integrated in an identical framework. The authorities in charge of the planning policy and the ones in charge of executing services have not demonstrated any reliable long-term policies for accomplishing a comprehensive linkage scheme. Consequently, the challenge for urban governors to move toward sustainability is to fill the gaps between those authorities so they can be integrated in the same framework of urban development.

5.2.1.3 Lack of public awareness

It is obvious that the current policies ignore public awareness as a significant factor for sustainable development. The intensive consumption of energy and water that were shown earlier throughout this thesis has partly occurred as a result of the lack of public awareness about the risk of depleting natural resources. Natural resources are considered the basis of life in every community. The wealth and the socio-economic stability in every society are always measured by the level of availability and quality of its natural resources and the way in which they are managed. Apart from renewable energy, it is well known that Oman has very limited natural resources.

In Muscat, as a particular case, land which is considered the main natural resource has been consumed intensively since the early Seventies. Despite the scarcity of lands which are suitable for cultivation and development, the existing planning policies and building regulations have largely contributed to the huge consumption of lands. Consumption of lands takes many shapes in Muscat in particular; transport infrastructure mainly for car provisions takes the lead as the largest lost area. In addition to street infrastructure, cars require huge areas in cities including parking lots at houses, workplaces, shopping malls, parks, etc. These areas, which are mainly suitable for agriculture or for economic investment or for public utilities, have to be asphalted to cope with the increases on traffic flows. Shopping malls are another example for the shape of the consumption of land, particularly in Muscat, as they require large areas of land for parking and car-accessibility.

Consequently, the challenge for urban governors is to reduce the demand for further land consumption and to preserve the remaining land for the coming generations. Alexander (1979) argued that 'the land which is best for agriculture happens to be best for building too. But it is limited and once destroyed, it cannot be regained for centuries.'[1] Consequently, protecting the farmlands from the expansion of urbanization to encourage the local production is a principal challenge for the future. Changing the consumption pattern of the local society is a major challenge for future urban governors.

According to Newman and Jennings (2008), 'changing the consumption patterns of wealthy nations will require a shift in urban values to reflect sustainability concerns. A key to reducing consumption levels is bringing consumption and production processes closer together through the regionalization and localization of economies.'[2] Newman suggested four strategies for sustainable consumption including: encouraging voluntary simplicity individually or communally through simplicity circles by helping people to find other non-consumptive ways of addressing their needs; initiating education programs for demand management by examining more carefully the environmental and social qualities of consumer goods to change the impacts of consumption; initiating sustainable procurement programs at all levels of government and in private corporations and organizations; and backing the "slow movement" which focuses on three issues in particular: slow food, slow cities, and slow traffic.'[3]

To sum up, the major challenge for urban governors is determining how to attain equilibrium among the need for continuous urban growth while preserving the natural resources and quality of life. Thus, natural resource management is crucial to ensure the successful transformation to the post-oil age.

5.2.1.4 Car reliant and large use of AC

As shown earlier in this research, cars dominate our lifestyles to a degree that a person can be identified by the type of car he or she owns. The most influential challenge to the future of our cities is to answering *how to change our community from a car culture to one that promotes walking, bicycling and using the public transport?* Nozzi (2003), in his book "Road to Ruin", argued that 'what every commuter ponders while stuck in traffic: how did cars take over our towns and our lives, what has it cost us, and what happens next?'[8] He added that 'for more people, using an automobile should be an *option* instead of a requirement for daily survival.' [4] The intensive usage of air-conditioning systems represents another ongoing weakness. As shown earlier in this thesis, there are many factors for the intensive consumption of air conditioning in buildings in Oman. For instance, the design of buildings that are based on cubic free-standing built-form, the lack of thermal insulation and the non-climate responsive building materials, are considered as the principal factors for the overuse of energy in buildings. The major challenge for architects and designers in the coming future is to create energy-efficient buildings that meet the criteria of sustainability.

[1] Alexander (1979), p.27
[2] Newman P. and Jennings I. (2008), p.189
[3] Ibid, p.191
[4] Nozzi (2003), p. xiii

5.2.1.5 Large ecological footprint

The Ecological Footprint has emerged as the world's premier measure of humanity's demand on nature. It measures how much land and water area a human population requires to produce the resources it consumes and to absorb its wastes, using prevailing technology. By measuring the Footprint of a population—an individual, city, business, nation, or all of humanity—we can assess our pressure on the planet, which helps us manage our ecological assets more effectively and take personal and collective action in support of a world where humanity lives within the Earth's bounds.[1] Moderate UN scenarios suggest that 'if current population and consumption trends continue, by the middle of the next decade we will need the equivalent of two Earths to support us. And of course, we only have one.'[2] White (2002) argued that 'until now people in the richer countries have expanded their use of resources without any regard for the environmental constraints of which we are belatedly growing aware.'[3]

Reducing the ecological footprint is also a major challenge for the developers who attempt to direct themselves toward more liveable and sustainable communities. As it has indicated earlier in this thesis, the lifestyle and living standards in Oman have been improving since the early Seventies due to oil production, this socio-economic transformation has led to intensive consumption of natural resources such as energy, food, timber, etc. The transformation from agro-fishing society has led to Oman being nearly fully dependent on imported goods which has consequently enhanced the rate of the ecological footprint.

Therefore, this high rate indicates that the consumption of natural resources exceeds what is naturally regenerated. As the natural resources in the country are so limited, they are at risk of running out if the current exhaustive activities persist for the coming future. Climatically, Oman is one of the hottest countries in the world due to its hot-dry climatic conditions. Therefore, it is considered one of the world's greatest consumers of energy per capita. Due to its little precipitation, water in Oman is normally generated via desalinating plants. Air-conditioning systems largely share the increasing individual consumption of energy as it is considered the most common technology that is used ubiquitously and persistently. Consequently, the challenge of reducing the rate of the ecological footprint is becoming crucial to ensure the effective utilization of natural resources. Since the population is rapidly increasing, we have to start calculating how much we consume in terms of natural resources to acknowledge the individual consumption pattern. This enables us to create ecological legislations that limit the consumption of natural resources per person and to raise the public awareness of using these resources. Figure [117] indicates that Oman has considered one of world's highest footprint rates.

[1] http://www.footprintnetwork.org/en/index.php/GFN/page/footprint_basics_overview/ Accessed 23-01-2010

[2] http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/ accessed 23-01-2010

[3] White R. (2002), p.131

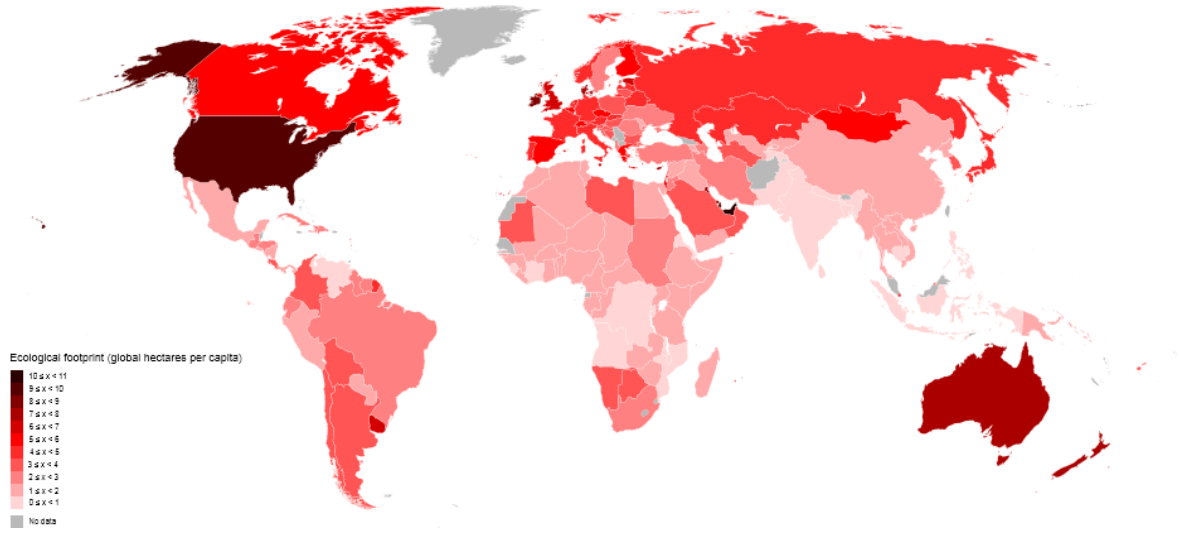


Figure 117: Oman is considered one of world's highest footprint rates

Map source:
http://commons.wikimedia.org/wiki/File:World_map_of_countries_by_ecological_footprint.svg
Retrieved on 28-3-13

Figure [118] tracks the per-person resource demand Ecological Footprint and bio-capacity in Oman since 1960.[1] It indicates the trend in the increase of the footprint rate in contrast to the gradual decrease in bio-capacity in the country. The total ecological footprint increased by 14% between 2010 and 2012 only which is considered as an at-risk rate for future development. Table [23] indicates the amount of change in the footprint rates in Oman between 2010 and 2012. Within those two years, the world's footprint rank of Oman has risen from 30 in 2010 to 14, as is indicted in Table [24].

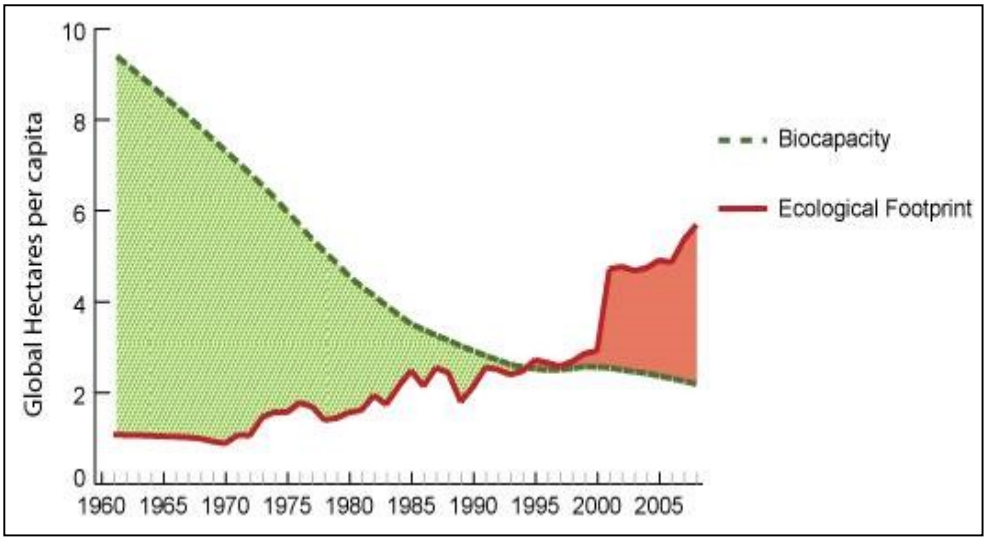


Figure 118: The change in footprint rate in Oman

Source: Global Footprint Network, found in http://www.footprintnetwork.org/en/index.php/GFN/page/trends/oman/ Retrieved on 28-3-13

[1]Biocapacity varies each year with ecosystem management, agricultural practices (such as fertilizer use and irrigation), ecosystem degradation, and weather, and population size. Footprint varies with consumption and production efficiency. Source: http://www.footprintnetwork.org/en/index.php/GFN/page/trends/oman/ Retrieved on 28-3-13

Comparing LPR 2010 and LPR 2012		
	LPR 2010	LBR 2012
Ecological Footprint per person	4.99	5.69
Ecological Footprint ranking	30	14
Biocapacity per person	2.14	2.20
Biocapacity raking	56	59

Table 23: Comparison of footprint rate in Oman between 2010 and 2012

Source: Global Footprint Network, found in http://www.footprintnetwork.org/en/index.php/GFN/page/trends/oman/ Retrieved on 28-3-13

Why are there differences in LPR 2010 compared to LPR 2012?			
	Per capita gha	Percentage change	Explanation
Total Ecological Foot print:	5.69	14%	
Carbon	3.27	2%	Source data revision;
Grassland	1.04	154%	Source data changed; Template improvement;
Cropland	0.74	5%	Source data changed; Template improvement;
Fishing grounds	0.37	-6%	Source data changed
Forests	0.16	6%	
Built-up land	0.11	-1%	
	Per capita gha	Percentage change	Explanation
Total Biocapacity	2.20	3%	
Grassland	0.07	1%	
Cropland	0.09	-8%	
Fishing grounds	1.92	3%	
Forests	0.00	3%	
Built-up land	0.11	-1%	
*All countries carbon Footprint decreased 27 percent due to a revision in oceanic carbon sequestration			

Table 24: Change in Oman's rates of ecologoical footprint and biocaptity beteen 2010 and 2012

Source: Global Footprint Network, found in http://www.footprintnetwork.org/en/index.php/GFN/page/trends/oman/ Retrieved on 28-3-13

5.2.2 Upcoming Threats

There are many threats that might counteract or hinder the attempts to attain sustainable urban growth. These major threats include oil depletion, climate change, public dissatisfaction, rapid population growth and destruction of local habitat. According to Newman and Jennings (2008), 'awareness is growing of two critical energy-related issues, climate change and oil depletion, that will be key forces shaping the future of cities.'[1]

[1] Newman and Jennings (2008), p.35

5.2.2.1 Oil Depletion

Obviously, oil depletion is not a local issue but has emerged as a global dilemma as oil remains the principal source for energy while other alternatives have not yet achieved a critical mass. 'We are in the era of 'peak oil' – the point at which the maximum rate of global oil production is reached. The era of cheap hydrocarbons is coming to an end'.[1] According to Gilbert and Perl (2008), 'the most important feature of coming oil depletion we want to convey to government officials is its imminence. There appear to us to be some government officials who understand something about oil depletion but believe the challenges to be so far in the future that early effective action is not warranted. An understanding of the potential imminence of oil depletion could be a stimulus to timely and effective policy making.'[2] Box [12] shows some key points that have been offered by the Oil Depletion Analysis Center (ODAC).[3]

Box 12: The points that are offered by the ODAC

- Oil is the world's premier source of energy and is fundamental to almost every important function of modern life. It fuels 95 percent of land, sea, and air transport, so the efficient movement of raw materials and goods, as well as personal mobility, is almost entirely oil-dependent. . . .
- Global demand for oil has increased seven fold over the past half-century due to rapid population growth and industrial expansion.
- Oil industry leaders acknowledge that new sources of oil are becoming increasingly difficult to find and more costly to exploit. . .
- The world has now consumed almost half the total amount of conventional oil most experts estimate will ever be available for recovery. . . .
- A growing number of experts now foresee a permanent downturn in global oil production rates within a matter of years and perhaps even decline rates of 5 percent could set in. . . .
- As growing demand exceeds available supplies, oil prices will rise substantially and the effects will be felt throughout the global economy. . . .
- The world will become increasingly dependent on oil from the Middle East as supplies from elsewhere decline. Already over 50 oil-producing countries have passed their peak production, including the United States, once the world's largest producer, which now relies on imported oil for over 60 percent of its domestic needs. . . .
- The productive capacity of Middle East oilfields is uncertain and the risks of supply disruptions are heightened by continuing political instability in the region. . . .
- The era of cheap, plentiful supplies of oil is coming to an end, requiring fundamental restructuring of the world's urban energy systems. . . .

Source: Newman & Jennings (2008), pp.36-37

[1] Adams and Jeanrenaud (2008), p.36
[2] Gilbert R. And Perl A.(2008), pp. 6-7
[3] The Oil Depletion Analysis Center (ODAC) is an independent, UK-based charity formed to enhance international public awareness and foster improved understanding of the issue of global oil depletion.

As one leading oil producer puts it, 'energy will be one of the defining issues of this century. One thing is clear: the era of easy oil is over. What we do now will determine how well we meet the energy needs of the entire world in this century and beyond.'[1] Therefore the major challenge that confronts cities in the future is how to transfer their economies from an oil-basis to sustainability-basis in order to allow future generations to live in a healthy environment with less using of non-renewable resources. Whilst we realized that fossil fuel-based energy has ended, our city design based on consumption of natural resources and poorly-managed technology has destructed our environment, it is urgent to start thinking about the future of our cities. It is wise to think about alternatives which can provide affordable and sustainable cities based on comfortable urban life. In Oman, since the oil revolution, urban sprawl has been invading the green areas which were the main food producers before the oil-age. For example, the Batinah Plain has transformed into a massive patchy urban form since the oil revolution which started in 1968.

Fossil oil is considered the most viable fuel to supply our city structures with energy, and it remains the main contributor of world energy consumption. However, if we observe the general performance of crude oil recently, we realize that oil depletion is ahead. Some countries have already reached peak oil while others have begun recording a decline in their oil production. The depletion of oil might encourage urban designers and architects to develop urban structures with less reliance upon inevitably depleting fossil oil energy. Thus, peak oil now is ahead and we should be ready to transform our life and cities to the post-oil age. Figure [119] illustrates this argument. The facts indicate that Oman's economy based on fossil oil, which has total proven reserves of only 5 billion barrels according to the World Bank Estimations. See Figures [120-121].

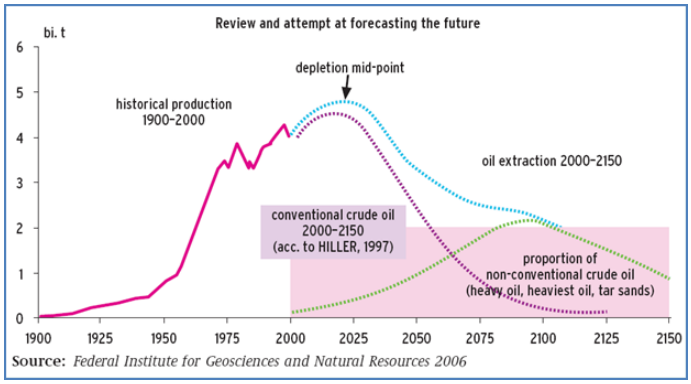


Figure 119: Forecasting graph of oil's future

Source: Federal Institute for Geosciences and Natural Resources.

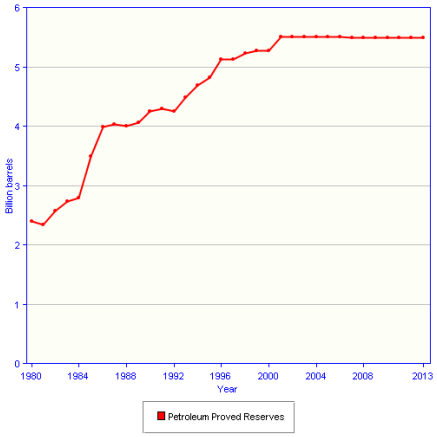


Figure 121: The level of oil reserves in Oman

Source: EIA http://www.eia.gov/countries/country-data.cfm?fips=MU&trk=m#pet retrieved on 04-05-2013

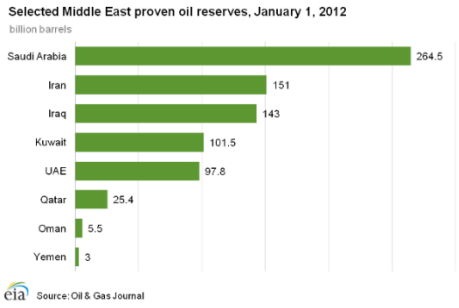


Figure 120: Selected Middle East proven oil reserves

Source: EIA http://www.eia.gov/countries/analysisbriefs/Oman/oman.pdf downloaded on 04-05-2013

[1] Chevron Corporation, http://www.willyoujoinus.com.

These reserves might run out within approximately thirty years. Obviously the government has begun to search for alternatives and other supporting incomes such as natural gas, tourism, industry, etc., yet our economy relies on the fossil oil sector since it forms '47% of the Sultanate's GDP.'[1]

Now, we have realized that oil has reached its peak and that it is now heading toward depletion. Back to the question that this thesis raises: "What will happen when oil is depleted? Obviously, it is inevitable; what has been accomplished to confront this inevitable fate? Are our cities and societies prepared for the inevitable post-oil era? What are the challenges that influence the transformation to this goal? D. Kumeta (2009) argued that "the intra-regional distinction between energy-rich and energy-poor states will play a critical role in shaping future relations with external actors. At 2006 production rates, Bahrain and Oman, together with non-GCC member Yemen, are projected to exhaust existing oil reserves by 2025. They consequently face imminent transitions to post-oil states.'[2] The local consumption of oil has sharply risen due to the rapid growth of population and private transportation. See Figure [124].

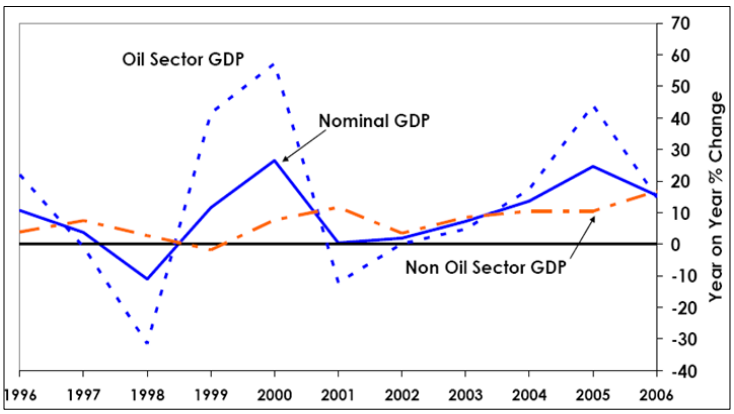


Figure 123: Oil participation to GDP.
Source: MNE, 2008

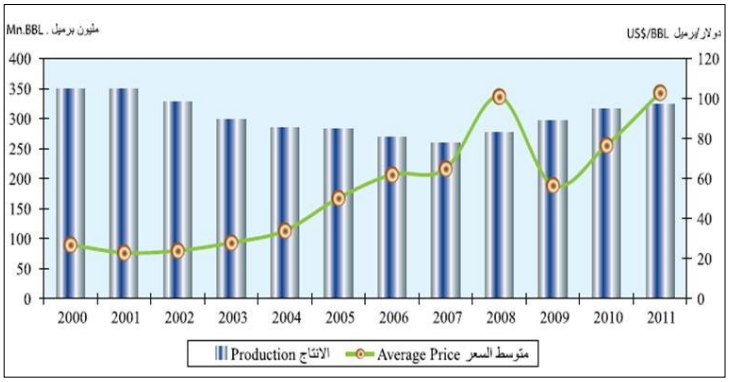


Figure 122: The change in crude oil in Oman, production and average price.
Source: NCSI, 2012

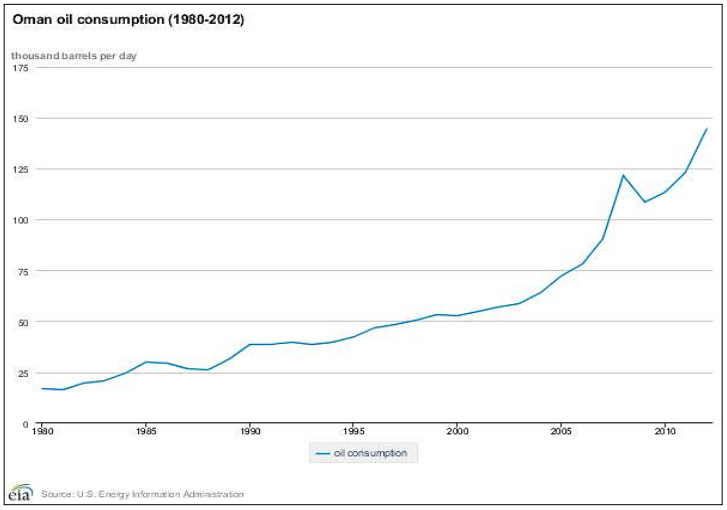


Figure 124: Oman Oil consumption
Source: EIA http://www.eia.gov/countries/country-data.cfm?fips=MU&trk=m#pet retrieved on 04-05-2013

[1]MNE (2008)
[2] Climate change in the Persian Gulf – regional security, sustainability strategies and research needs (Paper for the Conference: "Climate Change, Social Stress and Violent Conflict", Hamburg, 19 & 20.11.2009.

5.2.2.2 Climate change

A wide range of international debates and manifestos have been attributed to the issue of 'climate change'. Newman and Jennings (2008) argued that 'climate change poses an increasing threat to urban governance and human health.'[1] The United Nations estimated about US$60 billion in costs due to the global climate disaster in 2003 alone (UNEP 2003).[2] Cities are causing most of this climate change, as they account for 75 percent of the world's fossil fuel consumption, and cities will be the most impacted if they do not change (World Council on Renewable Energy 2005).[3] It is widely known that there is a potent correlation among climate change and the sustainable development. GSDP (2009) indicates that 'the impacts of climate change can hinder development progress and development choices will themselves influence the capacity to mitigate and adapt to climate change. The potential impacts and mitigation of climate change therefore need to be analyzed within the context of sustainable development. Climate policies can be more effective when consistently embedded within broader strategies designed to make national development paths more sustainable.'[4]

The Omani society in general, and Muscat's population in particular, have realized to what extent the climate change can threaten their lives since two blasted cyclones have struck most of the coastal cities over the past five years. The serene oceans that have long been utilized as a main source of food and for sailing have recently become a threat to the coastal inhabitants. Enormous loss of life and property were due to the two cyclones. Many development schemes and projects were setback or terminated to reform the damages of the basic infrastructure. Moreover, climate experts indicate that Oman is in the vicinity of future cyclones and hurricanes that may occur as a result of the unstable climate conditions between the warm Arab Sea and the Indian Ocean in Eastern Asia (i.e. tsunamis).

The initial reaction from the government was establishing the first ministry in the Gulf Region which is intended to pursue and predict the climatic conditions. The Ministry of Environment and Climatic Affairs which was established right after the strike of Cyclone Gonu in 2006 is expected to undertake a great role in relation to minimizing the impact of natural disasters and climate change. Obviously, the pattern of urban development can also diminish the impact of the climate change disasters through many urban design guidelines, such as outlaying the pattern of urban growth strictly in respect of water-runoff areas. The climate change and the rise of temperature have posed big challenges for architects and urban designers.

Globally, buildings consume more than half of all energy consumption and produce more than half of the overall polluting gases which are the main reasons for the climate change. In addition the oil crises in the 1970s, the green design movement has emerged as a practical response to reduce the reliance on fossil-oil energy and reduce the amount of gases that harm our environment.

[1]Newman and Jennings (2008), p.36
[2]UNEP (United Nations Environment Program) (2003)
[3]World Council for Renewable Energy. 2005. 13-15 June.
[4]General Secretariat for Development Planning. (GSDP), (2009), p.102

With the current cubic free-standing design, air-conditioning systems represent the highest consumer energy-consumption device in any single building in Oman. In most buildings the air-conditioning systems work 24 hours a day to keep the inner spaces habitable. Consumers do not care about the amount of energy consumed because the cost of energy in the current oil-age is still modest. However, with potential energy crises following the forthcoming depletion of oil, this public illusion has to be changed. The challenge for architects and urban designers will be great to adapt the policies for energy efficiency to provide a rapid response for climate change. One of the effective responses is to reduce the consumption of energy in houses by adapting the notion of the 'eco-house'. The competition of 'eco house' among local universities, which was sponsored by the Research Council in Oman in early 2012, is considered as a significant step for exploring the criteria of sustainability to reduce the consumption of energy in construction sectors.

5.2.2.3 Rapid population growth

The census of 1993 indicated that Omani society is a young society due to the higher proportion of children under 15. Despite the slight decrease of family household members from 9 people in the 2003 census to 7.5 people in the 2010 census due to the growth of working women, the rate is still very high compared with the global level. Census 1993 highlighted the challenges that will confront society because the rate of fertility has accelerated more than the economic growth, while the rate of consumption of natural resources consistently remains higher, mainly with non-renewable resources. In 1994, the government launched a program using anti-pregnancy techniques that supports married couples to limit the number of children they wish to have, and to facilitate determining when they want to procreate. In addition of the transformation of socio-economic conditions and decline of the average marriage age, this program has contributed to a drop in the overall rate of fertility to nearly half of that in 2003.

5.2.2.4 Unsatisfied Public

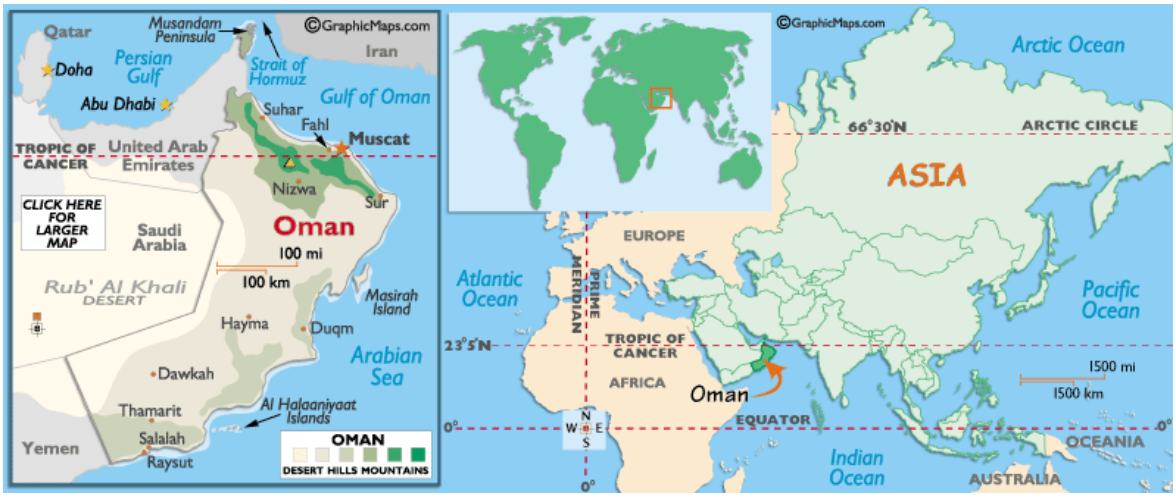
Local policies which rely on unilateral ordinance sources represent an influential threat for the coming future. The dis-involvement of local people in decision-making and participation in the urban development process generates unsatisfied generations and reduces the rate of general stability and public security. The emergence of the so called 'Arab Spring' in 2010 is a result of these unilateral actions that aim to funnel local freedom.

5.3 Potentials

5.3.1 Strengths (already used)

In most parts of Oman, the local community still demonstrates its cohesion and coherence, particularly at public events such as the religious events, weddings and funerals. These social activities are inherited from Omani heritage which consolidated the notion of compactness and unity as unique features which were expressed in the compacted built form.
There are more than 3,000 kilometers along the coast of Oman overlooking three oceans: Arab Sea, Gulf of Oman and Persian Gulf. These stunning coasts can be utilized for attracting more investments in tourism, and for other economic purposes, similar to Dubai and other GCC countries.

The official statistics indicate that people prefer living in urban areas where basic services are mostly available. Therefore, the government has expanded the regional development schemes through the Five-year Development Plans (please refer to part 3 for more detail about the main objectives of the five-year plans). The schemes include the continuation of basic infrastructural projects and the orientation of economic investments towards various cities. This is significant not merely to control the internal migration but also to ensure the appropriate distribution of population along with the available resources at every administrative area.



Picture 44: The strategic location of Oman

Source: www.worldatlas.com retrieved on 23-5-2012

5.3.1.1 Oman Economic Vision 2020

The Oman Economic Vision 2020 was launched as a result of the 'Oman 2020' conference organized in Muscat in June 1995. The main target was to shift the national economy to a bright era of development. Obviously the vision offers various requirements as endeavors to attain gradual success in other sectors over the oil sector which dominates the general GDP budget. The conference insisted that by the year 2020the national economy will no longer rely on oil, but will be diversified with higher levels of savings and investment from non-oil sectors. The common aims and targets of Oman Economic Vision 2020 are highlighted in Box

[13]. Oman's Economy Vision 2020 final report indicates the major challenges that Oman's economy faces in the effort to achieve economic balance and sustainable growth as is shown in Box [13]. 'In view of the necessity to gradually reduce reliance on oil, it is necessary to increase non-oil revenues, whether taxable or non-taxable, so as to raise their contribution to not less than 60% of gross revenues by 2020. Positive development will occur in the structure and growth rates of the GDP as a result of the aforementioned changes that will result from the application of approved program policies. These approved policies will lead to an increase in GDP growth rates throughout the next twenty-five years. The GDP growth rate is expected to increase from 5.8% in 1995, to more than 7.4% in 2020.In addition, this acceleration of growth in the national economy base will result primarily from the upgrading and growth of non-oil sectors. The diversification of this base represents the main guarantee of the national economy's sustained growth for the period after 2020.[1]

Hence The Economy Vision 2020 expected the national economy will share merely 9% of the GDP within 25years (1996-2020), see Table [25]; the year 2011 designates that 15 years have passed from the vision's time line. However, the ratio has recorded an increase in the oil contribution to GDP rather than the targeting ratio. Therefore, there is no clear progress to reach the desired ratio in 2020 because oil remains the dominant sector for the national economy. Decreasing the oil participation from 33.5% to 9% within 25 years means a ratio of 1.28% annually has to be handed over to the non-oil sectors; this target has not yet been achieved.

Box 13: Common aims and targets of Oman Economic Vision 2020

A. Aims:

- Economic and financial stability.
- Reshaping the role of Government in the economy, and broader private sector participation.
- Diversification of the economic base and sources of national income.
- Globalization of the Omani economy.
- Human resource development and upgrading the skills of the Omani workforce.

B. Targets:

- The crude oil sector's share of GDP is estimated to drop to around 9% in 2020, compared with about 41% in 1996.
- The gas sector is expected to contribute around 10% to GDP in 2020 compared with less than 1% in 1996.
- The industrial sector is where the major change is envisaged with the non-oil sector's contribution rising from 7.5% in 1996 to 29% in 2020.

Source: MNE, Oman's Economy Vision 2020 final report chapter 2, prepared by the author

[1]MNE, Oman's Economy Vision 2020 final report, chapter 2

Activity	1995	2000	2020
oil	33.5	25.9	9.0
Gas	1.5	5.0	10.0
Agriculture	3.0	3.5	3.1
Fishing	1.1	1.0	2.0
Mining & Quarrying	0.6	0.6	2.0
Manufacturing	5.4	6.8	15.0
Electricity & Water	1.7	4.3	2.0
Building, Construction & Real Estate	3.2	6.9	10.0
Trade & Tourism	14.1	17.8	18.0
Transportation & Communication	7.0	8.6	8.0
Banks, Insurance & Financial Services	7.9	4.3	8.0
Other Private Services*	8.3	3.2	5.0
Public Services	13.9	12.6	10.0
Other Services**	-1.2	-5.0	-2.1
Gross Domestic Product	100.0	100.0	100.0

Table 25: Sectoral Relative Shares to GDP (%) 1993-2020 as targeted in Oman Economic Vision 2020. Source: MNE *Oman's Economy Vision*

Box 14: Major challenges facing Oman's economy in the effort to achieve economic balance and sustainable growth according to Oman's Economy Vision 2020 final report

- The increasing deficit in the general budget; a decline in financial reserves; levels of public debt that must not be exceeded; and instituting a mechanism for achieving equilibrium in the public finance.
- The dependence of the national economy on a single depletable source (oil), which is affected mainly by external economic and political factors.
- The expected gradual decline in the oil reserve in the coming twenty-five years.
- The prominence of the government role in the goods and services production fields, which limits the opportunities available for the private sector in these fields.
- The lack of certain laws and systems for the provision of a suitable environment for the growth and diversity of private sector activities.
- The weak integration between the oil sector and other production and services sectors. All production and services sectors are characterised by low efficiency and poor quality, which reduces their ability to compete at international level.
- The poor production efficiency in government systems and the inefficient utilization of available resources.
- The low levels of private saving and investment rates and the increasing consumption tendencies.
- The existing disequilibrium in the labour market, including the low level of national labour participation and the expansion in the employment of expatriate labour.
- The poor productivity of human resources, the low status of some professions and handicrafts, in addition to their insignificant participation in the national economy.
- The incapability of national labour to cope with the rapid developments in the technological field.

Source: MNE, *Oman's Economy Vision 2020 final report chapter 2*.

5.3.1.2 Shura Council and Municipal Councils

Oman has experienced Shura (consultation) with various strides over the past three decades. The first practice was with Majlis Al Istishari (Consultative) which was established by His Majesty the Sultan in 1981. The council's members were appointed by His Majesty himself without any participation from civil society. However, in 1991, Majlis A'Shura (Consultation Council) replaced Majlis Al Istishari, and so embarked on a new era of democracy in Oman. Every Wilayat with population of 30,000 and above could afford two representative candidates whereas those Wilayats with less than 30,000 of population are represented only by one candidate. The principle role of Shura Council, as it was initially declared, was to attain a large area of democracy and merge the civil society with government in decision-making to the governmental plans and policies. Although the new council deluded the civil society with its fully elected members from the local people, its role was limited to express opinions to the central government for some projects that are presented to it without any legislative or executive role. Despite the recent legislative and oversight powers that have been awarded to the council, such as consulting and monitoring the governmental ongoing and upcoming projects, accountabilities tasks that are published in the council's official website ensure that the council remains merely an adviser for the government. The words *revision, give opinion*, *provide recommendations, examine*, etc. are most common initials for the tasks' articles. Despite the new candidates that have tried to change this general vision by raising some queries that dealt with some of the economic and financial issues, they have received the regular response, which maintains generalization and not details. This explicates the bulky gap between the Shura Council and the decision-makers.

In the past, just before the production of oil, the Sablah was considered the society's parliament venue hosting all of society's parties under one roof. The Sablah, which derived its roots from Omani inherited customs, is a remarkable platform for unity, consultation, exchange of knowledge and resolution of social problems. However, the role of this cultural heritage venue has been dismissed since the emergence of 'Public Majlis' or 'Public Sablah' that replace the traditional Sablah. Despite the recent notable growth of Public Majlis which are varied in form, size and function, the new structure has lost its authentic value and character of being a symbol for every local community.

In contrast with typical the old Sablah, which was positioned carefully at the core of the neighborhood's fabric, nowadays increased number of Public Majlis at every district has notably led to the society's disunity and tribal fragmentation. Since the socio-economic transformation, the new Sablah has no longer been an influential place that utilizes the major forms of social interactions. Its role has been confined to a meeting place for weddings and funerals. Sometimes, the number of Sablah in a village or a district exceeds the actual needs. A fraction of a tribe or even cousins have become owners of independent Sablah buildings which are utilized exclusively for their occasions. Apart from its main function as a meeting space for the flocks of people who attend the ceremonies, funerals consolations, or weddings, people have become competitive about the size and form of their Sablah building as it reflects the status and power of the owners. People have become proud of how large the Sablah is that they own. In contrast they do not care about how much area is consumed for these buildings and their utilities. In fact, plenty of area is consumed for developing these particular structures. In addition to its large size, this structure consumes large areas for parking lots.

Municipal councils have played essential roles of governing the local civic society in modern civilizations. However, in Oman, these councils have been absent until recently when it was announced in late 2011 that a municipal council would be established in every governorate. Like Shura Council, every municipal council involves locally-elected candidates. There will be '11 municipal councils to represent the eleven governorates in the Sultanate. The Municipal Council will consist of representatives of each Wilayat according to the number of Omanis in the Wilayat.'[1]

The general aim for the Municipal Councils is to 'contribute significantly to the development of the governorates and give citizens, through their membership in the council, the right to participate in development plans and minimize centralization, thus contributing to the development of the local economy.'[2] In order to attain the decentralization on decision-making, 'decisions on local levels will gradually become more decentralized and in the hand of those who are in the Wilayat. The elected members of the Municipal Council have the right to make decisions and recommendations in three committees/areas: health, social and environment committee; general affairs committee; and legal affairs committee.'[3]

The general distinction between the work of Shura Council and Municipal Council is that the first one is 'a legislative council empowered with regulatory and administrative authorities, whereas the municipal council is a developmental and service council which has nothing to do with legislation and regulating and operates within the framework of governorates only.'[4]

5.3.1.3 Supreme Council of Planning

The Supreme Council of Planning is considered as a potential element that represents a strong element for future development. 'According to the Royal Decree No. 30/2012 issued by His Majesty Sultan Qaboos Bin Said about establishing the Supreme Council of Planning, the council aims to achieve sustainable development and to find mechanisms that will implement policies and strategies to achieve economic diversification and exploitation of resources.

The council, in order to achieve its goals, should exercise the following authorities:

- Putting a comprehensive national strategy for long-term development in the light of natural and human resources available and the sustainable development requirements.
- Planning future vision, the general trends, and mechanisms required for implementation of strategies to achieve sustainable development goals.
- Implement real estate strategy for the Sultanate and approving the general policy of urban planning in the light of the approved development plans and in accordance with economic, social and environmental status.
- Implement a national strategy for statistics and information.
- Implement standards for the priorities of development projects and methods of development planning, ensuring a balance between economic and social aspects of development.
- Approve annual development budget.
- Adoption of the draft of five-year development plans and financial allocations for it.

[1] http://oman.dxbwebsite.com/municipal-council-polls-move-hailed/ accessed 3/7/2012
[2] http://www.omantribune.com/index.php?page=news&id=119664&heading=Oman accessed 3/7/2012
[3] http://oman.dxbwebsite.com/municipal-council-polls-move-hailed/ accessed 3/7/2012
[4] http://www.omantribune.com/index.php?page=news&id=119664&heading=Oman accessed 3/7/2012

- Carrying out a periodic evaluation of strategies, future visions, public policies and the five-year plans, taking into consideration the economic, social and other developments.
- Set the basis of the Sultanate's economic cooperation with states, regional and international organizations.
- What is referred by His Majesty the Sultan to be studied.'[1]

5.3.1.4 Oman National Spatial Strategy (ONSS)

Oman National Spatial Strategy (ONSS) has been initiated to be a 'long-term strategy that will have far reaching benefits to the people, the government has decided to efficiently and optimally make use of land to support balanced regional growth and thereby achieve social economic development. The 30-year plan is considered to be a systematic response to the government's intention to promote balanced regional development.'[2]

The main objectives of the Oman National Spatial Strategy can be summarized in the following[3]:

- Optimize utilization of land and natural resources by proper allocation of land for development of economic sectors, social and physical infrastructure while protecting the environment including natural and cultural heritage.
- Identify the strategic needs of the country in terms of infrastructures and services.
- Fostering geographical balance through equitable distribution of development programs among the various governorates/regions of the Sultanate and utilize the comparative advantages of each governorate/region to sustain intra- and inter-regional integration.
- Achieve a balanced urban growth for cities and to promote rural development.
- Facilitating the development of various enterprises.
- Improve and upgrade the social services and infrastructure in both urban and rural areas.
- Achieve integration between planning activities and policies and availing required data for planning purposes and decisions making through the establishment of efficient planning system for the purpose of the proper implementation of the National Spatial Strategy.
- Achieve higher levels of participation of national workforce in economic activities.
- Establish an integrated system for geographical data and information (GIS) required for planning purposes in various fields.

Though the researcher reveres all content in this ongoing scheme, it is better if it integrates other principles such as economic development, social development and environmental development as is exemplified by Qatar Vision 2030 (see the next chapter). Otherwise this scheme will not make a major difference from the previous schemes such as the structural plans which were prepared from the late Nineties until the early Seventies, and none of them were executed.

[1] http://www.omantribune.com/index.php?page=news&id=120817&heading=Oman accessed2/11/2012
[2] http://www.timesofoman.com/innercat.asp?detail=38417 accessed on 12/09/2011
[3] Ibid

5.3.1.5 The Wave and Blue city

The Wave and Blue City are considered significant examples of compact city developments. The Wave, in Muscat, is a US$3.5 billion mixed-use residential and commercial project whose ownership is shared among three stakeholders. The Wave has over 6 kilometers of natural beach, and will include a Greg Norman 18-hole championship golf course, landscaped parks, five star hotels and a vibrant marina with a variety of restaurants, upscale shopping and leisure opportunities.[1]

Picture 45: The Wave offers range of housing choices in one place
Pictures source: The author

Its location is close to Muscat International Airport and it was designed by Atkins. The total developed area is nearly 2.5 square kilometers. The most important progress in The Wave, it is believed, is the provision of this type of unique urban landscape in one place which is very exclusive compared with the scattered urban developments which are seen in all areas of Oman. In spite of the fact that public transport is not involved in the project, the mixed-use development and the proper urban density represents the vital utilization of land compared with the planning areas which are granted to the local citizens. In comparison with normal urban development, this project reduces the cost of living and the consumption of energy. In other words, mixed-use development ensures that living, working and leisure places are within reasonable reach because all distances do not exceed six kilometers.

Figure 125: The Wave Muscat master plan. Source: www.thewavemuscat.com

[1] www.thewavemuscat.com Greg Norman is a well-known golf player

Blue City is not only much larger than The Wave but it is considered the largest accumulated urban development in the Sultanate. Blue city, in Arabic called *Madinat A'Zarqa*, is a '32 square kilometer' area located on a natural peninsula in *Sawadi* just an hour drive north of Muscat. The coastal city will be built along 16 kilometers of shoreline along the Gulf of Oman. The whole project which will cost US$15-20 billion is subdivided into ten phases that will take 12-15 years to complete. The city will house '200,000 inhabitants when the construction of all phases is completed. Therefore, the density is estimated to be 6,250/square kilometer which is fairly higher than the habitual urban areas that are granted to citizens. 'The Blue City is more than just a resort real estate development; the city is being designed and built to include all the elements needed for a thriving metropolitan community. The organization behind this progressive project is Al Sawadi Investment & Tourism Company (ASIT) which has the endorsement of the government of Oman to bring this massive urban development to life.'[1]'

The Blue City will serve as a growth engine for the Omani economy and will radically expand the tourism facilities in Oman. The city will generate large-scale employment opportunities for Omani nationals, promote property ownership for nationals and expatriates alike and serve as a hub for leisure activities in the Sultanate. Freehold ownership laws are already in place and the Oman government was the first of the Gulf countries to bring clarity and transparency to property ownership legislation. It will not only be an important component of Oman's 21st century economy, but will also contribute to the sustained economic development of the Sultanate by attracting value, enhancing seed investments and making it a catalyst for commercial investment and tourism. The project forms part of Oman's drive to diversify its economy and attract non-traditional business, commerce and tourism to the Gulf States. Oman 2020, the Sultanate's visionary diversification plan, will gradually reduce the country's dependence on oil. The project which is conceptualized according to the highest international standards and applies the principles of sustainable development and eco-friendly design, aims to attract direct foreign investment and some of the top global players as operators for the facilities.'[2]

The master plan which is designed by Foster & Partners represents the 'compact city' settlement that is inspired by 'traditional Omani architecture integrating sustainable and contemporary lifestyle with the optimum urban density. The master plan has a richly layered grain, comprising a series of clustered communities with private courtyards and narrow, winding streets that fuse seamlessly with an efficient transport and road network extending across the site.

Picture 46: Blue city will be developed within ten phases

Source: http://www.almadinaalzarqa.com/

[1]Article:MD & CEO - Al Madina A'Zarqa found in: http://www.omanvistas.com/2008%20year%20end%20issue/al%20madina.html1/6/2012

[2]The Golden Book of the Sultanate of Oman: Development & Prosperity, The Official Publication of Federation of Gulf Cooperation Council Chambers, found in: http://www.geocfrance.com/Free%20Download/Golden%20Book%20of%20Oman%20Final.pdf 1/6/2012

A contained city, there will be schools, a university, stadia, golf facilities, a concert hall, marina, hotels, health facilities, souqs, as well as further retail and amenities serving the individual communities. The beaches will be improved to the highest resort standards and the creek (or Al Khor) extended, with hotels, restaurants and a pedestrian route concentrated along the water front. A further network of shaded, pleasant pedestrian routes continues throughout the site, while the wider roads are characterized by a careful balance between pedestrians, cars and public transport. Each residential community will have its own identity. The apartment buildings will offer residents their own private courtyard and discreet car-parking. The material palette will comprise locally-sourced stone and timber. Borrowing from the indigenous architectural heritage, the design is small-scale, compact and organic. It is inherently sustainable through passive means, such as natural ventilation, careful orientation – to minimize direct sunlight and maximize ventilation – and the manipulation of the thermal mass of the buildings. The communities have a layered concentric structure, with each layer becoming more private and intimate as it retreats to the heart of the residences – respecting Omani traditions of privacy and an internalized architecture as seen in the Omani heritage settlements of Bahla and Manah. Designed to appeal to a diverse social mix, the city will grow to be a dynamic social-economical combination of integrated land use.'[1]

The first phase which covers 2.2 square kilometers of built-up areas was also designed by Foster &Partners. In addition to 5,500 residential units which will house around 27,000 inhabitants, the first phase also involves luxurious hotels, one 18-hole golf course, a marina, natural green areas, schools, parks and other facilities and services.

Picture 47: The blue-city's first phase covers about 2.2 sq. km of built-up areas Source:http://www.fosterandpartners.com/Projects/Alphabetical/Default.aspx 1/6/2012

Picture 48: Blue City Phase one Master plan

Source:http://www.fosterandpartners.com/Projects/Alphabetical/Default.aspx 1/6/2012

[1]http://www.fosterandpartners.com/Projects/1604/Default.aspx :4/6/2012

Picture 49: In contrast of the existing blurred urban realm, the public spaces are emphasized and shaded.

http://www.fosterandpartners.com/Projects/Alphabetical/Default.aspx 1/6/2012

Picture 50: First phase includes high density residential areas

http://www.fosterandpartners.com/Projects/Alphabetical/Default.aspx 1/6/2012

5.3.2 Opportunities (future chances)

A critical link between oil depletion and climate change is that mitigation of the impacts of climate change could require additional use of oil. Another link could be more synergistic. To the extent that reductions in oil consumption could prevent or delay climate change, oil depletion could have a beneficial effect.[1] Newman and Jennings (2008) related the transformation of economy from local-based economy to global-based with the transformation of urban form of cities from compact, mixed-use, small, walkable cities to large sprawling segregated megalopolises. They suggested that 'the challenge for cities will be to create more locally oriented places within this broader global economy.[2]

5.3.2.1 Diversification Policies

The diversification of economy is another opportunity that influences the transformation towards sustainability. Recently, the government has declared the launching of the economic area of Duqum. This area is proposed to host mega-economic projects which could be the basic pillar for the national economy, and could create employment opportunities for the national workforce. For instance, the economic projects that have recently launched been in Al-Duqum in Wusta Governorate led to a notable growth of population in the region by nearly 14% between the 2003 and 2010 censuses.

5.3.2.2 Use of renewable energies

Wind power is renewable and produces no greenhouse gases, such as carbon dioxide and methane, during operation. Airflows can be used to run wind turbines. Modern wind turbines range from around 600kW to up to 5 MW of rated power, although turbines, with rated output of 1.5–3 MW, have become the most common for commercial use, the power output of a turbine is a function of the cube of the wind speed, so as wind speed increases, power output increases dramatically. Offshore resources experience mean wind speeds of ~90% greater than that of land, so offshore resources could contribute substantially more energy. This number could also increase with higher altitude ground-based or airborne wind turbines.[3] It is well known that 'areas where winds are stronger and more constant, such as offshore and high altitude sites, are preferred locations for wind farms.'[4] Geographically, Oman is a unique marine country since it overlooks three oceans: Arab Sea, Gulf of Oman and Persian Gulf. It is characterized by long coasts that reach about 3,200 kilometers. Those distinctive offshore areas could be utilized also to generate energy by wind turbines.

[1]For example, construction of levees to protect coastlines from rising sea levels would require much use of heavy-duty equipment that runs on diesel fuel, and much use of concrete, the production of which is energy-intensive, although not necessarily requiring oil. Such uses could compete with requirements for additional fuel to construct means of alternative energy generation – for example, hydroelectric dams and tidal power stations – in preparation for replacement of oil by electricity. (Gilbert R. And Perl A.(2008), p.198

[2]Newman P. and Jennings I. (2008), p.38

[3]www.wikepidea.org

[4]http://www.ewea.org/fileadmin/ewea_documents/documents/publications/WETF/Facts_Summary.pdf

More than15% of the total area of Oman is inhabitable mountains. '*Al Hajar Mountains'*, which are located in the heart Oman, overlook the most populated regions in the Sultanate. They are mostly inhabitable mountains with various altitudes which peak at about 3,000 meter. These mountains can be utilized by planting wind turbines to generate electricity. Propitiously, Al Hajar Mountains overlook Muscat and Batinah from the northern part and overlook Dhahirah, Buraimi, Dakhliyah and Sharqiyyah from the southern part. This proximity adds another advantage to the location, as it shortens the linking routes amongst all the previously mentioned regions, and consequently the cost of developing this scheme will be reduced.

On the other side, Dofar, which houses 9% of the Sultanate's total population, occupies the far south of Oman and it is more than 1000 kilometers from Muscat, the capital. Dofar is also surrounded by another concatenation of mountains called *'Dofar Mountains'* located just before approaching the region from the north. Very few inhabitants occupy these mountains, which are characterized by an exclusive annual season called *'Khareef Season'*.[1] A very strong wind blows across these mountains and their topography is commonly seen as horizontal plains and smooth surfaces regardless of their high altitude. This location is extraordinarily convenient for planting wind turbines along those plains to produce renewable energy. The researcher believes the amount of electricity that could be generated by wind turbines in *'Khareef Season'* is enough to supply all of Salalah's dwellings.[2]

Solar energy is considered a promising sector worldwide. It is not only used to generate energy but also help to lessen the gas emissions that are emitted from fossil fuel energies. As Oman is located in mostly clear-sky and hot-dry weather, solar energy harvesting will be successful. Figure [126] indicates that Oman is one of the appropriate locations for solar energy in the world. The available data indicates that about 82% of Oman's total area is inhabitable desert. Therefore, these huge areas can be partly utilized for installing solar panels to generate solar power.

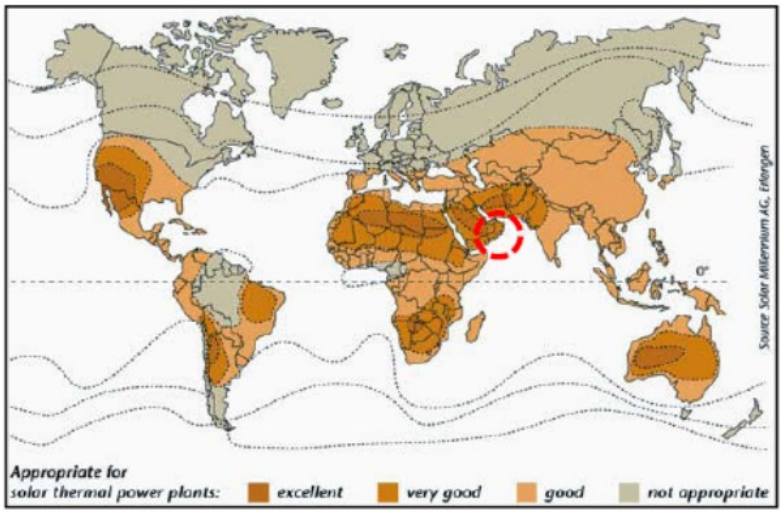


Figure 126: Oman ranked as excellent location for solar thermal plants.

Source: Solar Millennium AG, Erlangen

[1]'Khareef Season' means autumn, a four-month period from the late of June until the late September. It occurs when eastern winds that comes from the Indian Ocean strikes the cliffs of Dofar's coasts causing a very unique climatic condition. The sky remains drizzling daily, the grounds are changed into green cover, the wind is very strong and the temperature does not exceed 22˚C while other parts in Oman and other Arab Countries live beneath extreme and unbearable weather.

[2]Salalah is most populated city in Dofar with 172,570 (69.2% of the total population in Dofar Governorate according to 2010 census).

Tidal power captures energy from the tides in a vertical direction. Tides come in, raise water levels in a basin, and tides roll out. Around low tide, the water in the basin is discharged through a turbine. The data indicates that energy in water (in the form of motive energy or temperature differences) can be harnessed and used. Since water is about 800 times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy.

It was mentioned earlier in this thesis that Oman has a wide, long coastline extending from Musandam Island in the north, crossing the Sea of Oman in the middle reaching the Arabian Sea in the south, forming about 3,200 kilometers of coastline. These enormous offshore areas can be partially invested as an initiative for generating energy by tidal turbines. It is obvious that the carbon footprint rate can be reduced by using the renewable energy sources available in the Sultanate. In May 2008, the Authority for Electricity Regulation issued a major study on renewable energy in the country assessing technologies, locations and policy instruments suitable for the country (Authority for Electricity Regulation, Oman 5/2008). Figure [127] indicates some of the Middle Eastern countries' activities towards solar power.

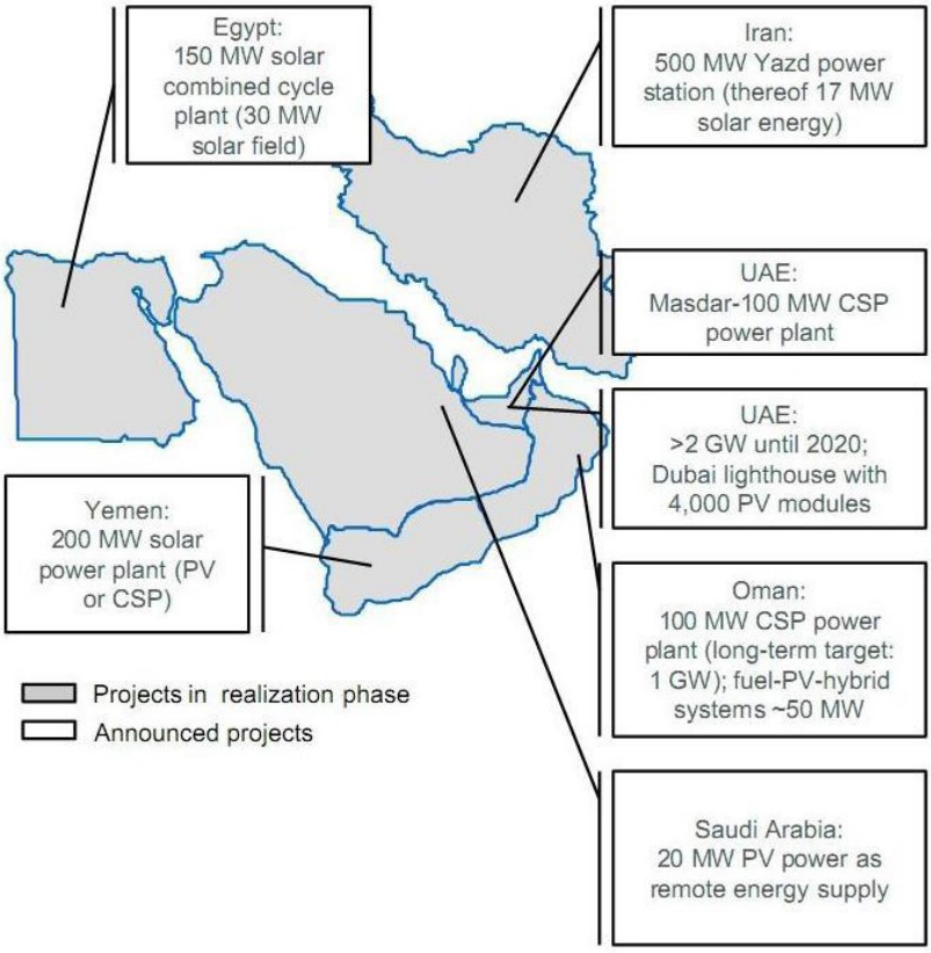


Figure 127: Some Middle Eastern countries activities towards the solar power.

Source: Dill, (2009)

5.3.2.3 Public awareness

The public's awareness of their health is also a major challenge to assure the transformation for healthy cities. According to Figure [128], residents living in sprawling metropolitan areas may experience higher levels of physical, chemical, and biological exposure and are likely to have elevated mortality risks from tumors, infection, or respiratory diseases.[1] In addition, sprawl promotes extensive auto use and increases social polarization among communities, which may increase crime rates, worsen traffic conditions, and make residents more vulnerable to external causes of death.[2] Economic impacts of automobile dependence include the effects of obesity on the health system from lack of physical activity, including walking.[3]

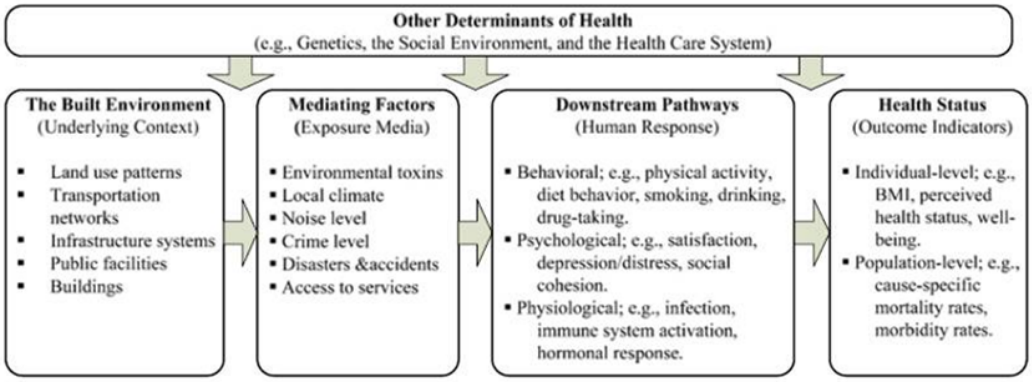


Figure 128: A conceptual model of how the built environment impacts health.

The model presented in this figure is adapted from a conceptual model developed by Klitzman et al

The model has been modified to highlight the mediating factors and downstream pathways by which the built environment influences health outcomes. 'The World Health Organization (*WHO) Global status report on non-communicable diseases 2010* (GSR 2010) showed that non-communicable diseases (NCDs) are the biggest cause of death worldwide. More than 36 million people died from NCDs in 2008, mainly cardiovascular diseases (48%), cancers (21%), chronic respiratory diseases (12%) and diabetes (3%). More than 9 million of these deaths occurred before the age of 60 and could have largely been prevented.'[4] According to *WHO* Report 2011, the NCDs in Oman are estimated to account for 83% of all deaths, [5] See Figure (129). Studies have shown that the prevalence of diabetes mellitus in Oman is increasing. The National Health Survey of diabetes, which was conducted in 1991, showed that the prevalence was 9.75%, while the National Health Survey in the year 2000 showed prevalence increased to 11.6% among adults over 20 years of age.[6] In comparison to the GCC countries and the world, Oman leads in deaths caused by non-communicable diseases by 83%, as indicated in Figure [130].

[1]Journal of Urban Health: Bulletin of the New York Academy of Medicine, Vol. 86, No. 5 doi:10.1007/s11524-009-9382-3, 2009 The New York Academy of Medicine. p.710
[2]Ibid, p. 710
[3]Schiller, et al (2010)
[4]World Health Organization (2011), Noncommunicable diseases country profiles 2011. http://whqlibdoc.who.int/publications/2011/9789241502283_eng.pdf
[5]Ibid, p.142
[6]Ministry of Health Annual Report (2009), Chapter Eight: Health Domains, p. 68 - 69

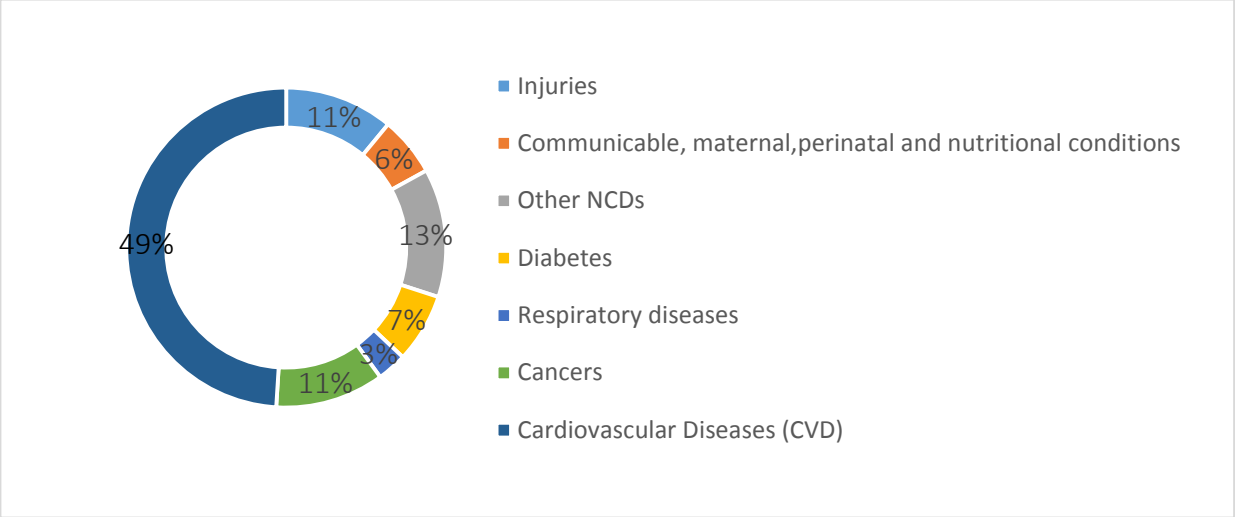


Figure 129: NCDs are estimated to account for 83% of all deaths.

Source: WHO, NCD Country Profiles, 2011

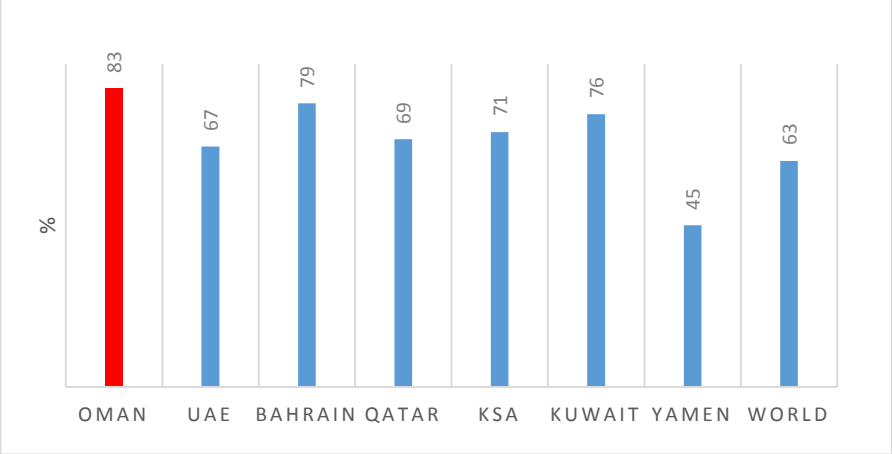


Figure 130: Death ratio by non-communicable diseases in GCC countries in 2010

Source: WHO, NCD Country Profiles, 2011

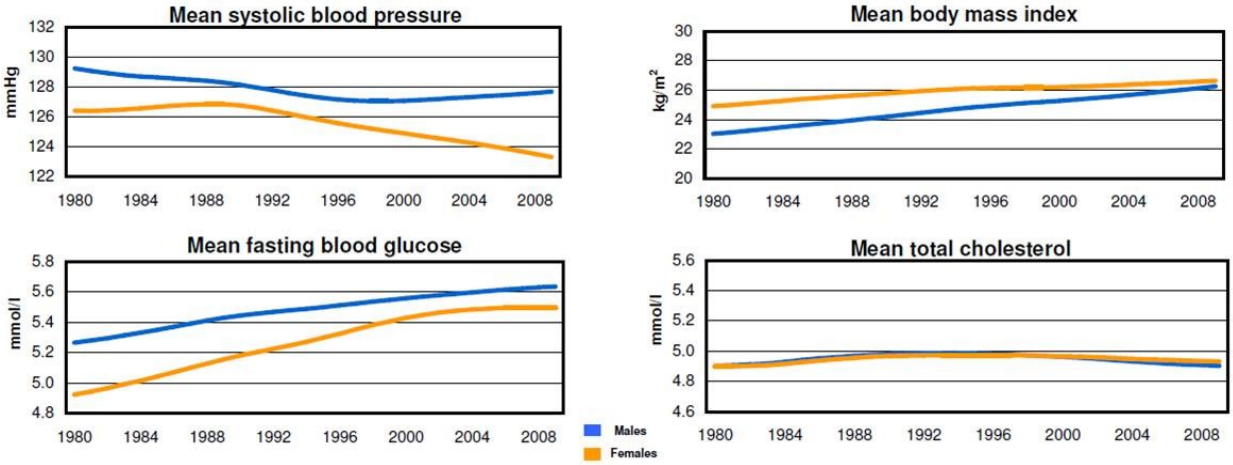


Figure 131: Metabolic risk factor trends in Oman, 2010

Source: WHO, NCD Country Profiles, 2011

World Health Organization reported that all of non-communicable diseases will cost the world more than US$7 trillion in the period between 2011 to 2025, and diabetes alone will cost the world the equivalent of 0.42 trillion dollars in the period (2011-2025). According to the report, the loss resulting from non-communicable diseases in the countries classified with high and average income, including Oman, is about US$140 per person per year. The report also indicates that the percentage of the burden of diabetes, loss of productivity per capita of the total burden of non-communicable diseases is estimated to be 6%.[1]

As part of the national strategy to fight the deadly menace of non-communicable diseases (NCD), which was advocated during the GCC-wide campaign, the Ministry of Health, hosted a forum to raise awareness on NCD. The forum pointed out that 'these diseases are growing around the world due to the unhealthy lifestyles adopted by modern-day societies in consequences of lacking physical activity and deficient, unbalanced diet and food intake increases obesity and the associated psychological pressures and burdens of modern-day living.'[2] It also indicated that 'mortality and illness rates and disability caused by these diseases, average 60 per cent of all deaths, which with the present trend is expected to increase to 73 per cent by 2020.'[3]

The forum showed the spread of NCD and the risk factors for the total population in the Sultanate: diabetes 15 percent, hypertension 45 percent, high cholesterol 37 percent, obesity and weight gain 40 percent, lack of physical activity 40 percent, tobacco use is 6.9 percent.[4] This data provides grim indicators of the local society's conditions in consequences of the transformation of lifestyle within the past four decades. Most scholars relate the high trend of these diseases to the transformation from a walkable society to a car-dependent society.

NCD mortality*		
2008 estimates	*males*	*females*
Total NCD deaths (000s)	5.0	2.7
NCD deaths under age 60 (percent of all NCD deaths)	44.5	32.6
Age-standardized death rate per 100 000		
All NCDs	757.8	494.2
Cancers	81.1	71.8
Chronic respiratory diseases	31.5	19.1
Cardiovascular diseases and diabetes	545.7	333.3

Behavioural risk factors			
2008 estimated prevalence (%)	*males*	*females*	*total*
Current daily tobacco smoking	6.6	0.2	4.0
Physical inactivity	...	...	...

Metabolic risk factors			
2008 estimated prevalence (%)	*males*	*females*	*total*
Raised blood pressure	36.6	31.3	34.5
Raised blood glucose	9.9	9.6	9.7
Overweight	56.9	54.2	55.8
Obesity	18.9	23.8	20.9
Raised cholesterol	...	...	...

Figure 132: NCD mortality, Behavioural risk factors and metabolic risk factors in Oman in 2008

Source: WHO, NCD Country Profiles, 2011

[1]WHO, 2011 reports in association with Harvard University estimations
[2]Source: Oman Observer vol.31, No. 63, Monday, January 16, 2012
[3]Ibid, p.1
[4]Ibid, pp. 1-4

The forum also indicated that 'the pattern of disease development in most countries of the region requires that high priority be given to health information and health education activities that are specifically designed to change behavior. In this respect, the media and other mass communication broadcasting systems play an important part in contemporary life, as they affect lifestyles and consumption patterns.'[1] The forum insisted that 'increased awareness of the various causes of these health-compromising diseases reduces their occurrence and allows for treatment.'[2] The forum's participants suggested the need for 'the promotion of health through an integrated package of preventative solutions that will work to eliminate the spread of non-communicable diseases among the populaces.'[3]

Although the forum has engaged in a wide range of discussions and arguments in relation to the effort to combat NCDs, which mainly relate them to the level of welfare, it has not paid attention to some aspects which coerce people into this poor health status. The scattered development, the distant service from the residential areas, the absence of viable public transport, the cheap fuel and seduction of the automobile industries are main factors that encourage the automobile-dependent society. The use of private cars eliminates physical activities leading to obesity which is considered one of the main causes of diabetic and heart diseases.

As is the belief of the researcher, sustainable urban management plays an influential role towards decreasing the risk of these diseases and achieving a healthy community. Health awareness should be integrated by many, if not all, parties. *Media* can play a crucial role in pointing out the negative behaviors in relation to individual's daily activities, for example the negative use of automobiles and the importance of physical activities. Media can show alternatives and initiatives that might help to eliminate the use of private automobiles and encourage walking and cycling.

Since the youth in Oman represents about one third of the society, *education curriculum* can also play a crucial part to visualize the negative parts in our daily behaviors particularly the awareness of the incorrect usage of automobiles they are as it considered the direct cause of obesity and its related health issues.

[1]Ibid, p.4
[2]Ibid
[3]Ibid

5.4 Regional references

5.4.1 General outlook

This section brings the experiences of two countries in the region in relation to the progress and attempts of promoting long-term strategies, policies and schemes that ensure attaining sustainable developments. It also includes their future plans and urban management that can reserve the natural resources and reduce the consumption of energy to ensure moving securely to the inevitable post-oil age.

GCC countries have launched a range of future visions that focus mainly on economic diversification. Saif (2009) argued that 'Dubai and Qatar launched financial centers, the Dubai International Financial Center and the Qatar Financial Center respectively, to compete with Bahrain that is ranked the first financial hub of the region. Bahrain, in turn, gave new impetus to its own position with the launching of the Bahrain Financial Harbor.'[1]

Abu Dhabi, for example, has oriented its economy towards the investment in the sector of cultural heritage. In this route, Abu Dhabi paid US$548 million to use the French Louvre's museum name and is expected to pay an additional amount of US$788 million to the Louvre and other French museums for management and advice.[2] Investing in the sector of renewable energy is another approach for diversifying the national economy. Masdar Initiative represents the most promising project that Abu Dhabi aims for, not only to attain the local requirements of renewable energy, but also to be the world's largest producer and exporter of clean energy in the future.

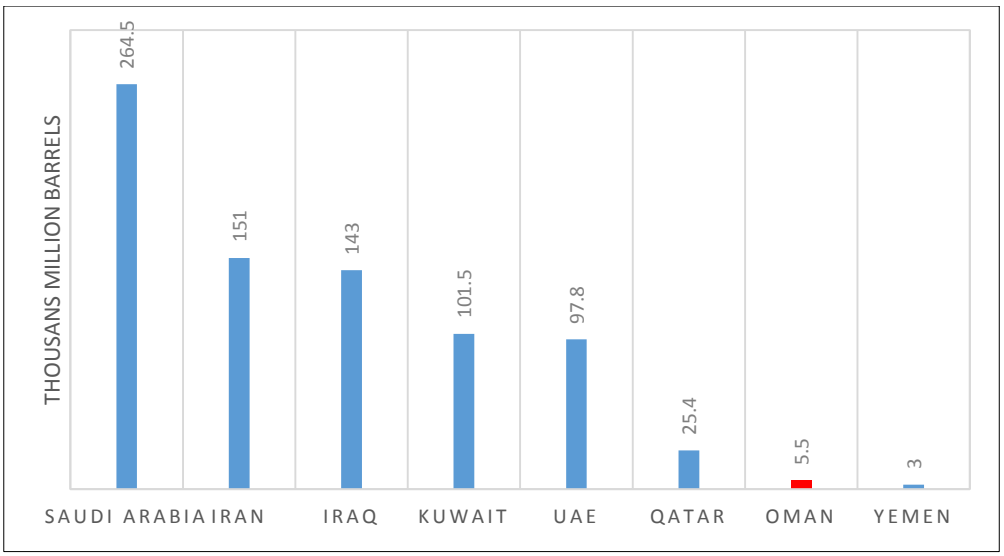


Figure 133: Proved Reserves of Oil at end 2010 in Middle East Countries

Source: BP Statistical Review of World Energy June 2011[3]

[1]Saif, I. (2009), p.14

[2]Robert Booth, "From Desert to Cultural Oasis, Complete with Louvre, Guggenheim and Ferrari," *Guardian*, September 3, 2008, http://www.guardian.co.uk/world/2008/sep/03/middleeast.art

[3]ULR:http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/BP-Energy-Outlook-2030-info-graphics.pdf 31/1/2012

'In most states, hydrocarbons – meaning oil and gas – account for at least 80% of both export earnings and government revenue, although the percentage fluctuates depending on the oil price.'[1] If oil is depleted, changes in taxation policy will become obvious. The table below indicates the GCC states' remaining oil in years. Cheap energy contributes to the rapid urban sprawl in the GCC states. Table [26] indicates the Super Gasoline and Diesel Retail Prices in the GCC states as of mid-November 2008 (in US cents/liter) (GTZ 2008). In relation to the GCC countries' contribution to air pollution (CO_2 Emission Per Capita), Qatar heads the list, whereas Oman ranks 13th globally. See Table [28].

Country	Super Gasoline	Diesel
Bahrain	21	13
Kuwait	24	20
Oman	31	38
Qatar	22	N/A
KSA	16	9
UAE	45	62

Table 27: Super Gasoline and Diesel Retail Prices in the GCC states
Source: (GTZ, 2008)

Country	Remaining Oil in years
Qatar	62.8
Oman	21.3
KSA	69.5
UAE	91.9
Kuwait	More than 100
Bahrain	N/A

Table 26: GCC states remaining oil in years

Source: (BP, 2008)

Country	Total CO_2 Emission (thousands metric tonnes per year)	World Rank	*Per Capita* CO_2 Emission (metric tonnes per year)	World Rank
Qatar	12,598	60	12.1	1
Kuwait	23,618	42	9.4	2
UAE	38,060	32	9.0	3
Bahrain	5,807	79	7.8	4
United States	1,568,806	2	5.2	9
Oman	11,285	66	4.4	13
Saudi Arabia	104,063	15	4.4	14

Table 28: Oman in rank 66th for total carbon dioxide emission in 2006, however ranked 13th for *per capita* emission because of its small population.

Source of data: CDIAC, 2009; CDIAC, 2009; QSA, 200

[1] The Economist Intelligence Unit Limited 2010, The GCC in 2020: Broadening the economy, A report from the Economist Intelligence Unit Sponsored by Qatar Financial Centre Authority.

5.4.2 United Arab Emirates

United Arab Emirates (UAE) is situated in the southeast of the Arabian Peninsula in the Persian Gulf's southern bank, bordering Oman from its east and northern parts, Saudi Arabia from west and south. UAE shares the marine frontier with Kuwait, Bahrain, Qatar, Iraq and Iran. The UAE is a federation of seven emirates (equivalent to principalities), each governed by a hereditary emir, with a single national president. The constituent emirates are Abu Dhabi, Ajman, Dubai, Fujairah, Ras al-Khaimah, Sharjah and Umm al-Quwain. The capital is Abu Dhabi, which is also the state's center of political, industrial, and cultural activities.[1] Abu Dhabi is the most populated Emirate with 38% of the UAE population. The Emirate of Dubai has a further 30% of the UAE population, so over two-thirds of the UAE population lives in either Abu Dhabi or Dubai. Abu Dhabi has an area of 67,340 square kilometers, which is 86.7% of the country's total area, excluding the islands. It has a coastline extending for more than 400 kilometers and is divided for administrative purposes into three major regions. The Emirate of Dubai extends along the Persian Gulf coast of the UAE for approximately 72 kilometers. Dubai has an area of 3,885 square kilometers, which is equivalent to 5% of the country's total area, excluding the islands. The Emirate of Sharjah extends along approximately 16 kilometers of the UAE's Persian Gulf coastline and for more than 80 kilometers into the interior. The northern emirates which include Fujairah, Ajman, Ras al-Khaimah, and Umm al-Qaiwain all have a total area of 3,881 square kilometers. There are two areas under joint control. One is jointly controlled by Oman and Ajman, the other by Fujairah and Sharjah. [2]

Year	1963	1968	1975	1980	1985	1995	1999	2005	2010
Pop.	95,000	180,226	557,887	1,042,099	1,379,303	2,411,041	2,938,000	4,106,427	8,264,070
±%	-	+89.7%	+209.5%	+86.8%	+32.4%	+74.8%	+21.9%	+39.8%	+101.2%

Table 29: UAE population trend.[3]

[1] Source: www.wikipedia.org 15-1-2012
[2] ibid
[3] UAE National Bureau of Statistics. (PDF). Retrieved on 2012-01-01
http://worldgazetteer.com/wg.php?x=1245683461&men=gpro&lng=en&des=gamelan&geo=-267&srt=npan&col=abcdefghinoq&msz=1500&geo=-12
http://www.thenational.ae/news/uae-news/population-leaps-to-8-19-million

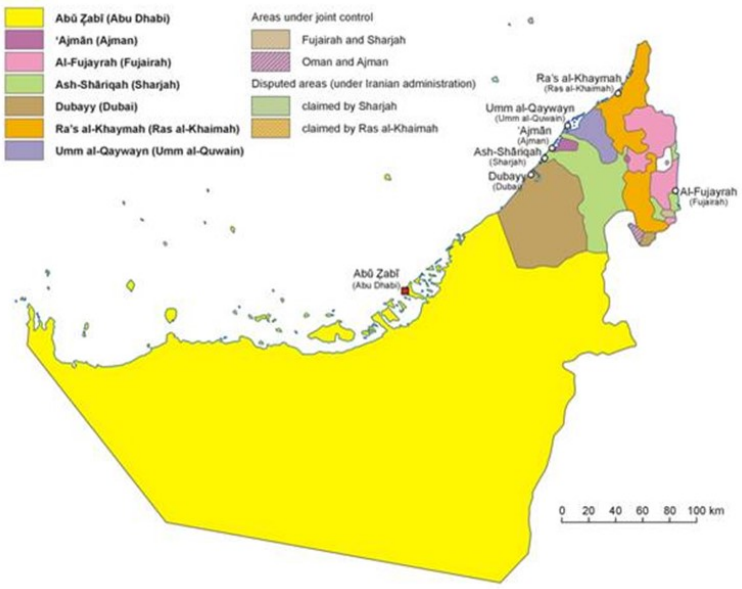


Figure 134: Regional distribution of UAE

Source: http://en.wikipedia.org/wiki/The_United_Arab_Emirates 1/6/2012

The rapid economic growth due to revenue from hydrocarbon resources has led to a rapid development and a highly improved lifestyle. This trend is also accompanied with a rapid increase of natural resource consumption. Consequently, UAE leads the list of the world's biggest consumer of energy per person and the largest footprint rate in the world. Oman and UAE are nearby countries and have the same climate conditions while the major difference is the behavior in energy usage. Although the UAE's oil life span exceeds Oman by more than 70 years[1], it seems that UAE is preparing to shift towards the post-oil age according to a strategic plan including the diversifying its economy, designing eco-friendly cities and conservation of energy.

At the economic level, although UAE oil reserves are ranked as the world's sixth-largest[2], diversifying the economy comes at the top of its priorities. That it is why UAE's economy is considered one of the most developed economies in Western Asia. Much has been written and documented recently about the "Dubai Model" as a smart, mixed-use development formula based upon a full service – a single-source solution that is now being branded and replicated in the region and other parts of the world. It can be paraphrased that the participants used the term "Dubai Model Metaphor", not as it particularly related to that city, but more generically as a phenomena of the prototype developments now characteristic of the region.[3]

Dubai has adapted trade as a key to diversify its economy and to move towards what is known as the 'post-oil economy'. The 'free trade zone' was first founded in Dubai in 1985 in Jabal Ali as the first in the GCC countries. This trade zone which was situated in the far western part of Dubai has attracted local, regional and international investors because of the low and competitive taxes, the viable infrastructural services as well as the easy and dynamic logistic processes. These distinctive characteristics encouraged many international companies to transfer their headquarters to Dubai.

[1]Remaining Oil in UAE 91,9 years while in Oman 21, 3 years according to the BP estimations in 2008
[2]https://www.cia.gov/library/publications/the-world-factbook/rankorder/2178rank.html
[3]Caton S, et al (2010), p.128

Consequently, though Dubai's economy was built on the back of the oil industry, revenues from oil and natural gas currently represent less than 6% of the emirate's revenues. Despite that Dubai was merely a tiny desert emirate just prior to the Sixties, it is now considered as the commercial hub of the Middle East. Sheikh Mohammed, he Ruler of Dubai, said he would reach the 2015 target by boosting trade, transportation, tourism and financial services. The emirate draws around 6 million visitors a year, more than any other Arab tourist destination except Egypt. Oil accounted for only 3% of GDP in 2006 compared with 10% in 2000.[1]

Sheikh Mohammed argued that "*We will focus on the strong sectors in our economy including tourism, trade, transportation and financial services*." Dubai's drive to wean its economy off oil, emulated around the Gulf, and has been led by state-owned companies such as Emirates, the largest Arab airline, and Dubai Ports World, the third largest container port operator in the world. The emirate's economy grew at an average of 13.4% between 2000 and 2005. In 2005, real GDP growth was 16%, according to official figures that were not adjusted for inflation.[2]

In preparation of the shift toward an energy efficient society, Abu Dhabi has launched a new mandatory green building code aimed at reducing energy consumption in new homes by 40%. Starting September 1, 2011, 'all buildings must meet sustainability and urban design requirements' to receive building permission. [3] Dubai also 'finalised the regulations for green buildings aimed at implementing environmental design for buildings by using energy-efficient construction materials and methods to reduce consumption of power and water.' This was followed by the Ruler of Dubai declaring in 2007 that all buildings constructed in Dubai from 2008 should meet the green building standards. The government is also looking at offering incentives to encourage developers to adopt the green building specifications. [4]

The Green Building Regulations & Specifications[5] consists of 77 pages and includes six sections proposed at meeting the following aspects[6]:

> a) to improve the performance of buildings in Dubai by reducing the consumption of energy, water and materials, improving public health, safety and general welfare and by enhancing the planning, design, construction and operation of buildings to create an excellent city that provides the essence of success and comfort of living.
> b) to support Dubai's Strategic Plan, create a more sustainable urban environment and extend the ability of the Emirate's infrastructure to meet the needs of future development.
> c) green building is the practice of creating structures and using processes that increase the efficiency of resource use -energy, water, and materials- while reducing building impacts on human health and the environment during the building's lifecycle, through better sitting, design, construction, operation, maintenance, and removal.

[1]Source: http://www.arabianbusiness.com/7310, 24 April 2007
[2] Ibid
[3]Source: http://www.ameinfo.com/news/Real_Estate/ 11/12/2011
[4] Ibid
[5]Found in http://www.dewa.gov.ae/images/greenbuilding_eng.pdf
[6]Ibid, p. 5

In regards to reducing the footprint rate[1], in October 2007, the Al Basama Al Beeiya (Ecological Footprint) Initiative was launched as a national effort to ensure a sustainable future by measuring and understanding the impact of the ways of living on planet Earth.[2] The Initiative has determined that the UAE household sector is the main driver of the UAE's Ecological Footprint, representing 57% of the UAE's consumption followed by business/industry and government with 30% and 12% respectively. This research is not only very relevant for guiding sustainability campaigns but also for policy prioritization, as it helps us prioritize those sectors of society that contribute to our footprint the most, which in turn helps facilitate the UAE's development towards sustainability.[3] With this information, the Initiative, in 2008 and 2009, has been able to develop a preliminary research agenda for future scenario modelling of the UAE's Footprint that istruly the first of its kind in the world. Developing quantifiable evidence-based scenarios that map how the UAE's Footprint might evolve in the future is crucial from a policy-making perspective. This not only helps assess the implications of current policies and plans on the Footprint, but moreover, by developing alternative 'lower Footprint' scenarios, helps facilitate the development of policy portfolios to reduce the UAE's Footprint.[4] The scientific research conducted through the Initiative has also helped to inform the development of a new sustainable lifestyle campaign known as 'Heroes of the UAE', co-developed by EWS-WWF and the Environment Agency – Abu Dhabi.

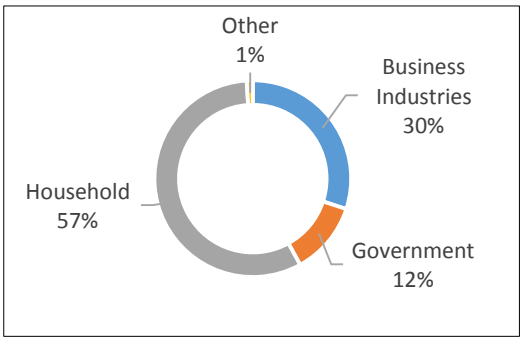


Figure 135: UAE footprint is driven by three society's players.

Source: Emirates Wildlife Society – WWF, UAE Ecological Footprint Initiative e-brochure http://www.agedi.ae/ecofootprintuae/default.aspx

The Heroes campaign intends 'to work with businesses and industries in the UAE to raise awareness and help them to reduce their contribution to the Ecological Footprint.'[5] The initial focus of this campaign is targeted at the household sector, providing simple tips to help reduce energy and water consumption, thereby reducing the individual footprint and also tackling climate change. It will also target schools, businesses and the government sector.[6] To sum up, 'the initiative is working on five main areas, data collection and verification, science and research, capacity building, policy analysis and education and outreach.'[7]

[1]The Living Planet Report 2008 ranked the UAE as the country with the highest Ecological Footprint per capita in the world at 9.5 global hectares per capita - three times higher than the world average per capita Footprint.
[2]The Initiative is a unique three year public - private partnership comprised of local and international entities, including the Ministry of Environment and Water , Abu Dhabi Global Environment Data Initiative (AGEDI with the Environment Agency – Abu Dhabi), the Emirates Wildlife Society in association with WWF (EWS-WWF) and the Global Footprint Network (GFN). In addition to these main partners, a number of local UAE academic institutions, local government agencies and private sector entities actively contribute to the Initiative. Source: UAE Ecological Footprint Initiative e-brochure http://www.agedi.ae/ecofootprintuae/default.aspx 11/6/2012.
[3]Ibid
[4]Ibid
[5]http://ecologicalfootprint.heroesoftheuae.ae/en/article/what-is-our-role/everyone-in-society-plays-a-part.html accessed 11/6/2011
[6]Ibid, Further information is online at www.heroesoftheuae.ae
[7]Ibid

At the urban governance level: major progress has been achieved in relation to the post-oil cities. For example, in February 2009, the UAE launched a nationwide energy sustainability campaign under the name, *"Heroes of the UAE"*. Developed in conjunction with the Emirates Wildlife Society, the Worldwide Fund for Nature and the Environmental Agency-Abu Dhabi, the campaign's goal is to seismically reduce the high carbon footprint and energy consumption by UAE nationals and a multitude of expatriates and foreign visitors.[1]The website of the campaign is smartly designed to attract users of all ages. The website, which is both in Arabic and English, intends to show the issues of ecological footprint as a social problem at a primary level, and demonstrate how every candidate in society can contribute to reduce its impacts. The website includes, for instance, general knowledge about the ecological footprint, the role of the campaign, how does it help and what is it important for the UAE, how everyone can cooperate to reduce the rate of ecological footprint, etc.

If successful, the "Heroes" template should enable the UAE and the wider GCC to progress through to a potential "post-oil world". The GGC states have experienced an exponential increase in domestic demand for hydrocarbons as a result of demographic increases, combined with enlarged industrial demands arising from economic diversification. An astute and comprehensive plan should incorporate renewable energy as an integral part of the UAE's diversification strategy. The UAE may become known for its creative leadership in the global market and for the practicality of its carbon mitigation projects.[2] The main aim of the scheme is to compute the consumption of natural resources, to be aware of it and to develop some strategies that enable the effective usage of these resources. For example, the Ecological Footprint becomes a principle factor for calculating the consumption of natural resources.

The Abu Dhabi Urban Planning Council (UPC) – a highly reputable organization for extensive sustainable urban planning and rapid urban growth – was founded by Emiri Decree Number 23 in 2007 to be in responsible to sketch the future of Abu Dhabi's urban milieu, assure the city's identity and create a better sense of community. Abu Dhabi Urban Planning Council defines the shape of the Emirate, ensuring factors such as sustainability, infrastructure capacity, community planning and quality of life, by overseeing development across the city and the Emirate as a whole. The Abu Dhabi Urban Planning Council ensures best practice in planning for both new and existing urban areas.[3]

Central to the planning efforts in Abu Dhabi are the 2030 Plans which establish a vision for future development of the Emirate. The 2030 Plans include[4]:

- Plan Capital 2030: Urban Structure Framework Plan
- Plan Al Ain 2030: Urban Structure Framework Plan
- Plan Al Gharbia 2030: Urban Structure Framework Plan

This thesis will take the first structure plan as a reference.

[1] Dubai School of Government News, A Model in Preparation for a "Post-Oil" World http://www.thenational.ae/article/20090320/OPINION/182711949%26SearchID%3d73348628755124 accessed 11/6/2011

[2] ibid

[3] Plan Abu Dhabi 2030, Urban Structure Framework Plan, p.1

[4] Abu Dhabi Planning Council, Vision Abu Dhabi 2030, *Abu Dhabi Public Realm Design Manual, p.4*

UPC has developed a unique environmental framework in collaboration with the Environment Agency. This framework is called '*Estidama'*, which is the Arabic word for sustainability. Estidama is not merely a sustainability scheme,it is 'the symbol of an inspired vision for governance and community development.'[1] It promotes a new mindset for building a forward thinking global capital. To establish a distinctive overarching framework for measuring sustainability performance beyond the usual planning and construction phases, UPC has worked with the team guiding Estidama to assure that sustainability is continually addressed through four pre-defined angles: environmental, economic, social and cultural.[2] The purpose of Estidama is to create a new sustainability framework that will direct our current course while allowing adaptation as new understanding evolves. By promoting a new sense of responsibility with Estidama, UPC is going beyond other sustainable development initiatives around the world, by creating new tools, resources and procedures crucial to the 2030 vision.[3] The ultimate goal of Estidama is to preserve and enrich Abu Dhabi's physical and cultural identity, while creating an ever improving quality of life for its residents on four equal pillars of sustainability: environmental, economic, social, and cultural.[4] Under the Estidama scheme, Abu Dhabi Urban Planning Council (UPC) introduced 'Pearl Rating System (PRS), the Arab World's first sustainability rating mechanism established in 2009 to assess sustainability performance of buildings, communities, and villas.'[5]

In relation to adopting sustainability within urban development, Abu Dhabi established an authority which was basically founded to invest the available renewable energy to reduce the reliance on the energy which is generated from fossil oil. Abu Dhabi Future Energy Company (ADFEC)[6] is an ambitious enterprise which was founded for investing the green energy and sustainable development. The major target of ADFEC is to turn Abu Dhabi into the world leader in renewable energy.

Masdar -- driven by ADFEC -- is considered as a unique initiative that undertakes sustainability through urban planning. It is a combination of socio-economic and ecological conditions that provide a liveable built environment with high quality lifestyle standards. Despite its location within one of the most polluted city in the world, Masdar City intends to be the first 'neutral carbon' in the world. With the Masdar initiative, Abu Dhabi becomes the predominant city in renewable energy in the world. As a result of its efforts in renewable energy, Abu Dhabi won the permanent headquarters of International Renewable Energy Agency (IRENA) in June 2009.

Masdar (Arabic for "source") will point the way toward a future without fossil fuels. In February 2008, construction began on Masdar City, a futuristic, environmentally-friendly metropolis, which Abu Dhabi will present to the world in 2016 as living proof that life without fossil fuels can offer plenty of quality.[7]

Some 50,000 people are expected to be living in Masdar City by 2016. Conventional cities the size of Masdar can emit up to 22 tons of CO_2 per resident per year, which translates into total annual emissions of around 1.1 million tons. Masdar City will get this figure down to zero

[1] http://estidama.org/?lang=en-US 11/12/2011
[2] Ibid
[3] http://estidama.org/
[4] http://estidama.org/
[5] http://estidama.org/media-center/estidama-press-release-redirect.aspx?lang=en-US , Accessed 11/12/2011
[6] A Private holding company owned by Mubadala Development Company.
[7] http://www.siemens.com/innovation/en/publikationen/publications_pof/pof_fall_2008/gebaeude.htm 11/12/2011

using state-of-the-art technologies. There are several steps that can be taken to achieve this ambitious goal. The first is to minimize energy consumption. Masdar City will have to make do with only around 200 megawatts of installed electrical capacity rather than the 800 megawatts that cities of a similar size in its climate zone are accustomed to. Cutting down on the use of fresh water is one way to go about this, as obtaining potable water requires seawater to be desalinated by power-hungry facilities. In general, closed raw material cycles and consistent recycling will keep resource consumption down in the desert metropolis. Masdar City development is aimed at demonstrating the principles of sustainable development and showing how an integrated approach to master planning, transportation and infrastructure planning can produce a sustainable integrated city where people can live in a safe and secure enhanced environment with reduced impacts which are experienced by inhabitants of traditional cities.[1]

Generally, Masdar City is committed to advancing Abu Dhabi's drive towards a sustainable Arab capital that focuses on:[2]

- Advancing renewable energy technologies
- Mitigating climate change
- Diversifying the economy
- Preparing Abu Dhabi for a clean energy future

Figure 136: Layout of city with space allocation outside of the populated areas (Courtesy Masdar)

Picture source: AECOM
http://www.aecom.com/Where+We+Are/Middle+East/DesignPlanning/_carousel/Masdar+City+Public+Realm,

[1] http://www.siemens.com/innovation/pool/en/publikationen/publications_pof/pof_fall_2008/buildings/masdar_city/pof208_gebaeude_masdar_en.pdf 11/12/2011

[2] Brebbia C.A. & Beriatos E. (2011), p.35

Picture 51: Masdar, UAE A car-free, pedestrian pathways

Masdar, UAE A car-free, pedestrian dominated environment in which there is substantial dappled shade from photovoltaic sun screens to help achieve livability in one of the world's hottest places. This is a street scene in what promises to be the world's first 'one planet', carbon neutral city. (*Image and architecture by Foster + Partners*)

Abu Dhabi has also become a pioneer spot that promotes culture as a key element for its long-term development. Saadiyat Island, merely '500m off the coast of Abu Dhabi and just five minutes' drive from Abu Dhabi's downtown'[1], is intended to boost its position globally as a tourism attracter. The island will house four major cultural venues that certainly will lay the emirate as one of the most tourism attractors in the globe. Every museum is designed by a globally prominent architect, the Louvre Abu Dhabi is designed by Jean Nouvel, the Guggenheim Abu Dhabi by Frank Gehry, the Performing Arts Center by Zaha Hadid; and the Sheikh Zayed National Museum is designed by Norman Foster.

These cultural structures will be integrated by many other utilities and services such as hotels, recreational parks, shopping centers, housing estates, etc. The island will house around 150,000 inhabitants spread out over 27 square kilometers. It is subdivided into seven individual districts with total urbanized area around 2,600 hectare. Figure [137]. In line with conserving the natural resources, two plants will be utilized to recycle waste water. In line with reducing car-dependency, Saadiyat Island will be linked with the downtown by ten kilometers of light railway network. To ensure the optimum utilization of land, the vast majority of areas will be developed by high-density urban blocks rather than villa-type development.

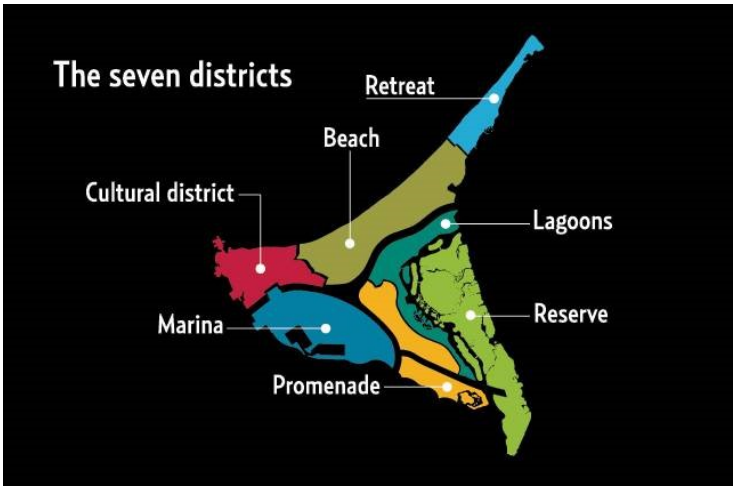


Figure 137: The seven district of Saadiyat

[1] Saadiyat Island brochure found in: http://www.saadiyat.ae/en/Uploads/pdf/SDYT_EBR_ENG.pdf

Source:

Picture 52: Saadiyat Cultural District

Source: http://www.saadiyat.ae/en/Uploads/124041Saadiyat_Brochure_CD_E.pdf 1/6/2012District

Picture 53: Saadiyat utilizes high-density urban blocks as most favourite urban form over the villa-type urban form.

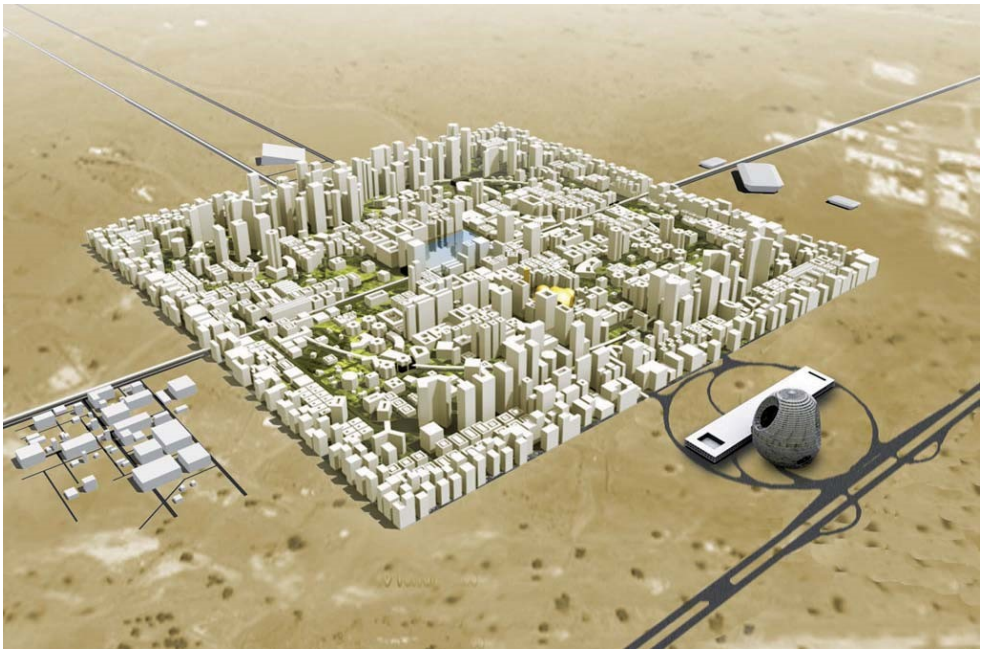
Source of picture: http://www.designyourway.net/blog/inspiration/saadiyat-cultural-district-and-its-great-architectural-projects/ 1/6/2012

Picture 54: Sheikh Zayed Museum is surrounded by urban blocks

Source of picture: Ibid

Moving towards the northern emirates, Ras Al Khaima is considered the gateway of the UAE as it is the first emirate in the doorway of the Persian Gulf. In this regard, the emirate unveils various schemes to diversify its economy as it remains dependent on oil as its main source of revenue. The scheme includes the urban development that enhances the basic infrastructure to attract investments in tourism, commercial and industrial fields. Hence, RAK Gateway emerges as a predominant project which has its master plan designed by Office Metropolitan Architecture (OMA). Picture [55]. The main concept is similar to Masdar City in Abu Dhabi that utilizes a square-shaped compact city development with high density mixed-use urban fabric. To fulfill the requirements of sustainable development, the project integrates modern technology that generates clean energy, such as photovoltaic.

Unlike the common sprawled urban growth in the region, OMA has designed residential towers and other mixed-use facilities on a mere one square mile piece of land. The development intends to be a liveable gateway to the city. The conceptual designed of the city is inspired by the traditional oasis settlements which are characterized by high density and compact development. Ras Al Khaimah also has undertaken another trend to diversify its national economy. Since sport became a promising industry that attracts large segments of people, the emirate has recently unveiled plans with one of the world's highly reputable soccer teams to build "Real Madrid Resort Island". The $US1 billion project will include luxury hotels, villas, an amusement park, a club museum and a futuristic 10,000-seat stadium with one side open to the sea.[1] The 430,000 square meter development off the Emirate of Ras Al Khaimah is expected to open in January 2015 and attract one million visitors in its first year.[2]



Picture 55: RAK Gateway compact development designed by OMA

Source:http://v3.arkitera.com/UserFiles/Image/news/2007/05/22/benzer2.jpg retrieved 2/4/2012

[1]http://www.guardian.co.uk/football/2012/mar/22/real-madrid-holiday-resort-uae/ accessed 31/03/2012
[2]http://www.thesun.co.uk/sol/homepage/sport/football/4212098/Real-Madrid-unveil-plans-for-1bn-holiday-resort.html accessed 31/03/2012

Picture 56: An overall image of Real Madrid Resort Island designed by JH Boiffils.

Photograph: AFP/Getty Images. http://arabiangazette.com/real-madrid-theme-park-uae/ Retrieved on 17-02-2012

When Sheikh Saud bin Saqr Al Qasimi, Ruler of Ras Al Khaimah, was asked in 2009 just one year before becoming the leader of the emirate, about his hopes and ambitions for the Ras Al Khaimah in 2020, he said, 'I hope that the Ras Al Khaimah would become a place to create better future for its people, not just dreaming but making their dreams as reality.' When asked about the identity and image of the Ras Al Khaimah that he likes to introduce to the world, he said that 'generosity and hospitality are our identity, we want the world to meet here where natural beauty and traditions of thoroughbreds as we are at the heart of Asia, facing Africa and the approach of Europe, then we are at the heart of the world. It is obvious that the Sheikh's vision was not an illusion but a combination of planning, preparation and hard work to observe the dreams as a tangible reality to catch up to the global fame of the dazzle of Dubai and the splendor of Abu Dhabi.

On the subject of public transport, most urban debates reveal that public transport systems are considered the predominant driver for creating sustainable cities. In relation to integrating public transport into the sustainable development in UAE, both Dubai and Abu Dhabi have shown advanced strides towards building highly efficient public transport based on reducing the rate of footprint which is an outcome of the high consumption of energy and natural resources. Both cities have visualized their transport's schemes which mainly focus on rail, metro and rapid bus. This project is part of Abu Dhabi's Department of Transport plan to invest US$82 billion in the transport network of Abu Dhabi, which includes the construction of roads and light rail.

The Dubai Metro is a driverless, fully automated metro network in the United Arabic Emirates city of Dubai. It is the first urban train network in the Arabian Peninsula. Its construction was strongly desired in order to solve the great traffic problems of the city.[1] The Red Line and Green Line are presently operational, with three further lines planned. These first two lines

[1] http://www.mediamobile.it/Web/CaseStudydubaiMetro.aspx Retrieved in 18/2/2012

run underground in the city center and on elevated viaducts elsewhere (Elevated railway).[1] Before launch, Dubai Municipality Public Transport Department expected the metro to carry 1.2 million passengers on an average day, 27,000 passengers per hour for each line, and 355 million passengers per year once both lines are fully operational. It is planned to provide transport for 12% of all trips in Dubai. After the first month of operation (on a limited network), the actual monthly ridership was 1,740,578, which equates to under 60,000 passengers/day.[2] The first two lines of the Dubai Metro will have 70 kilometers of lines, and 47 stations (including nine underground stations).[3] The Roads and Transport Authority's master plan includes 320 kilometers of metro lines by 2020 to cater to the expected 3.3 million residents of the city.[4]

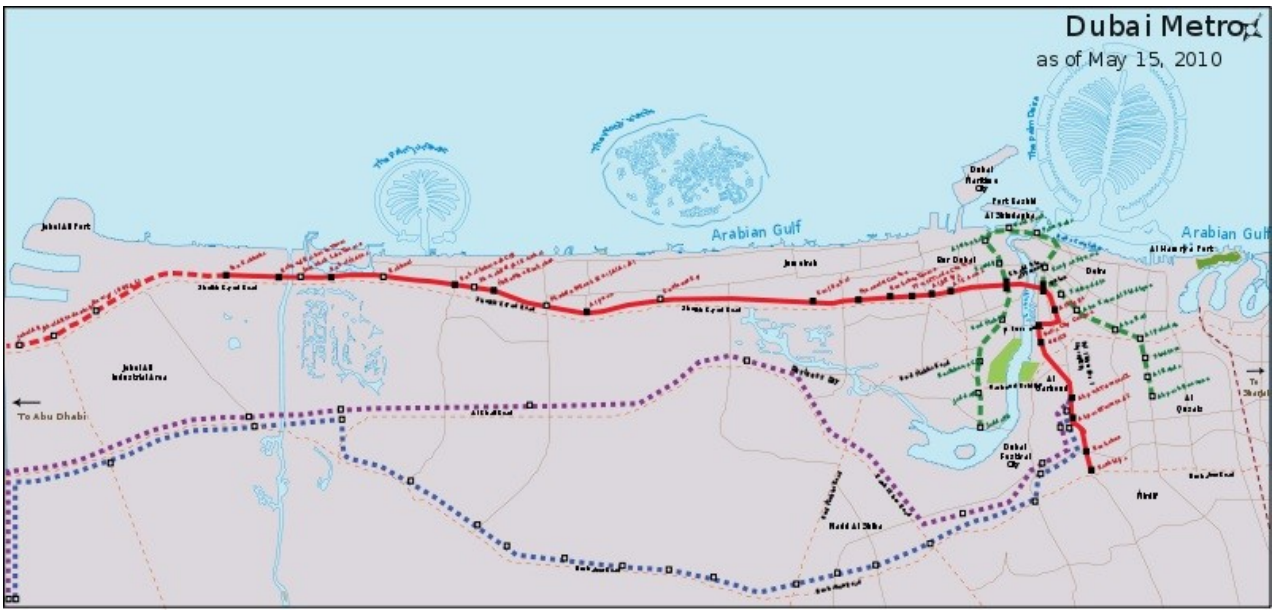


Figure 138: Dubai Metro map

Stations in black ■ are open, stations in white □ are not. Dashed lines are under construction, dotted lines are planned. Source: http://en.wikipedia.org/wiki/Category:Dubai_MetroRetrieved in 18/2/2012

[1] http://www.rta.ae/Retrieved in 18/2/2012
[2] http://www.arabianbusiness.com/570391-dubai-metro-lifts-17m-passengers-in-first-monthRetrieved in 18/2/2012
[3] http://archive.gulfnews.com/articles/07/11/08/10166000.html*Gulf News*. 2007-11-08. Retrieved in 18/2/2012
[4] http://www.business247.ae/Articles/2009/9/Pages/10092009/09112009_3bb5d0ac942140ef952e73cc9580c337.aspxRetrieved in 18/2/2012

5.4.3 Qatar

Although Qatar is considered the second smallest country in the GCC countries, it achieved notable progress in sustainable development. Qatar has the world's largest per capita production and proven reserves of both oil and natural gas. In 2010, Qatar had the world's highest GDP per capita, while the economy grew by 19.4%, the fastest in the world. The main drivers for this rapid growth are attributed to ongoing increases in production and exports of liquefied natural gas, oil, petrochemicals and related industries.[1] Although Qatar's oil reservoir exceeds Oman's reservoir by more than five times (BP, 2011), and the depleting time exceeds Oman by more than 41 years (BP, 2008), Qatar has proven to have very advanced success in moving the country to the inevitable post-oil age.

Figure 139: the location of Qatar

Source: Qatar Statistics Authority (QSA)

The first great step to attain this target was the launch of *Qatar National Vision 2030*(QNV 2030) in October 2008. QNV 2030 is driven by all aspects of sustainability based on four pillars as shown in Box [15]. The high rate of Qatar's economic growth resulted in rapid urban development and high population growth which have direct impact on sustainable development. In order to minimize the risks, Qatar has adopted several initiatives to protect its natural environment, including projects to monitor air and water quality, reduce carbon emissions and maintain biological diversity.[2] QNMP 2030 transforms the QNV four pillars into seven spatial and physical planning principles: quality of life for all; sustainability; environmental values; connectivity of people and places; economic growth and diversification; ownership in planning and implementation; and, identity.[3]

Box 15: QNV 2030 four pillars

- *Human Development*: development that expands the opportunities and capabilities of all the people of Qatar to enable them to sustain a prosperous society;
- *Social Development*: development of a just and caring society based on high moral standards and supportive social policies, and where Qatar plays a significant role in the global partnership for development;
- *Economic Development*: development of a competitive and diversified economy capable of meeting the needs of, and securing a high standard of living for, all its people both for the present and for the future; and
- *Environmental Development*: management of the environment such that there is harmony between economic growth, social development and environmental protection – the three dimensions of sustainable development.

Source: Qatar National Vision 2030, *Qatar's Second Human Development Report*

[1] http://en.wikipedia.org/wiki/Qatar 16-12-2011
[2] Ibid
[3] Kennedy, J (2010), p.97

In relation to **economic sustainability**, *Qatar National Vision 2030* (QNV 2030) has addressed the climate change as "cross-generational challenge."[1] The reason as they believe is that 'climate change is a long-term problem with cumulative outcomes, mitigation measures implemented today, no matter how stringent, may not appear beneficial within the lifetime of the present generation.'[2]

QNV 2003 Report noted that 'Qatar's abundant oil and gas reserves offer a window of opportunity to make the transition to a post-carbon economy, to help develop and exploit environmentally friendly and energy efficient technologies, and to invest in sustainable development. Changes in global markets will open up new opportunities for Qatar to take a leadership role in emerging fields such as emission-reduction approaches, energy efficient technologies, green buildings and financing of low carbon activities.' [3]

To achieve a balance between development needs and protecting the environment, including air, land, water and biological diversity, the QNV 2030 foresees the following environmental outcomes:

- Preserving and protecting the environment, including air, land, water and biological diversity, through:
  - An environmentally aware population that values the preservation of the natural heritage of Qatar and its neighboring states;
  - An agile and comprehensive legal system that protects all elements of the environment, responding quickly to challenges as they arise; and
  - Effective and sophisticated environmental institutions that build and strengthen public awareness about environmental protection, and encourage the use of environmentally sound technologies. These institutions will also conduct awareness-raising campaigns, employ environmental planning tools, and carry out environmental research.
- A comprehensive urban development plan for Qatar that adopts a sustainable policy with regard to urban expansion and population distribution.
- Encouragement of regional cooperation to put in place preventive measures to mitigate the negative environmental effects of pollution arising from development activities.
- A proactive and significant regional role in assessing the impact of climate change and mitigating its negative impacts, especially on countries of the Gulf.
- Support for international efforts to mitigate the effects of climate change.

Source: The General Secretariat for Development Planning (GSDP), 2008

[1]Qatar National Vision 2030 Report, 2009, p.3
[2]Source: ibid
[3]Source: ibid

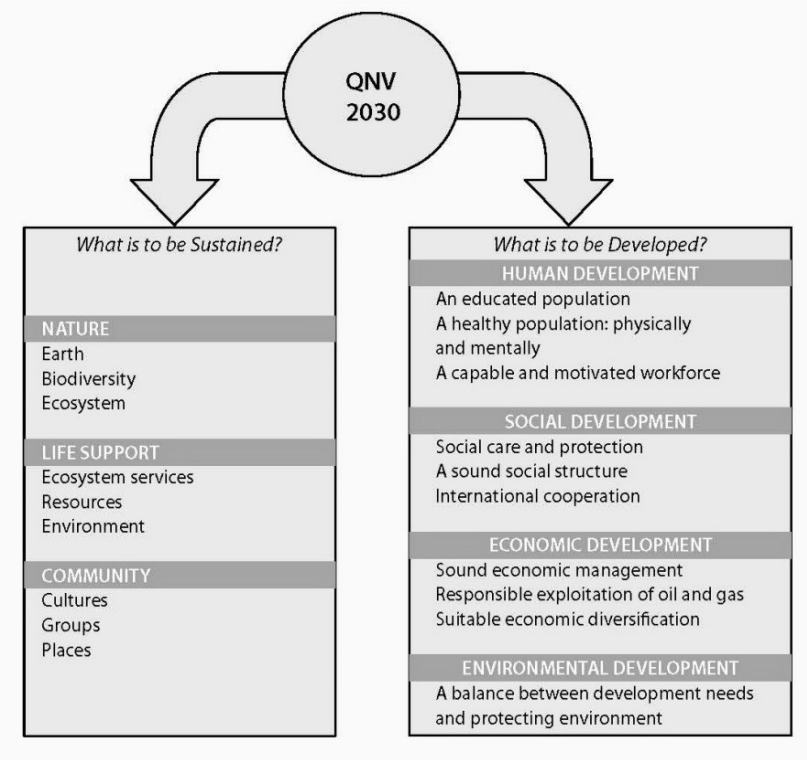


Figure 140: QNV 2030 builds a bridge between the present and the future

Source: Qatar National Vision 2030 Report, 2009, p.12

Sound management of Qatar's hydrocarbon resources will continue to secure improvements in standards of living. However, an improved standard of living cannot be the only goal of a society. As the QNV 2030 notes, Qatar must balance five major challenges:

Modernization and preservation of traditions;
- The needs of this generation and the needs of future generations;
- Managed growth and uncontrolled expansion;
- The size and quality of the expatriate labour force and the selected path of development; and
- Economic growth, social development and environmental management.

Source: QNV 203 Report.

Despite its rank as the world's second highest gas exporter, Qatar also concentrates on media and sport as another way of diversifying its economy. Since media is considered an essential contributor for development, Qatar has utilized it as a tool for branding the country worldwide. Currently, Al Jazeera Network represents the world's second largest television enterprise which effectively has branded Qatar as one of the countries that attract most investments and capitals. Along with the common debates that indicate sport as a fundamental player and viable contributor for sustainable development, Qatar has shown very advanced success for utilizing sport as a key element for branding the country worldwide. A great example that proves Qatar's success in sports is when it gained the confidence to host the FIFA World Cup 2022, the most popular sport competition worldwide.

In relation of sustainable urbanization, the Pearl and *Musheireb* (Heart of Qatar) seem to be the significant examples for sustainable development in Qatar. QNV Vision utilizes *density* as an essential driver for sustainable development. As the current built-from, which does not meet sustainable criteria, the future vision assures the use of various aspects that are available in traditional buildings, such as the high density urban form, courtyards and buildings adjacent to each other. These unique traditional features have proved their efficiency of energy and resistance against the local harsh climate. Consequently, the targeted density in the downtown reaches an average of '100 to 150 people per hectare.'[1] It has been indicated that "Musheireb Properties began work on the world's first sustainable downtown regeneration project in Qatar's capital city." This QR20 billion mixed-use development adapts the traditional built form with modern building technology.

Picture 57: Musheireb development integrates tradition and compact urban form

Source: Forbes Magazine found in http://forbescustom.com/qatar

[1] Source: http://projects.msheireb.com/retrieved in 18-2-12

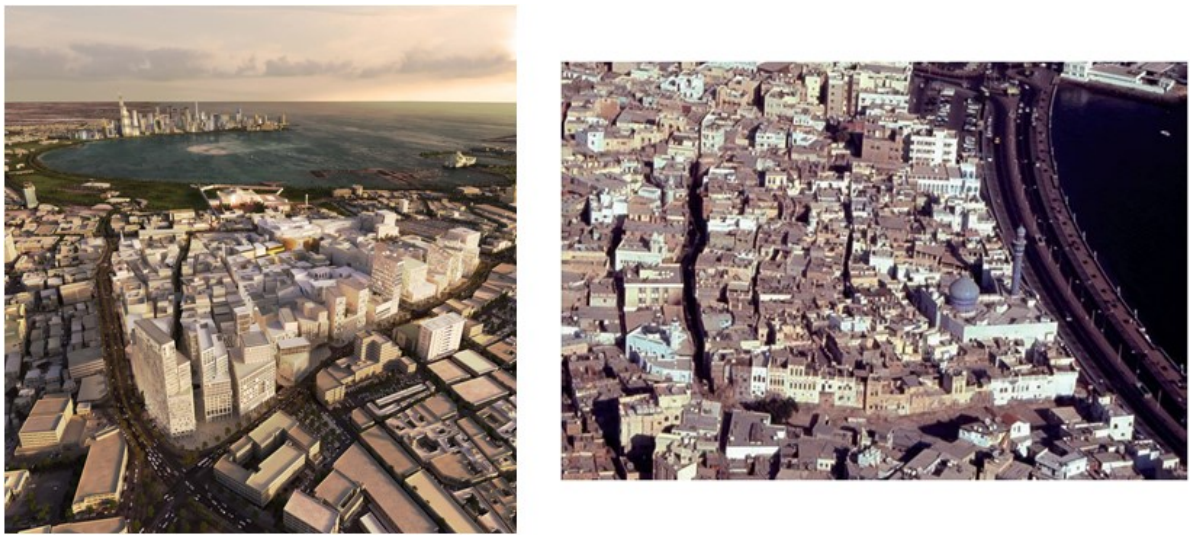
The primary objective of the Musheireb project is to reverse the pattern of development and growth of Doha in recent decades which has tended towards isolated land uses with urban sprawl and heavy reliance on car transport. Focus will be on reducing car use and congestion, while improving connectivity across the wider city area.[1] For an effective step to add a sense of community, 'an underground basement extending over the entire area will accommodate approximately 13,700 car park spaces, will effectively remove vehicles from the streets around Musheireb, reclaiming the outdoor spaces for the community to enjoy.[2]The project started in early April 2006, with the first phase of Musheireb project being completed in 2012, while the entire development is expected to be ready by 2016. "Musheireb, when completed in 2016, will provide Doha with a downtown that reflects the nation's aspirations and newfound position in the world, and will revive the downtown's past as the center of residential and commercial life of the city," says Eng. Issa M. Al Mohannadi, CEO of Msheireb Properties. Development in the Musheireb will be based on five pillars; Heritage and Culture, Innovation, Sustainability, Enrichment and Environment.[3] It will feature several aspects and aesthetic values inspired by traditional Qatari architecture, including proportion, simplicity, space, light, layering, ornament and response to climate, yet it will fully utilize state-of-the-art sustainable technology. *At the Heritage and Culture level*, 'much of the historic street pattern is retained including Kahraba Street and the line of the old Wadi. Overlaid with the curving lines of historic streets, a contemporary grid of urban blocks is created, interwoven by an intricate lattice of lanes, sikkas and small urban spaces.'[4]

At the technology level, 'using the latest in sustainable technology, combined with traditional techniques of climatic design such as shading structures, wind catchers and massive construction, high levels of performance will be achieved with minimum wastage and low levels of pollution.'[5]

At the sustainable level: 'since the discovery of oil and gas in the 1930s, the small fishing village of Doha has grown to create a sprawling city. Greater prosperity and the rise in private car use have fuelled suburban expansion which has weakened the city's centre of gravity. The Musheireb will revitalise the historic core of Doha itself, giving families the opportunity to live in beautiful homes and enjoy the benefits of a strong, well-served local community.'[6]

At enrichment level, 'the car-dominated lifestyle and isolated social norm of the suburbs will be replaced by beautifully designed and compact city neighborhoods where family homes will be within easy walking distance of schools, shops, public squares, mosques and other cultural activities and the majority of vehicles will be below ground. As in Doha, organic courtyard patterns embody deep-rooted family traditions of privacy and security. Townhouses will be arranged as 'fireej' clusters, each sharing a communal majilis and courtyard garden. This is the revival of a time-honoured urban form, the nucleus of Qatari society.'[7]

[1] Ibid
[2] Ibid
[3] http://projects.msheireb.com/ accessed in 18-2-12
[4] Ibid
[5] Ibid
[6] ibid
[7] ibid



Picture 58: Musheireb Model in Doha, right: Sur al Lawatya in Muttrah, Muscat
Pictures Source: left http://projects.msheireb.com/ accessed in 18-2-12 and right: Peterson (2007)

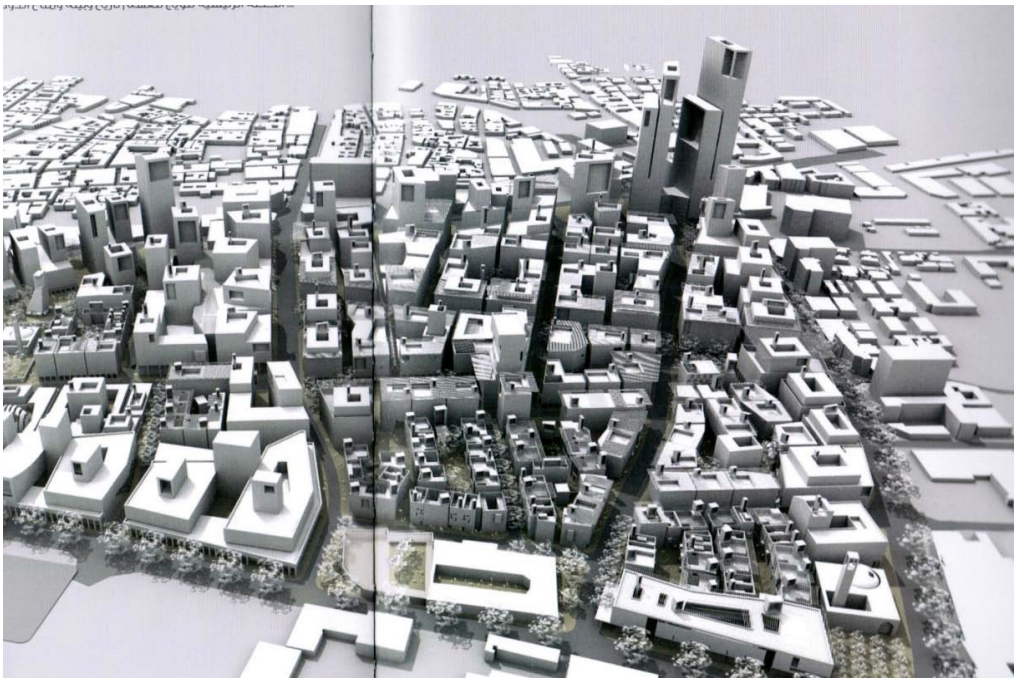
At environmental level, 'by understanding the local climate, by maximizing shade and by using the prevailing wind direction, the Master-plan optimizes the pedestrian environment, with colonnaded streets, living roof scapes and water features within the landscape.'[1] Musheireb, observed as a mix-use development, minimizes the long commute which is common on the single land-use areas. The high density built-form minimizes the areas of buildings' plains which are exposed to the hot air and sun rays. The irregular narrow pathways and the six-floor high buildings ensure casting shades for pedestrians. Consequently, the reliance of private cars is kept minimal by the encouragement of walking and using the viable public transport. Generally, the urban form of Musheireb is largely similar to *Sur al Lawatya* in Muttrah in Muscat as indicated in Picture (58).The building design and orientation are based on the local weather conditions. Thus, they are 'positioned in clusters, the buildings will have façade articulation to respect the prevailing climate rather than compete against it. The orientation of the buildings are planned to take advantage of the prevailing offshore northerly winds. Streets are aligned and building heights increased towards the south of the site to benefit from the sea breezes.'[2]

Picture 59: Visualization aerial view, Doha Master Plan, Qatar, 2005

Source: AS&P – Albert Speer & Partner GmbH found in http://www.as-p.de/projects/urban-planning/259105-doha-master-plan.html?content=image0, accessed 11/12/2011

[1] ibid
[2] http://projects.msheireb.com/ accessed in 18-2-12

As the design principles are derived from the traditional Arab city, 'the development will be of an inner urban scale, relatively dense, with blocks of interconnecting buildings interspersed with a network of squares and courtyards. Landscaped streets will run between the major blocks of the development, while smaller access lanes and pedestrian routes will crisscross more randomly, affording greater protection from the intense sun. Colonnades will line many of the streets to provide shading and a grand central square, which will become a new destination in Doha.'[1] Since the local economy condition influences the city's life style pattern and the rate of commute, 'Musheireb looks to create a dynamic local economy that will facilitate community interaction and social exchange, and ensure self-sufficiency in school and basic amenities. The development and regeneration of the 35 hectare site will put people and communities first, encouraging them to explore their full potential and to flourish.'[2]



Picture 60: Musheireb Model- Massing Concept.

Source: Kennedy, F (2010), p.101

[1]Ibid
[2]Ibid

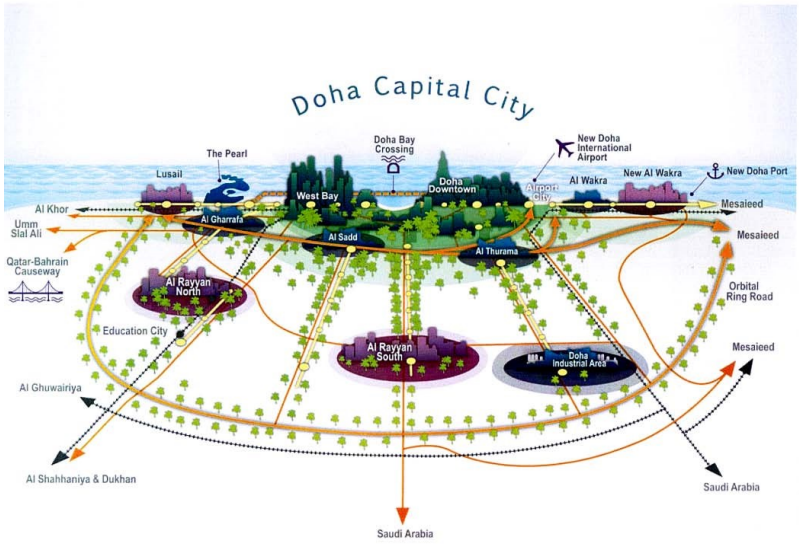


Figure 141: schematic vision of Doha's urban expansion. Source: Kennedy, F (2010), p.101

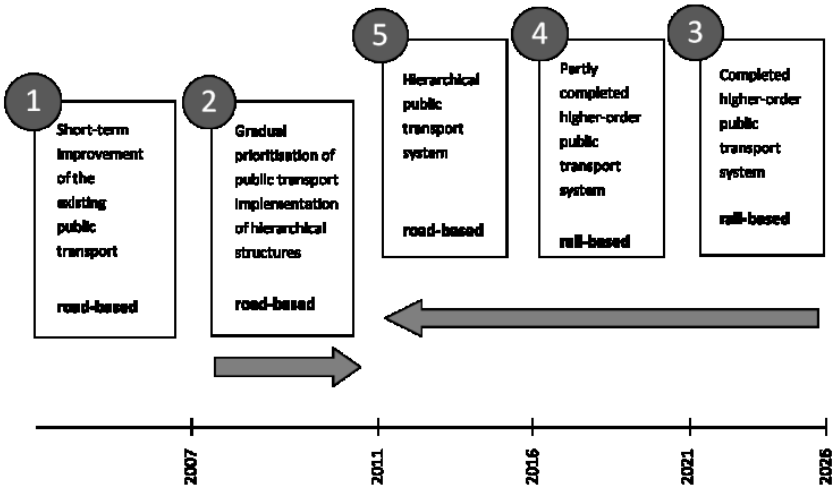


Figure 142: Vision of Public Transport System, move people, not cars

Source: Public Transport System for Qatar. The Transport Master Plan for Qatar, 4th April 2007. www.ptvag.com

Unlike Oman's Vision 2020 which is focused on economy, Qatar's National Vision 2030 focused on four important pillars which are crucial for attaining sustainable development. These paradigms include Human Development; Social Development; Economic Development and Environmental Development. The difference between Musheireb development and the Blue City in Oman is that the first one is considered a rehabilitation of an entire quarter in the downtown that is integrated with the natural urban fabric. However, the Blue City, despite its high density urban form, is far away from the existing development and appears isolated from the existing urban fabric. This indicates how urban development can reform the structure of a city by adding more liveability to the space and how other urban development contributes by adding more sprawl and fragmentation to the overall urban pattern.

5.5 Conclusion

This part is divided into two significant fractions: the first fraction highlighted the state of sustainability in Oman. The second part brought some unique examples from neighboring GCC Countries that have largely succeeded in integrating sustainability with urban initiatives. The first envisaged sustainability indicators in Oman, which can be motivated to boost the paradigm of sustainability in urban development. These indicators with their ambitious prospective can offer a powerful contribution to the urban governors to ensure the transformation of our cities transform consumptive cities to productive cities. The economic indicators in Oman are represented by the unique economic characteristics that make Oman a rich milieu for investments.

For instance the strategic location along main marine routes and the ecological diversity raise its investment value in comparison with other countries in the region. The renewable energy sources in Oman are considered as the most significant indicator that reduces the reliance on fossil energy and assures the shift toward a post-oil age. This part also indicated the challenges that might be confronted during the transformation towards the post-oil age. It involves the four development parameters, economic, social, ecological and urban. Although all those parameters are crucial for the sustainable urban development, oil depletion is considered the major challenge because oil is still the main resource that controls our economy. Diversifying the economy during the little time left of the oil depletion era is a genuine challenge for urban governors if they intend to move towards sustainable urban growth.

Climate change is considered a very potent challenge for future development. Sustainable planning will avoid the huge cost of future natural disasters that arise as a result of the burden on natural resources. As cars represent the most influential factor of the current urban pattern, shifting our society from a car-culture to walkable one represents a major challenge for future urban governors. The rapid urban growth without strategic urban management for natural resources leads to the collapse of local ecosystem. The intensive consumption of energy leads to a raise in gas emissions in the air and largely increases the temperature. This trend is not only harming the local habitat but also causing a direct threat to life in general.

Unlike Oman's development policies over the past four decades, which were mainly focused on developing the basic infrastructure, GCC countries, besides developing their basic infrastructure, have undertaken other policies to diversify their economies and attain the sustainable development. For instance, in relation to economic diversification, Dubai has focused on real estates and trade sectors to attract investments and capitals. It has offered comfortable ambience for investors by promoting the free market policies. Therefore, Dubai has become one of the world's largest hubs for trade and services. Its extensive developments indiversifiedsectors have paved the way for the increasing demand for investment from national and international investors.

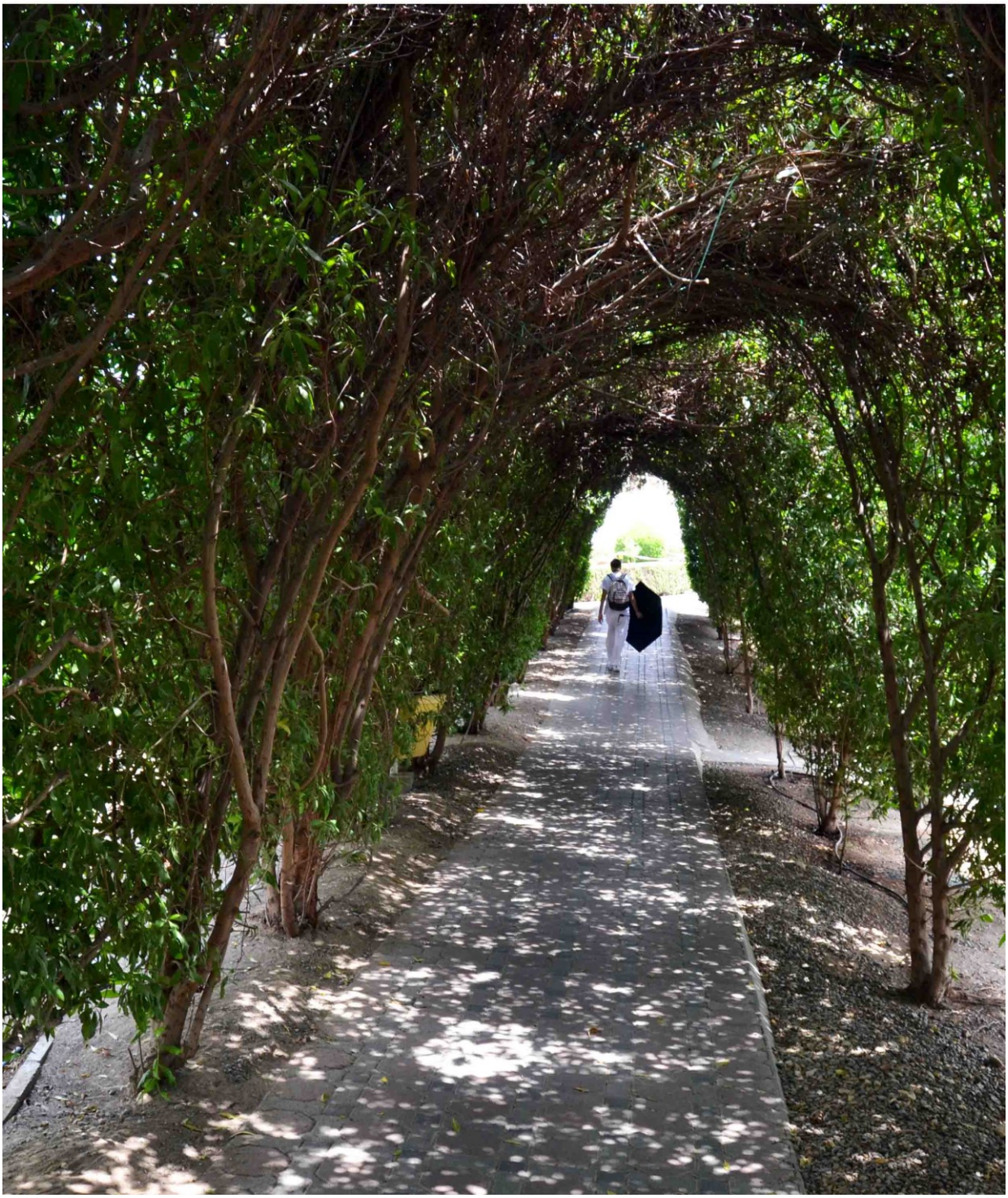
In addition to its development of basic infrastructural services such as transport, water, health, education, sewage, telecommunications, etc., Dubai has largely focused on the real estate sector which is based on speculation. The structures, which are known to be some of the world's largest, biggest, tallest, first, etc., have largely contributed to branding Dubai worldwide. For instance, Dubai is home to the world's tallest tower, biggest mall, largest

artificial island, first rotating building, first under water hotel, etc. Unlike Oman's urban growth, which is commonly based on low-density private villa development, Dubai's urban growth is based on investment of higher density multi-story buildings and mixed-use development. Despite the rapid urban growth which is promoted on speculation which leads to insufficient liveability in cities, the urban development is normally initiated according to master plans and strategic planning policies. Dubai initiated the application of the 'green building standards' in all buildings in late 2009. In March 2009, Dubai's Department of Tourism and Commerce Marketing confirmed its commitment to sustainable tourism, aiming to reduce hotel carbon emissions by 20 percent by 2011.

Abu Dhabi, the capital of UAE, has followed an exclusive path in order to attain sustainable development. Progress towards major sustainability in the emirate was initiated by the launch of Plan Abu Dhabi 2030 by the Abu Dhabi Urban Planning Council. The application of the *Estidama Program* (meaning 'sustainability' in Arabic) in late 2009 represents a significant step towards the construction of eco-friendly buildings. In addition, the emirate which overlooks the calm Persian Gulf focuses on developing cultural heritage as a key element of economic diversity and attracting tourism. Despite its long-term oil reservoir, which is estimated to last more than 90 years, it intended to become the world's pioneer in the sector of renewable energy. Moreover, the Masdar initiative represents a tangible practice for utilizing clean energy that one day can displace the fossil oil energy. Since buildings have become the most energy consumers and the largest polluter in the country, energy efficiency programs and sustainability policies have become common in the construction sector.

The Qatar Green Building Council, which was established in 2009, will develop green building standards to be used by all developers. Unlike the Oman Vision 2020, which focuses on economic development, Qatar National Vision 2030 (QNV 2030), launched in October 2008, conceives the aspects of sustainability into four pillars, Human Development, Social Development, Economic Development and Environmental Development. Musheireb's development represents a unique illustration of compact city urban form that merges tradition with sustainability. The Musheireb's high-density mixed-use urban pattern that is integrated with narrow and shaded pedestrian pathways indicates a vital solution for the contemporary sprawled and fragmented urban pattern.

PART SIX
THE UPCOMING INTERVENTIONS AND CONCLUSIONS



6. PART SIX: THE UPCOMING INTERVENTIONS AND CONCLUSIONS

6.1 Scenarios

6.1.1 Introduction

To assist the local authorities manage the ambiguity of the future urban pattern, potential consequences of an action will be examined against certain variables. Thus, local authorities, decision-makers and other parties related to urban development can take advantage of these scenarios to manipulate the future trends of urban growth. The three scenarios being developed are based on multiple parameters in the aforementioned four significant pillars (economic, social, environmental, governance) that constitute the urban sphere in Oman.

As it was pointed out earlier in this thesis, according to BP (2008) reports, Oman's oil is forecast to remain for only21.3 more years. Oman is in, or perhaps beyond, its peak-oil era and we should be ready to transform our life and cities to the inevitable post-oil age. Therefore, this chapter assumes a set of three scenarios that project the urban pattern in Oman for the coming 20-25 years according to six main pillars: economic, social, environmental, governance, urban management, and technology. The three scenarios can be highlighted as follows:

- ***Scenario 1: Status quo***(Pessimistic view on future development)
- ***Scenario 2: Maximum Intervention***(Optimistic view on future development)
- ***Scenario 3: Packages of key interventions, judicious and resilient interventions***(Realistic view on future development)

Scenario 1: Status quo *(Pessimistic view on future development)*
The era of oil depletion is characterized by a shrinkage in oil production which leads to steadily rising gasoline prices and largely harm the economic stability which is based on this finite resource. The cost of living will be extremely high as the majority of our mobility is based on using the private automobile and our personal comfort is based on using air-conditioning systems. This scenario embodies the worst assumptions in consequences of the persistence of utilizing the current urban management system for the coming 30 years. This period is characterized by a decline of the oil production. The decline of oil production could directly harm the lifestyle patterns in the country, while the depletion of oil might cause panic and collapse on a socio-economic level.

Until now, the government used to subsidize gasoline prices to make it affordable for people. For Scenario 1, it is assumed that nothing will occur in the coming 30 years in relation to changing the existing policies for sustainability. What are the characteristics of urban pattern at the oil-depletion era which inevitably begins very soon according to proven oil reserves? Does the government persist in fixing fuel prices for people, and for how long? What about if the government cuts off the fuel-subsidy due to oil depletion? Do people start thinking about changing their attitudes, such as changing their residential places, for instance, to be closer to their workplaces? Or do they change their transport behaviors –for instance, sharing the mode of transport for workplaces? What will happen in the coming 30 years if the government persists to utilize the same land management system, the same planning standards, and the same building regulations?

What will the urban pattern look like with the current growth rate of population and the huge consumption of land for residential purposes and for transport infrastructure? Do local authorities ensure that lands are sufficient for the coming generations, particularly in Muscat where lands for residential and investment purposes are scarce? Is it the right time to stop giving lands for low-density and remote areas?

Gradually shifting our society towards energy efficiency becomes a must since we have merely a few years remaining in the oil-age. No doubt, shifting our society to the post-oil age requires enormous efforts in all sectors. It includes reforming most of the existing planning ordinances that cause the current patchy urban pattern. What are the characteristics of the urban pattern in the era of oil-depletion if the current urban management remains for the next 30 years?

Scenario 2: Maximum Intervention *(Optimistic view on future development)*
The second scenario is more optimistic as it assumes that the government's politicians and decision-makers are fully responsive to the age of oil-depletion. Scenario two is considered the best that can be undertaken to ensure a full execution of the criteria of sustainability to attain improved liveability. However, if the governmental officials fail to cover all requirements of scenario two, then scenario three is designed to be more pragmatic, more realistic and more resilient.

Scenario 3: Packages of key interventions, judicious and resilient interventions *(Realistic view on future development):*
The scenario offers packages of key interventions that are considered as judicious and resilient interventions to attain improved liveability (when prioritization comes before optimization). Scenario three is based on assumptions that can be accomplished according to the available socio-economic circumstances. Scenario three is a hybrid that provides a realistic view that might be achieved within the potentials of Omani Society of the 21st century. The most important aspect is to minimize the requirements for coping with challenges of the oil-depletion. Normally, people tend to perform certain careless behaviors that can be reasons for many ecological issues such as climate change. These attitudes also largely affect the urbanism pattern. Changing people's behaviors in a short time is not an easy task and involves plenty of effort at all levels of individual life and society.

The optimization in sustainability requires massive efforts and limitless competences. It is obvious that there are many things that would be nice to have but we can't get them all. However, there are certain mandatory tasks which are necessary and can be considered as top priorities. Therefore, this scenario assumes various packages of key interventions that can set the politicians and decision-makers at ease in attaining sustainable development according to the available capabilities. Table [30] below summarizes the common variables that are discussed in the three scenarios.

Pillar	Variable	Scenario 1	Scenario 2	Scenario 3
	Source: the Author			
Economic	Degree of economic diversity	Low	High	Average
	Degree of oil dependency	High	Low	Average
	Rate of local production and handicrafts	Low	High	Average
	Rate of share of employment in public sector	High	Low	Average
Social aspects	Rate of urban population growth	High	high	High
	Rate of unemployment	High	Low	Average
	Rate of social equity	Low	High	High
	Degree of preserving resources for coming generations	Low	High	High
Environmental conditions	Rate of utilizing energy-efficient programs	High	Low	Average
	Degree of utilizing renewable energies	Low	High	Average
	Quantity of new private automobiles	High	Low	Average
	Rate of urban densification	Low	High	Average
Governance	Degree of decentralization	Low	High	Average
	Degree of adopting sustainability in land administration	High	Low	Average
	Degree of efficiency of public transport	High	Low	High
	Rate of mixed used development	Low	High	Average

Table 30: Summary of the scenarios based on assumed variables

Source: The author

6.1.2 Variables of the scenarios
6.1.2.1 Economic aspects

The degree of economic diversity	Economic diversity is crucial to attain sustainable development. It is important to recognize the future of economic performance in the time of energy crisis and increase of population. Will local authorities continue adopting the current oil-dependent economic policies for the coming 20-25 years or is there an efficient policy for diversifying the national economy? In this case, the amount of contribution of the non-oil sectors to the GDP is crucial to measure the degree of economic diversity.[1]
The rate of local production and handicrafts	Obviously, the rate of local production is a significant factor for economic sustainability. The imbalanced rate between imported and exported goods might broaden the socio-economic problems. Overseeing the rate of local production in comparison to the imported products is crucial to assure the structure of the national economy is moving towards the post-oil economy. The rate of local production includes food productions, small-scale manufacturing and handicrafts are integrated into the local economy in micro- and macro-urban levels.
Degree of oil dependency	Oil remains a dominant source for the national economy. However, the degree of shift needed for the national economy to transition from oil-dependence to non-oil dependence determines the degree of security to the national economy when approaching the post-oil age.
Rate of share of employment in public sector	Currently, the employment policies were oriented towards the public sector with weak attraction to the private sector. The percentage of Omani employees in government sector was above '72% in 1999'[2]The public sector has been attracting the national workforces because of better allowances with less working hours. The government tried to encourage the private sector to share the Omanisation Scheme with the government sector by introducing a prize called 'Green Card' and awarded those companies that comply with the criteria of the Omanisation Scheme. Despite this facility, private sector remained

[1] According to the 2012's budget, oil revenue represents 81% of the total exports in the Sultanate and 45% of GDP. Based on BP estimations 2008, merely 21 years remain before oil-depletion from Oman's fields. Every year, the country pays a part to the fuel costs to be affordable to the local expenditures. According to 2012-budget Report, about (OMR.170 million) are paid to maintain the high increasing energy.

[2] source: http://www.omanet.om/english/misc/omanise.asp Accessed 5/6/2013

less prevalent (or preferred) for the national workforce. This is subjected to the rapid consumption of public spending as well as the decrease in rate of production. The question might be raised: is the governmental sector apt to absorb the massive flows of job-seekers from now up to the coming 20-25 years? Is the government being continuous in adopting the current employment policies?

6.1.2.2 Social

Rate of urban population growth

The rate of attracting people to urban areas will determine the impacts to the local socio-economic and environmental conditions. With the natural growth of population, the expertise population can affectively determine the impact level to the socio-economic and environmental conditions and the entire lifestyle patterns. The rate of internal immigration from rural to urban areas influences the quantity of local food and handicrafts productions that are mostly created in rural areas.

Based on the rate of population growth that was issued by the National Centre for Statistics and Information (NCSI) in 2012, Oman's population is expected to grow from 2,773,479 in 2010 to nearly 8 million in 2020, and more than 18 million in 2040. This rapid growth of population will largely affect the level of consumption of natural resources. The absence of energy efficiency policies will lead to extreme consumption of natural resources. Meanwhile, the segregation of land use enlarges the distances between families and relatives. As people are kept apart by the fragmented land use pattern, the sense of community will be reduced. Family relations will be segregated even further. The ratio of community involvement and culture actions will be absent, while insecurity and theft will be at higher level because of the construction pattern in very low-density areas. Public spaces such as parks and children play areas will dwindle as they are handed over for private transport infrastructure. The urban development that relies on single land use, such as villa type areas, tends to separate people from living and work places.

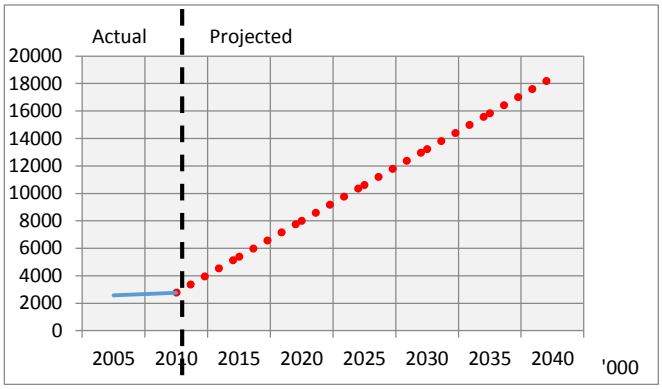


Figure 143: actual and projected population growth in Oman.

Source: The Author based on NCSI statistics.

Rate of unemployment

Unemployment rates represent the most problematic issue in every country. Currently, the unemployment rate in Oman is 15% which is fairly higher than other countries in the region. Despite the policies overseeing the *Omanisation Scheme* (working toward replacing expatriates with trained Omani Personnel) which was launched in 1988[1], the unemployment records continued rising. This is because the employment policies were oriented towards the public sector with weak attraction to the private sector.

Degree of social equity

The degree of reasonable access to resources, employment, education, participation in political and cultural fields, etc., determines the degree of social equity. For instance, affordable housing is crucial for achieving social equity and reducing the level of poverty. Therefore, the degree of financing for affordable housing determines the degree of social equity.

Degree of conserving resources for coming generations

The degree of conserving natural resources ensures the degree of achieving the social sustainability. Land is a major element that future generations have the right to acquire. The degree of consumption of land determines the degree of conserving this resource for the coming generations.

[1] source: http://www.omanet.om/english/misc/omanise.asp Accessed 5/6/2013

6.1.2.3 Environmental aspects

Degree of adopting energy-efficiency programs	As shown previously, consumption of energy and water in Oman is extremely high. Obviously, the more energy consumed, the more natural resources are depleted and the more greenhouse gases are emitted. Therefore, the degree of adopting energy-efficiency programs is crucial to determine the amount of resources depleted from one side and the damage of local environment from the other side.
Degree of utilizing the renewable energies	Renewable energies are the most suitable component that might determine the future life of our cities. Since renewable energies such as solar, wind and tides are largely available in the country, the degree of utilizing these infinite energies during the next 20-25 years defines the scope of transferring our life to the post-oil age.
Quantity of new private automobiles	Automobiles are one of the most destructive elements for the ecosystem and local environment. The number of automobiles that are introduced to the streets determine the impact to the environment and amount of harm to the local ecosystem. Energy-efficient transport will be inevitable in the future of our cities, particularly in the age of the energy crises. It is known that Oman is one of largest world's highest contributors of CO_2 emissions due to the rapid growth of traffic and private automobiles. Therefore, the degree of utilizing energy-efficient transport during the coming 20-25 years will impact the degree of harm to the local environment.
Rate of urban densification	It is known that densification becomes not only a crucial factor for attaining efficient use of land but also a method to reduce energy consumption because less energy and private cars are used. Therefore, the rate of density determines the rate of air pollution that harms the local environment.

6.1.2.4 Governance

Degree of adopting sustainability in land administration	As was discussed earlier, the land granting system, based on public land lottery, has largely contributed to the emerging patchwork urban growth and scattered urban pattern throughout the Sultanate. Therefore, the changes to this land governance towards sustainability will determine the transformation of our cities to the post-oil age.

Degree of decentralization

Decentralization of power emerges as one of the most essential priorities to ensure a successful progression towards the post-oil age. As it was indicated earlier in this thesis, the governance in Oman is characterized by centralization in decision-making. The centralized authority dominates all political, social and economic sectors. The development process is normally planned, decided and executed by central governors. Therefore, the degree of decentralization will ensure the ratio of participation by local people in decision-making and the number of and degree to which metropolitans become self-governing. This action contributes to the level of public satisfaction.

Degree of efficiency for public transport

In a time of lacking public transport, our cities remain dominated by cars. Consequently, lots of money is required to subsidize the construction and maintenance of roads to cope with the increase in population and cars. Public spending is not limited to providing vehicular infrastructure, such as roads and parking, but also includes the rise in car accidents that results in a tremendous number of annual injuries that are mostly treated in governmental hospitals. Consequently, the national economy is largely harmed by increased rates of private car use and car accidents. It is obvious that the current planning policies boost a car-dependent society while safe and convenient pedestrian pathways and viable public transport are absent. Therefore, in addition to problematic traffic jams which will be augmented and resulted in an increase of time spent in cars, there is a gradual increase in car accidents and the associated rise in the number of death and injuries. Based on Royal Oman Police statistics in the last two years, the death rate in car-accidents is expected to grow sharply from 1,056 in 2011 to 3,416 in 2021.Therefore, the degree to which our cities can shift from car-reliance to the use of efficient public transport and increased pedestrian mobility ensures the effective shift towards the post-oil age. The amount of cars shifted from streets by encouraging walkability and utilizing public transport also determines the decrease in the amount of car-accidents occurring.

Rate of mixed used development

Mixed development is considered a viable tool for achieving sustainable development. The rate of mixed-use development which integrates services, workplaces and housing structures in one readily accessible locale determines the need for commuting. In contrast, the rate of single land-use development determines the consumption of time and energy.

6.1.3 Scenario one: Status quo

(Pessimistic view on future development)
The overall assumption:
- There will be no change 'laissez-faire'
- Oil is going to be depleted after 20-25 years
- The scope of time: 2040 Scenario one is based on following variables

Economic

***Degree of economic diversity*:** In 2040, the national economy relies 83% (as in 2013) on oil revenues. The national economy will go into a deep crisis or even collapse by 2040.

***Rate of local production and handicrafts**:* Agriculture will decline; local food production will come to a stop, expensive imports will be necessary to support the growing population; risk of growing poverty.

***Degree of oil dependency**:* The GDP will decrease and affect the entire lifestyle pattern while population increases, poverty level will increase.

Rate of share of employment in public sector: Jobs will be scarce, the degree of unemployment will increase, and the public sector will no longer be able to absorb the bulk of jobseekers. As government sector in Oman has very limited productivity; this will increase public spending which will put large burdens on the national economy.

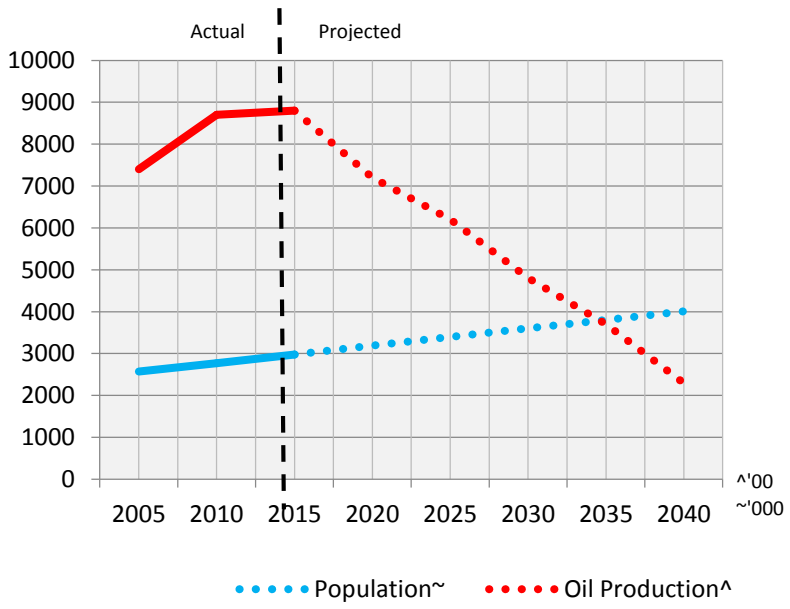


Figure 144: Projection of population trend and oil production in Oman

Source: Own calculation based on MNE and official

Social aspects

Rate of urban population growth

The rate of urban population growth will continue rising high in the coming 20-25 years due to internal and external immigrations. This will lead to increases in the consumption of natural resources. More land is needed for housing and transport. An increase of (expat) experts will boost the rate of unemployment for nationals, as wells as crime levels, etc.

Rate of unemployment

Jobs will be scarce in the coming 20-25 years because the existing employment policies rely on the public sector. The unemployment rate will rise from 15% in 2011 to more than 35% in 2040. The public sector will no longer be able to absorb the bulk of jobseekers. This will boost many social problems such as poverty and crime.

Rate of social equity

Continuing with current policies that restrict the participation of local people in political and cultural fields in the coming 20-25 years will increase public dissatisfaction throughout society. Support for affordable housing will decrease. Mostly, a lack of affordable housing will force the low- and middle-classes to accept high interest mortgages and personal loans to finance their housing schemes, which will be already above their financial means; this will lead to a decrease in the quality of life. As lack of affordable housing increases so will crime levels, such as burglary and robbery.

Degree of preserving resources for coming generations

Land water and other natural resources will be at high consumption rates in the coming 20-25 years. Land for food production will be scarce because of rapid urbanization. These resources will no longer be adequate for future generations.

Environmental aspects

Rate of utilizing energy-efficient programs

Lack of energy-efficient programs for the coming 20-25 years will lead to a further burden on natural resources. This leads to a limit on resources (mainly land and water) which comes to an end in 2040. Lack of energy-efficient programs, such as installing thermal insulation in buildings or using energy-efficient materials, will lead to a further increase in energy consumption which will bolster natural resources depletion.

Degree of utilizing renewable energies

The lack of utilizing renewable energies for the coming 20-25 years will lead to a further increase in energy crises. This is because energies that are generated by the fossil fuel energies lead to a depletion of natural resources. Moreover, the energy toll will increase because the local authority will no longer be able to support the energy subsidy. Waste and air pollution will increase. Following the current policies of energy consumption, which rely on intensive consumption, will lead to further harmful impacts on the local environment. The impacts will include draught, hurricanes, desertification, etc.

Quantity of new private automobiles

The increase in the quantity of new private cars, which mostly depend on using the fossil-oil fuel for the coming 20-25 years, will lead to further destruction of the eco-system and local habitats. It will also lead to a high depletion of oil resources.

Rate of urban densification

The continuation of extreme low-density urban growth for the coming 20-25 years will lead to a high increase in energy consumption due to the intensive use of private transport which raises the rate of air pollution and toxic waste. This will cause a harmful impact on the local environment and eco-system.

Governance

Degree of decentralization

Governance policies which are mainly based on centralization remain in the coming 20-25 years. The degree of social equity and satisfaction will further decrease. Therefore, multi-dimensional problems will emerge. For instance, the decisions which are solely undertaken by the central governors will become monotonous and weaker due to the population growth and the scarcity of natural resources. While density is increasing, the faults of planning policies and building regulations will become more visible to the public. As a result, with regulations that are not fit for their local conditions, a feeling of dissatisfaction will be common among the public.

Degree of adopting sustainability in land administration

The urban management will adopt unsustainability for the coming 20-25 years. Persistence in the current land granting system, which affords citizens large plots at random lottery, will enlarge social segregation and decentralize basic infrastructural services. It will also increase the consumption of natural resources including water, energy and land**.**

Degree of efficiency of public transport

The public transport system will be completely inefficient in the coming 20-25 years. Transport will remain dependent on private automobiles. The number of car accidents will increase as before. This trend will lead to increasing the costs of health care which will have to be paid by citizens themselves in times of economic crisis which will increase the rate of poverty (no social welfare any more).

Rate of mixed used development

Urban development will adopt the single land-use policies for the coming 20-25 years. The urban development that relies on single land use, such as villa type areas, will tend to separate people from living and work places. With the lack of public transport, services will not be easily accessible by foot or bicycle, but only by private car. A single land use scheme normally influences the size of the investment in the residential sector as well as influencing the rental prices and tenure.

6.1.4 Scenario 2: Maximum Intervention

(Optimistic view on future development)

The overall assumption:
- There will be a maximum application of sustainability
- Oil is going to be depleted after 20-25 years.
- The scope of time: 2040 Scenario two is based on following variables.

Economic aspects ***Degree of economic diversity***

High degree of economic diversity: Public and private sector activities are balanced, tourism plays a vital role but not the only one; the nation has a stable and growing economy in accordance to population growth in 2040. A large share of investments have been achieved in renewable energies and energy-efficient transport. A high proportion of the national workforce has been employed in these sectors.

Degree of oil dependency

Low degree of economic dependency: Investing in various sectors such as tourism, industries, agriculture and fisheries has reduced the degree of oil-dependency to a maximum level. Investment has been made into public mass transport systems, modal choice has been achieved, including water taxis, rail based transport system has been established and adapted to local conditions. Car trips have been considerably reduced. The number of car accidents have been reduced as well. The cost of transport has decreased. Roads are going to be narrowed or reshaped in a way that either public (green) can be re-introduced into the residential neighborhoods, or the area could be used for other building purposes.

Rate of local production and handicrafts

High rate of local products and handicrafts: The local economy has been developed allowing rural or more remote communities to contribute through local /regional specific products. Agriculture has been recovered, new techniques of cultivation have been introduced, local food production contributes to fulfill the local need, and some products are even exported. The fish sector has been revived to contribute to local production and as a source of income to a lot of families. The revenues from the agriculture and fisheries sectors have risen from only 1% in 2011 to 25-35% in

2040. Handicrafts have been encouraged and supported to contribute to socio-economic balance.

Rate of share of employment in public sector

Low rate share of employment to the public sector. Local employment is based on the private sector. Owning small businesses has been supported. The share of employment in the public sector has been reduced. Public spending is reserved and oriented toward developing the local communities.

Social aspects

Rate of urban population growth

The rate of urban population growth will continue rising in coming 20-25 years, but at a low percentage. Mixed-use and high-density developments have developed in all of Oman. These developments have limited the internal migration to urban areas. Small businesses have played an important role in decreasing the rate of internal migration. Technical education and training offered in all of Oman have opened a new horizon of employing the national workforce. This has led to reducing the need for migration to urban areas. Agriculture, fisheries and handicrafts that are supported locally in all of Oman have played a significant role in limiting internal migration. This all has resulted in reserving the land and other natural resources in urban areas for the coming generations.

Rate of unemployment

Unemployment rate has been at its lowest level. The unemployment rate has been reduced from 15% in 2011 to less than 2% in 2040. Economic diversity programs have largely boosted the rate of employment, particularly for those in the national workforce. The investment in renewable energies as well as public transport, tourism sector have offered a maximum quantity of employment opportunities. Supporting local workforces who own small businesses and handicrafts have boosted the employment rates. This all has limited the rate of poverty and crime.

Rate of social equity

Rate of social equity has reached a maximum level. Local people have been given a maximum area of freedom in political and cultural fields. Cities have been socially inclusive (harmonious). This includes clustering houses around public spaces and enhancing the quality of public spaces. This has brought the social interactions to an optimal level. Public spaces have been largely activated which have played an essential role in rejoining people as they were in the traditional city. Affordable houses have been offered for low- and middle-classes. This has boosted the quality of life while reducing the levels poverty and crime.

Environmental aspects

Rate of utilizing energy-efficient programs

Energy-efficient programs have been integrated in development. Conservation policies have been adopted. New sustainable building codes have been integrated. Limited resources (mainly land and water) have been reserved for future generations.

Degree of utilizing renewable energies

Renewable energies schemes have been largely invested in all of the country. Clean and sustainable energies have been offered for local people and businesses. Energy tolls have become affordable for people. This sector has offered thousands of jobs to local people. As a result of using renewable energies, the rates of gas emissions that harm the local eco-systems have been largely decreased.

Quantity of new private automobiles

Quantity of new automobiles has been decreased to a minimum level. Our cities have been transformed from entirely auto-dependent cities to walkable cities. Efficient public transport and safe and shaded pedestrian pathways have been offered for people. Pathways have become safe and convenient for cycling and walking. The amount of gas emissions in the air has been reduced to a minimum level.

Rate of urban densification

The rate of urban densification has been at a reasonable level. The policies that relied on single villa have been changed to more diversified and densified built structures. The land allocation system that relied on public random lottery has been changed to one that boosted densification and encouraged integrated housing

blocks, which enabled developing housing spaces and services simultaneously. Mixed-use development has been widely integrated into the new development. This all has reduced the impacts on local environment while boosting quality of life.

Governance

Degree of decentralization

The degree of decentralization has reached a maximum level. Local people have become inclusive in decision-making. Public utilities have been decided and implemented after consulting the local people. The metropolitan has become self-governed. The quality of life and social equity have been largely increased.

Degree of adopting sustainability in land administration

A high standard of sustainability has been applied in urban management. Land administration that relied on Public Land Lottery has been changed to one that enabled high density mixed-use development. The new system has increased social interactions and quality of place. It has also decreased the consumption of natural resources: mainly, water and land.

Degree of efficiency of public transport

Degree of efficiency of public transport is high. An efficient public transport system has been integrated to the urban development in all of Oman. Local people have had multiple choices among the variety of public transport. In addition to providing bus routes that connect all the parts of Oman, tram lines have been proposed to cope with the increased growth of urban population. A drastic reduction in traffic has been recorded. The number of car accidents and their associated death rates has been largely reduced. The money that was paid for care of car-accident injuries have been reallocated to improving the local environment.

Rate of mixed-used development

Degree of mixed-use development is high. Land use which is based on single detached villa-type has been relocated to high-density buildings that achieve a reasonable rate of density. The mixed-used development reduced the journeys and the overall need for commuting. The mixed developments include multi-disciplinary housing units, shops, clinics, worship places, supermarkets and recreational places are all in one place and within reasonable walking distance to one other.

6.1.5 Scenario 3: Packages of key interventions

Judicious and resilient interventions. (Optimistic view on future development).
The overall assumption:
- There will be a pragmatic application of sustainability.
- Oil is going to be depleted after 20-25 years.
- The scope of time: 2040 Scenario three is based on following variables.

Economic aspects

Degree of economic diversity

Moderate degree of economic diversities. Diversification programs have followed pragmatic methods that are based on the local potentials and capabilities (some of these of these potentials and opportunities have been indicated in the former parts of this thesis). Investments made exclusively in sustainable transport infrastructure with less percentage for road networks. Government will no longer have to subsidize fuel prices. Private sector and public sector have played equilibrium roles in supporting the local economy to transform from a "consumptive" economy to a "productive" economy. Public and private sector activities are balanced; tourism plays a vital role but not the only one. The nation has a stable and growing economy in accordance to population growth in 2040. A large share of investments have been made in renewable energies and energy-efficient transport. A high proportion of national workforces have been employed in these sectors. Costs for road maintenance in 2040 were not as much as in 2013. Public transport has become the most favorite option for transit.

Degree of oil dependency

Moderate degree of economic dependency. Mixture policies that combine developing both the non-oil sector and oil sector. The national economy relies 10% on oil revenues in 2040, and 90% from non-oil revenues. The national economy will become more stable and sustainable in 2040. Within 20-25 years, the national economy will no longer be based on oil revenues. The contribution of the oil sector has dropped to 10-15%.

Rate of local production and handicrafts

Moderate rate of local products and handicrafts: Local production and handicrafts have been supported in competitive ways along with imported goods. Local food helps in reducing poverty. Imported goods, even though were needed to support the local production, do so but with a lower degree. The revenues from agriculture and fisheries sectors have risen from only 1% in 2011 to 20-25% in 2040. Land has

been reserved for investment more than for speculation. This has made for more affordable housing in 2040 than in 2013. Land was invested by the goal for which it was granted.

Rate of share of employment in public sector

Moderate rate share of employment to the public sector. Local employment is mostly based on the private sector in 2040. The private sector will dominate about 65% of the workforce while 35% will be in the public sector. Personal small businesses have been supported. Public spending is largely reserved and oriented toward developing local communities.

Social aspects

Rate of urban population growth

The rate of urban population growth will continue rising in the coming 20-25 years but not at a low percentage. A reasonable number of mixed-use and high-density developments have been constructed in all of Oman. These developments have notably limited the internal migration to urban areas. A reasonable support has been paid for small businesses to local people to limit the rate of internal migration. A reasonable amount of attention has been paid for training and educating local people to start their own businesses in their local areas to encourage them to stay there. This also has restricted the need for expatriate workforces in the country. The rate of urbanization has been reduced from 84% in 2009 to 70% because a lot of national workforces have returned to their home places in rural areas where there are better incomes and opportunities. The consumption of natural resources in urban areas (mainly land) has been largely reduced.

Rate of unemployment

Unemployment rate has remained at reasonable level. Economic diversity programs have largely offered employment opportunities for nationals. The unemployment rate has been reduced from 15% in 2011 to less than 5% in 2040. The investment in renewable energies as well as public transport, tourism sector have offered a reasonable quantity of employment opportunities. Supporting local workforces who own small businesses and handicrafts has largely boosted the employment rates. This all has led to a limited rate of poverty and crime.

Rate of social equity

Rate of social equity has reached a reasonable level. Local people have given a rational capacity of freedom in political and cultural fields. Cities have incorporated social inclusivity (harmonious). This includes clustering houses around public spaces and enhancing the quality of public spaces. This has brought the social interactions to a reasonable level. Public spaces have been better activated in which they have played an essential role of rejoining people as they were in the traditional city. Affordable houses have been offered for low- and middle-classes. This has reasonably boosted the quality of life while reducing the level of poverty and crime.

Environmental aspects

Rate of utilizing energy-efficient programs

Energy-efficient programs have been reasonably integrated into development. Conservation policies have been adopted. New sustainable building codes have been integrated. Special attention has been paid to public awareness about the consumption of energy. The programs included developing shaded and comfortable pedestrian pathways that encouraged people to walk instead of using their automobiles. The awareness included the education as well as curriculum, media, conferences and symposiums. This has decreased the consumption of energy at the household level. Social awareness has increased when people thought to conserve the cost of energy by replacing the private automobile with one that uses less fuel, others shared the majority of journeys, and others shifted the place of residence to be near to their workplaces, or closer to friends or relatives, for sharing their destination. This attitude encouraged people to cluster around major services and facilities to limit their travel time. The urban pattern has gradually become denser and public spaces are shared by a higher number of people.

Degree of utilizing renewable energies

Renewable energies schemes have been reasonability invested in all of the country as they are largely available in most of Oman's regions. The priorities have been given to solar and wind power energies. As indicated in part three, some parts in Oman represent the most appropriate sites for these kinds of energies. Clean and sustainable energies have been offered for local people and businesses. Energy tolls have become affordable for people. This sector has offered thousands of jobs to local people. The consequences of using renewable

energies, the rates of gas emissions that harm the local eco-systems have been largely decreased.

Number of new private automobiles

Number of new automobiles has been reduced to a reasonable level. Shifting the community from car-dependent sprawl to walkability with viable public transit has become most a priority demand to attain a successful shift towards sustainability. As public transport has become more viable, the number of cars, length of travel time, and the number of trips are largely reduced.The amount of gas emissions in air has been rationally reduced.

Rate of urban densification

The rate of urban densification has remained at a reasonable level. Densification programs have been introduced as priorities to reduce the rapid consumption of natural resources (mainly land and water). The land administration that relied on land lottery has been replaced by one that discourages dispersed, patchy development with on that enhances density. The number of high-density building blocks has increased over single-villa areas. This all has reduced the impacts on the local environment while boosting the quality of life.

Governance ***Degree of decentralization***

The degree of decentralization has reached a reasonable level. Decentralization that involves people in making decisions has become an imperative priority in 2040. Public utilities have been decided and implemented after consulting the local people. Priorities have been given to the local civic-society to share opinions and views with the urban governors. Planning policies have been applied with accordance to local conditions. The metropolitan has become self-governed. The quality of life and social equity has been largely improved. People and government have become satisfactory (founded on principles of good governance).

Degree of adopting sustainability in land administration

A high degree of sustainability has been pursued in land administration. The land administration policies that adopted the Public Land Lottery have been changed to one that enables high-density and mixed-use development. This has become the most imperative demand for change. The priority of granting land has been given for serious developers. This has reduced the speculation of land and boosted density. The new

system has reasonably increased social interactions and quality of place. It has also decreased the consumption of natural resources: mainly water and land.

Degree of efficiency of public transport

Degree of efficiency of public transport is reasonable. As private transport becomes the dominant factor of shaping our lifestyle, and has dominated most of the problems associated with high rates of car accidents and death rates, social dispersal etc., it has taken the priority in planning policies. Therefore, an efficient public transport system has been integrated with our urban and suburban areas to cope with rapid population growth. Consequently, the statistics on car accidents and car death rates have shown noteworthy declines. The amount of CO_2emission and other toxic gas have been reduced. The priority has been given to workplace transit by providing convenient buses that enable employees to get to their workplaces safely.

The number of cars has been reduced and large areas that were used for automobile purposes have been converted to enhance the public realm and boost local investments and businesses.

Rate of mixed-used development

Degree of mixed-use development is reasonable. The mixed-use development for the most part was commonly based on apartments instead of single-villa detached houses. The number of reasonable high rise mixed-use developments has become more than those low-density low rise single villa areas. Real estate companies have been supported to take the role of developing integrated high-density, mixed-use estates. This has resulted in better utilization of land and enhancement of the local quality of place and life.

6.1.6 Scenario 1 and its impact on urban development Muscat

While scenario one assumes that the government continues adopting the current oil-dependent policies for the coming 25 years, subsidies for basic infrastructure projects will decrease. Muscat will be the most affected city following the upcoming economic recession. Muscat will not obtain the same amount of support the development projects are currently afforded, but a more fairly distributed appropriation.

The rate of poverty will increase due to the high population growth and scarcity of natural resources. The scarcity of land in Muscat will lead to increases in land prices particularly at the city's cores or where the availability of public utilities are at a level that cannot be affordable by low and middle-classes. By following the real estate's market, the researcher has observed that residential land prices, with area of 600square meters in Um Abailah (located at northern border of Muscat), have doubled more than four times merely from 2009-2013.

Currently, Muscat can be classified as the city of most consumption of natural resources in Oman. The land that is appropriated for development is largely scarce. Based on the official statistics, population growth in Muscat is expected to double nearly eight times within the coming 25 years to reach almost 8 million, see Figure [145]. This record is extremely bulky according to the existing conditions in Muscat. It cannot be imagined how Muscat can cope with this tremendous growth in population. The city's officials cannot fulfill the demand for land for residential purposes in Muscat even while the population hovers around one million- How can they placate this increasing trend of population in the upcoming years? We realize that Muscat's areas have been allocated for mostly villa-type residential areas within merely four decades. However, if the current planning policies remain for the coming 25-35, we certainly need another Muscat. If the standards of land allocations do not change, the density will remain modest and encourage the consumption of more land. The standards include the plot size, the setbacks, the building heights, the built-up ratio, etc.

It is expected that the future will be worse with the recent declaration of various giant projects that the government intends to develop. Those projects include the redevelopment of Muscat Airport to be able to handle more than '12 million'[1] passengers annually for only the first phase (projected to end in 2014), whereas the figure will reach '48 million'[2] when the planned four phases are accomplished. The airport will provide more than 9,000 jobs. Also, the project of transforming the Sultan Qaboos Port from trade and cargo into a tourist port (cost OMR1billion, or Euros2billion) will provide more than 27,000 vacancies. The port is planned to receive 'three cruise liners, each accommodating 11,000 passengers at the same time.'[3] The question that must be raised is: In contrast of existing conditions, will Muscat be able to accommodate this tremendous addition of people?

[1]Source: Website of: Oman Airports Management Company
http://www.omanairports.com/seeb_newterminal.asp Accessed on 09-06-2013
[2] Ibid
[3]Source: Oman News Agency (ONA) found in:
http://www.omannews.gov.om/ona/english/newsDetails_inc.jsp?newsID=168862 accessed 10-06-2013

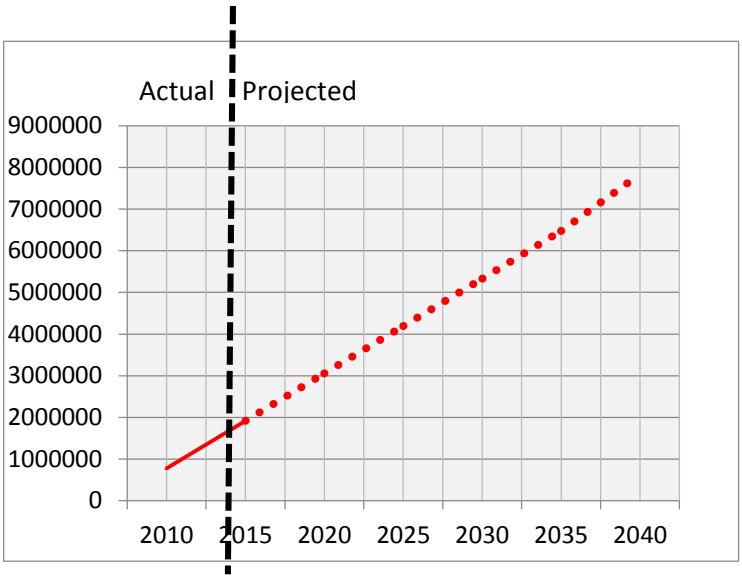


Figure 145: Actual and projected population growth in Muscat
With upsurge of population, the horizontal low-density development will affect overall life style patterns in Muscat as particular city.

Source: the author based on the National Centre for Statistics and Information

It is believed that the current urban management does not bear in mind any increase in population as Muscat has now reached an advanced stage of chaotic planning which allows for emerging social, economic and environmental problems. We realize that Muscat's population grows by 29% according to statistics of the National Centre for Statistics; how will Muscat be observed after the implementation of those projects?
Muscat is expected to have tremendous traffic and car-mobility in a form that cannot bear any more if current policies remain in practice for the next 20-25 years. As scenario one assumes that nothing has been changed in the current urban management, mobility patterns will be highly affected by the existing scattered land use. The high ownership of cars in Muscat, as it was indicated in part four, is evidence by the common mobility pattern. It is expected that the dilemma of high accidents, car-deaths, traffic jams will be worsened. The traffic will be exacerbated multiple times over when launching the aforementioned projects. Then, we can say that we need more than, or similar to, the existing street network to cope with the expecting growth of traffic.

The centralization of jobs and services at one place will increase mobility which leads to an increase in the demand for more streets and car-based services. This means more land, which could be used for investment and creating jobs, has to be handed over for cars despite the scarcity of proper land for development in Muscat. Bridges, tunnels, street furniture, street landscape, parking lots, etc., are all expensive car-utilities that will cost plenty of money in Muscat that will have to be added in future.

6.1.7 Scenario 2 and its impact on urban development Muscat

Muscat took the leadership for improving the economic diversity programs. This is simply because Muscat holds the best infrastructure in Oman. The basic infrastructure services can play a principle role for the economic diversity programs. Moreover, Muscat holds the seat of central government and most of the public and private sector headquarters. Investment in the tourism sector can play an important role in the economic diversity. Population growth is oriented towards 'production' instead of 'consumption'. As population growth in Muscat records an annual growth of about 29%, this growth can be invested in developing

the major sectors. Investing in public transport took the priority. Public transport includes tram lines, good scheduled buses, water taxi, etc. Thus, the quantity of cars and accidents will be reduced. The cost of car-utilities will be notably reduced. The roads can then be narrowed and integrated with public spaces for pedestrians, cycling and leisure.

Applying high-density clusters around public spaces enhances social interactions, which leads to Muscat becoming *more harmonious.* Emphasizing neighborhoods enhances identity and sense of place. Therefore, *the local identity in Muscat becomes obvious.* Creating mixed-use development and enhancing local production activities, activating the economic diversity programs in Muscat creates more jobs for local people.

Adopting natural resource efficiency will benefit Muscat more than other parts in Oman because Muscat is the most populated city in Oman (30% of total population and the second smallest city -- only 1.3% of Oman's total area). Conserving land and water ensures endurance for the coming generations. Muscat is the most polluted city in Oman as it holds the largest amount of traffic and two heavy industrial estates (Ghala and Rusayl). Decreasing the amount of traffic by introducing an efficient public transport system reduces the amount of waste and emissions which harm the local environment. Adopting the notion of sustainability during the next thirty years such as eco-house programs will decrease the consumption of energy at a notable level.

Inducting the society into the decision-making process will benefit Muscat more than other cities in Oman because Muscat holds much more cultural diversity. The high-density urban fabric ensures better distribution of services among reasonable population density. Zoning policies ensure creating neighborhoods with better local identity. The accumulation of these principles will lead largely to the reduction of energy and natural resource consumption.

6.1.8 Scenario 3 and its impact on urban development Muscat

Muscat is a particular place which can be utilized for investment. However, due to its limited areas, it is over-impacted to have further giant economic investments. Therefore, some priority projects such as investing in public transport or solar energy can take place in Muscat whereas the other projects that require huge areas can take place in other surrounding cities.

In Oman, particularly in Muscat where it houses about 30% of the Sultanate's population despite its scarcity of land for residential purposes, raising environmental awareness might take priority for the preservation of raw lands and obtaining higher rates of urban density.

Many techniques for public awareness could be followed such as media, curriculum, symposiums, public lectures, etc. The World Wide Web could be utilized for reducing the consumption of energy such as the *"Heroes of the UAE"* website which was launched to expand public awareness about the effects of the high degree of ecological footprint and energy consumption in UAE.

6.2 Recommendations

6.2.1 Towards a 'compact city' urban development

The 'compact city' notion could be utilized effectively to revitalize the current urban pattern in Oman. The majority of research and debate have referred to the compact city as an efficient solution for sprawl. Compact city is normally related with the high-density, mixed-use and viable public transportation. Even the traditional city or oasis settlements, which were shown in part two, are indicative of high-density mixed-use development. However, the current planning policies encourage sprawl development, which is clearly observed in most urban and suburban areas in Oman. It was shown earlier in this thesis that urban growth in Oman involves all measures of sprawl such as low-density, single land use with inefficient public transport. The land allocation system has contributed to the rapid consumption of natural resources. In consequences of the increasing demand and the population growth, land, which is considered the main natural resource in Oman, was consumed intensively during the past four decades. Thus, land has become scarce particularly in Muscat where lands are associated with various environmental and geographical restrictions. A compact city scheme could be utilized as are medial technique to guide the urban growth and to limit the consumption of natural resources.

6.2.2 Towards a diversified economy

The pursuant new policies of economic diversification emerge as the highest priority for the coming future. Diversity does not mean abandoning the investment in the oil sector and other existing sources, but finding viable alternatives that can take the place of oil revenues when oil is depleted. We do not want to wait until oil has run out to embark on a search for alternatives, but we have to start today since we have very limited time until oil depletion. Diversity policies do not require integrating all possible and impossible alternatives, but to take the most potential schemes. It is probable to initiate the process by reducing subsidies for energy via launching various programs of energy efficiency. These programs may include public awareness for energy conservationism. It may include policies that encourage the installation of thermal insulation in buildings which lead to reducing the financial subsidies for the demand of energy. The programs should also involve utilizing renewable energies which are largely available in most areas of Oman.

According to the local building regulations, the authorized built-up area must not exceed 40% of the 600 square meters of the plot's area. The other 60% of the plot's area is considered useless area. Therefore, inhabitants have to be encouraged to utilize this wasted part in their private boundary for food production. This cultivated area could be irrigated by recycling grey water from the output of every household. This area will not only help to attain self-efficiency with agricultural products, but also help in reducing the air temperature and decreasing the consumption of energy. At the neighborhood level, certain areas should be assigned for food production. This will raise the local production over the imported food and will meet one of the principles of sustainability.

The diversification programs that have been undertaken by some of neighboring GCC countries could be positive practices for local Omani governors. GCC countries, besides developing their basic infrastructure, have undertaken other policies to diversify their economies and attain sustainable development. For example, Dubai has focused on the real estate and trade sectors to attract investment and capital. It has offered a comfortable

marketplace for investors by promoting free market policies. Therefore, Dubai has become one of the world's largest hubs for trade and services. Its extensive developments in all sectors have paved the way for the increasing demand for investment from national and international investors. The structures which are entitled the world's largest, the biggest, the tallest, the first, etc., have largely contributed to branding Dubai worldwide. In consequences, oil contribution to the GDP declined to merely 3% in 2006. Abu Dhabi, the capital of UAE, has followed an exclusive path in order to attain sustainable development. The Emirate, which overlooks the calm Persian Gulf, focuses on developing cultural heritage as a key element for economic diversification and attracting tourism. The Emirate intends to boost its position globally as a tourism attracter by developing the Saadiyat Island which will house the names of four of world's most prominent cultural venues.

In addition to developing its tourism sector, and despite its long-term oil reservoir which estimated to last more than 90 years, Abu Dhabi intends to become the world's pioneer in the sector of renewable energy. Despite its location within one of the most polluted city in the world, Masdar City intends to be the first 'carbon neutral' city in the world. With the Masdar initiative, Abu Dhabi becomes the predominant generator of renewable energy in the world. As a result of its efforts in renewable energy, Abu Dhabi won the permanent headquarters of International Renewable Energy Agency (IRENA) in June 2009. Qatar National Vision 2030 (QNV 2030), which was launched in October 2008, motivates the aspects of sustainability into four pillars; human development, social development, economic development and environmental development. In relation to treating the urban sprawl phenomena Masdar City in Abu Dhabi and Musheireb development in Qatar represent the most tangible advances for utilizing compact city schemes to combat the contemporary sprawled urban growth.[1] Consequently, change in urban form can influence the economic conditions in urban areas.

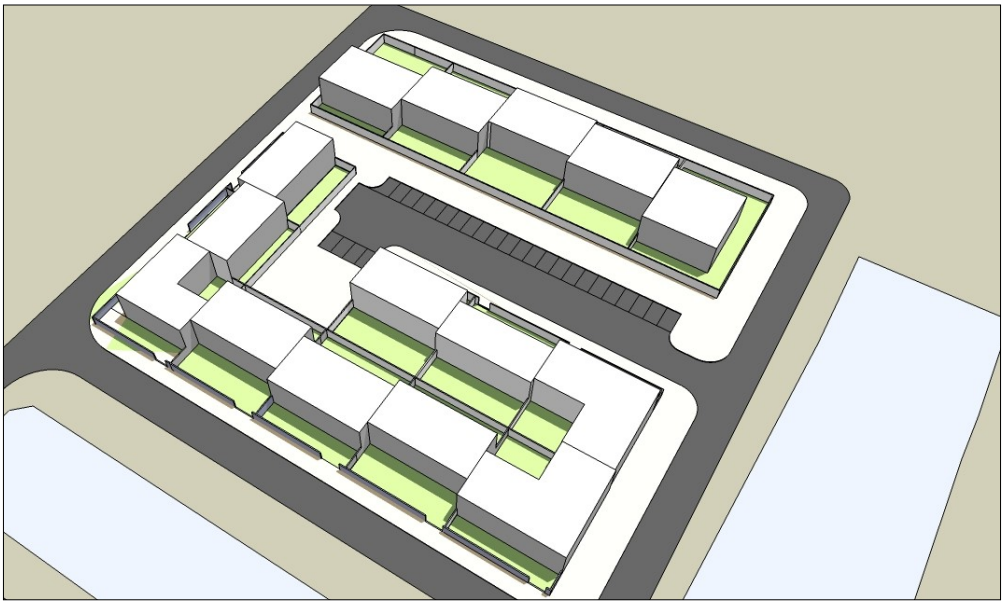


Figure 146: Conceptual sketch to better densification while keeping the same planning sequence but changing the built form

Source: The author

[1]The two projects are discussed in detail at part three.

6.2.3 Towards a sustainable land management

Densification is becoming a crucial component to attain the urban renewal. Mixed-use residential apartment estates can be one initiative to make urban growth denser. The principles of a compact city paradigm, which is characterized by high-density development around transport nodes, can be a practical instrument to alleviate the problems of urban sprawl in our society. Creating a sustainable city requires the encouragement of walking and cycling instead of depending on private cars. This target will not be reached without incorporating many aspects that should be initiated with public awareness and fulfilled with the design of safe and comfortable pedestrian and cycling pathways. The unique design of the Post-Oil City has to save on the cost of living. People have to live adjacent to their work, education, and places of worship and recreational to limit their movement costs and reduce the burden on natural resources. Apartment complexes that are clustered around semi-public space can attain not only high density but also better social interactions that are missed in the current villa-based urban model. In addition to conserving lands for residential and leisure proposes that have become scarce, particularly in Muscat, mixed-use apartment complexes reduce the need for long commutes and the use of private cars. Creating multifunctional urban spaces where people can live, work and recreate is a crucial demand in order to enhance the liveability and quality of urban pattern.

Increasing the density has to take priority in the future urban policies. To eliminate the rate of land consumption, strategies that employ extensive housing schemes have to be enhanced. Increasing the density may be achieved using varied methods. For instance, a plot of 600 square meters may be distributed among multi-families. *Twin Villa* has recently become popular in Muscat targeted to attain better profit from given plots.[1] A recent decision has certified land owners to build a duplex housing unit (called locally Twin Villa) in plots which have areas around 600 square meters and above. Although its allowed maximum height is only two floors, the twin villa trend has not only boosted the density but also pushed the rental market. This trend indicates that density has reached an average of 28 inhabitants per 600 square meters– an area plot which is fairly higher than a single villa which is occupied by a single family.[2]Currently this notion has become increasingly widespread among landowners: Why do local authorities not decrease the given area to 300 square meters instead of the current rate of 600 square meters? This certainly will reduce the consumption of land suitable for housing and provide living spaces for larger quantities of people. For instance, a plot of 600 square meters that occupies a four-story building can house eight households. The density increases eight times more than the current single-villa building layout.

[1]Twin Villa is duplex houses with separated entrances normally resided by two families. See Picture (62)
[2]Average Omani family is 7.2 according to the 2010 official census.

Picture 61: Twin Villa in Khoad houses four families

Source: The author
Date taken: 17/5/2012

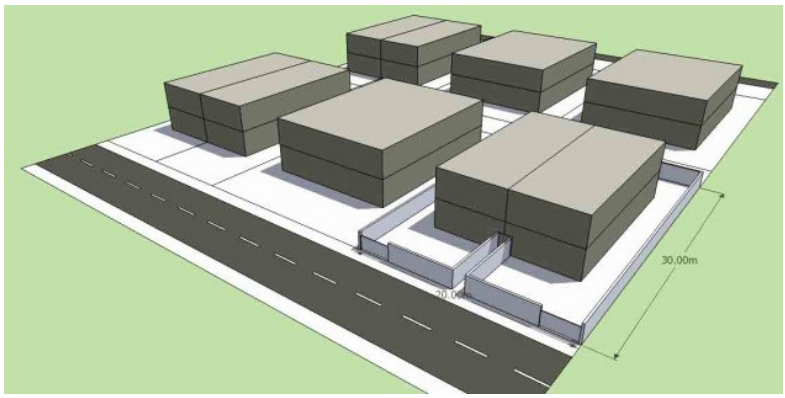


Figure 147: Twin Villa in 600m^2 plot's area with 2-storey height may include 4 residential units

Source: The author

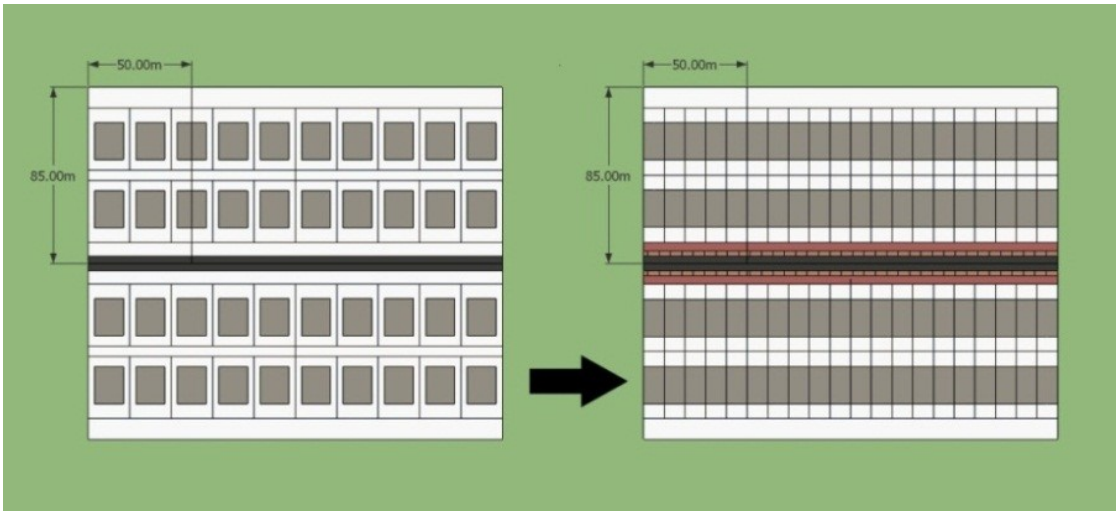
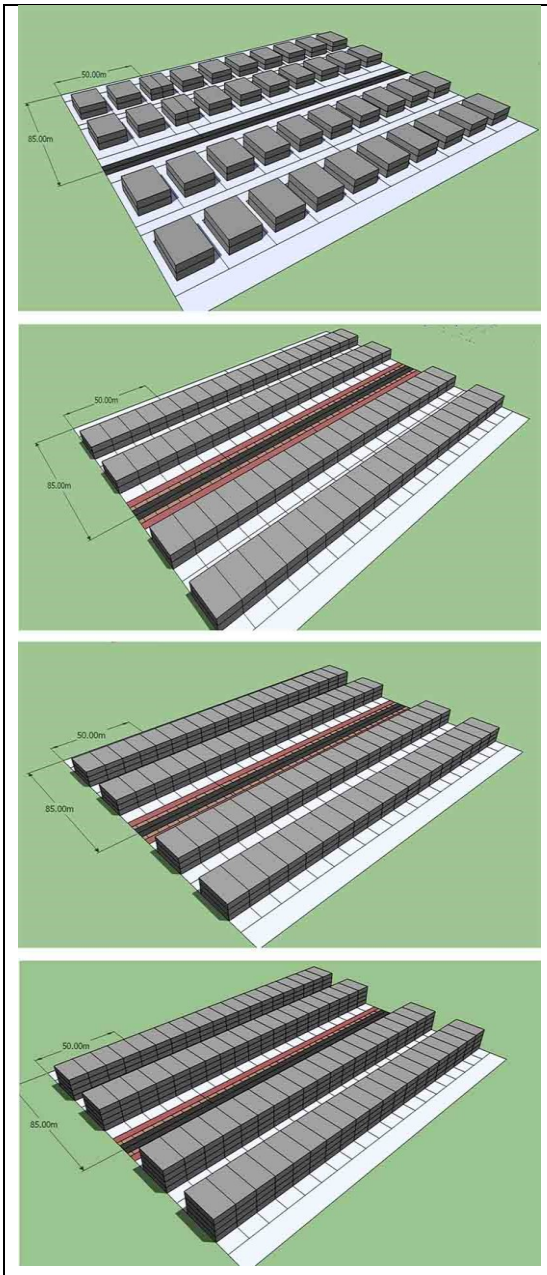


Figure 148: A schematic plan indicates the increasing density could be one initiative for reserve land

Density will grow from 35 inhabitants per acre to 70 inhabitants per acre. Source: The author



Current single villa-type housing model			
Area of plot	600m²	Max. floors	2
Ground Built-up area	252 m²	Gross Built-up area	504 m²
Number of units	40	Number of families	40
Total inhabitants	288	Density (inhabitant/acre)	36

Terraced type housing model			
Area of plot	300m²	Max. floors	2
Ground Built-up area	180 m²	Gross Built-up area	360 m²
Number of units	80	Number of families	80
Total inhabitants	576	Density (inhabitant./acre)	72

Apartments housing model			
Area of plot	300m²	Max. floors	3
Ground Built-up area	180 m²	Gross Built-up area	540 m²
Number of units	120	Number of families	120
Total inhabitants	864	Density (inhabitant./acre)	216

Apartments housing model			
Area of plot	300m²	Max. floors	4
Ground Built-up area	180 m²	Gross Built-up area	720 m²
Number of units	160	Number of families	160
Total inhabitants	1,152	Density (inhabitant./acre)	288

Table 31: Density may be varied according to the number of storeys

Source: The author

The residential apartments which are designed for multi-families will boost the density and reserve lands for coming generations. The mixed-use apartment estates will notably reduce the cost of living. Currently, automobile users begin to feel the cost of having private cars because of the cost of fuel, parking charges, tolls, cordon fees, maintenance, taxes, etc. Therefore, living adjacent to main community infrastructures will become more affordable and more desirable. At the same time, it minimizes the ecological footprint and raises the land use efficiency. Land use efficiency can be achieved by integrating the basic infrastructural services with living spaces. Once land use efficiency is fulfilled, the destruction of local environment is minimized. However, inefficient land use resulting from urban sprawl and the fragmentation of land uses will boost urban and environmental problems.

The future of the city should not be to make the streets wider, but to plan reducing automobile reliance by integrating research and investigation towards eco-friendly innovative schemes. We must trust in our abilities to shift our life towards sustainability, otherwise negative urban predicaments are inevitably coming. It could be a political decision for change, but in fact it has to be done very soon. Postponing is not acceptable as it deepens the dilemma, we have to start now while we still have time. The remedy has to be well organized and very precise. The critical step is public awareness. As census indicates that 40% of population remain at youth age, we must utilize this advantage to educate those young people about sustainable urban management, for natural resources, etc., to attain the basis of 'sustainable communities.' Awareness of sustainability could commence from as early as kindergarten to higher education. Government and society should work together to brand the notion of sustainability.

It is obvious from the discussion of scenarios in this part that the post-oil age is inevitably coming very soon. Thus, our society should prepare for change. Our lifestyle, which is dependent on the extreme consumption of energy, should be reformed. The design of our city should be transformed to sustainability. Our cities should be denser with the development clustered around viable nodes of public transport. The development itself should be mixed-use with a variety of affordable housing types. The unique design of the post-oil city has to save on the cost of living. People have to live as near as possible to their work and other basic infrastructural services to conserve energy by reducing the transit time. Walkable communities have to be encouraged by designing safe and friendly pedestrian pathways.

Compact development has to alter the current patchwork because it not only reduces the consumption of land, but also enables that basic services be subdivided and utilized among the optimum capacity of users. As seen already in this thesis, neither construction of new highways nor widening the existing streets solves the issue of traffic jams in Muscat in the long run. However, seeking new urban policies, such as those that promote high-density, mixed-use development while integrating viable public transport solve the problem for the long term.

To avoid low-density scattered development, urban governors should think of other initiatives for distributing lands rather than the current land granting system which is considered the main cause for the existing fragmented, low-density and patchy urban development. Although public lottery for land is intended to attain fairness in land distribution among citizens, it is a biased policy because the majority of granted plots are extremely far away from existing development and basic infrastructure. Developing such lands not only requires a lot of money but it is also considered a big challenge to the inhabitants due to the lack of liveability at a place with such conditions, particularly when basic infrastructure will normally take years to arrive.

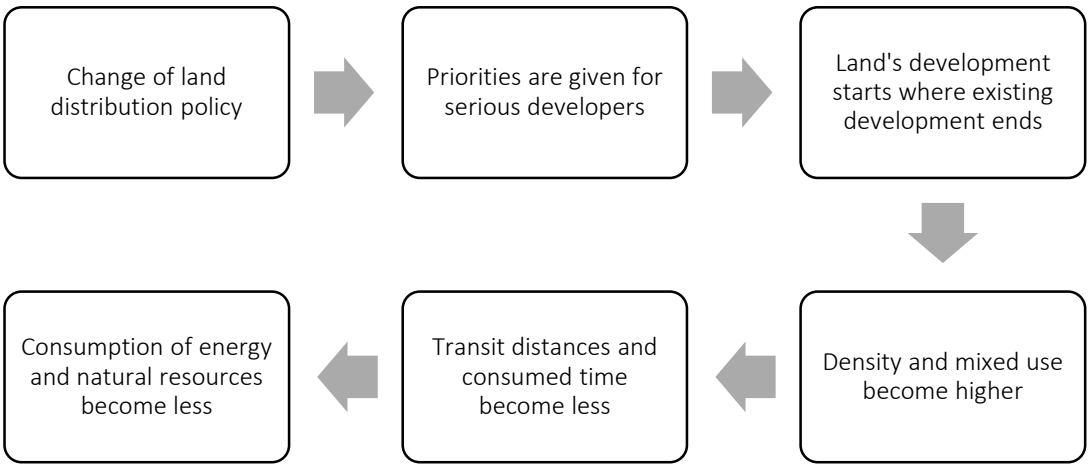


Figure 149: The output of reforming the land distribution system Source: The Author

The researcher believes that the policy of granting land should take another target rather than just the random distribution of land. Urban governors and the people should be aware that land is the most valuable item which could form our lifestyle pattern. As land is considered a critical possession in a person's life, local authorities should make the granted land as a source of happiness rather than a source of sadness. For instance, the high rate of traffic deaths proves the argument because the scattered development boosts the number of trips. Therefore, the more fragmented the development, the more accidents will occur. We should understand that land is given to provide a high quality lifestyle. However, the quality of lifestyle cannot be reached without improving the quality of the place, while the quality of the place cannot be reached without the accumulation of many socio-economic conditions beginning with the house design, street utilities, neighborhood layout, district identity, and ultimately the quality of the whole city. Urban form should be consistent? Enough as it influences the social norms of individuals.

The granted land must be for (residential) construction and not for other purposes. The public's satisfaction could not be fulfilled by a piece of land being sold at a very low rate once it is drawn. However, the real value of the land, if it is sustainably developed has an influential value at the socio-economic level. The urban growth has to take the hierarchal way of development by allocating the granting lands where the development reaches. The land is granted to those whom are earnest and geared to build. The ownership certificate can be authorized when the building is accomplished. This will ensure the increasing of density and the efficient distribution of services and facilities within appropriate population densities. The distribution of lands should also take the social aspects into consideration, such as the proximity of the awarded plots from the parents and relatives to enhance the social interactions.

To eliminate land consumption, we have to respond to the norms of sustainability that ensures the conservation of natural resources for future generations. Lands must be preserved for future generations just as many other natural resources are. Along with the scarcity of lands in Muscat and other areas in Oman, only families should be awarded a piece of residential land. A citizen can afford a residential land once married and capable to show the financial ability to develop it. The size of the plot should be determined according to the size of the household. Priorities of granting land have to be given to serious developers.

Reforming the land granting system should be an initial step whereas government and local authorities have to offer other housing schemes that promote residential estates with affordable multi-choice housing units. A citizen might purchase the type and size of housing unit according to his or her financial capacity. The housing units will be funded by affordable mortgages with legal backing. The private sector should be strongly integrated into the urban management. Private stakeholders can play a fundamental role in developing housing schemes which take sustainability as a basic norm. It also has to be entitled for the participation in reforming the building regulations to meet the local socio-economic and environmental conditions and to enable the transformation to the post-oil age. Central government should share the urban management among with the public, local authorities and stakeholders to ensure the right execution of building regulation.

Consequently, the sustainable development should be the top priority for the coming years. All pillars of sustainability which represent economic, social and environmental benefits should efficiently work together at one framework to achieve the success. Ignoring one pillar will certainly affect the overall output. In relation to the economic level, all of society's members are involved in the participation of creating the future of our life. Reaching the post-oil age without accomplishing the principles and criteria of sustainability means inevitable failure. However, the change begins from every individual family member up to the peak-level of urban governors.

In Oman's urban pattern, the scattered development makes it difficult to emphasis the outline of a neighborhood. Thus, local identity and decision-making for such urban condition become difficult to visualize. The determination of urban population in a neighborhood is crucial as this researcher believes that the identity is essential for spatial configuration because it enhances the value for the individuals and the quality of the place. In Oman's traditional city, the local identity of urban settlement is precisely defined. The interaction between people and space was obvious. Clustering around the public and semi-public spaces should be enhanced and the spatial hierarchy to enable people not only to communicate with each other, and also to enhance the quality of space as strengthening the local identity.

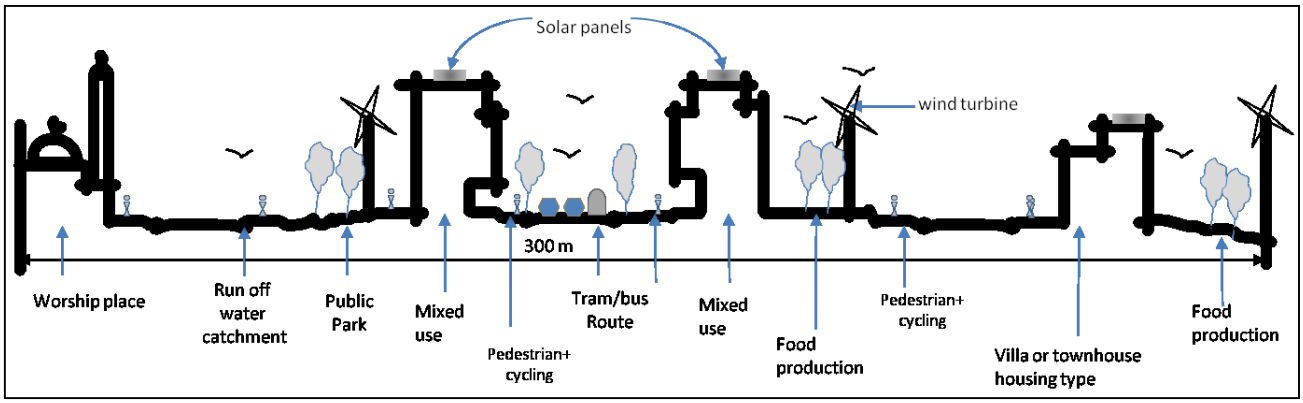


Figure 150: Schematic section shows the possible urban development at post-oil age

Source: The author partly based (derived) on Urban Task Force Towards an Urban Renaissance Final Report, UK, (1999), p.36

Awareness can play an essential role that promotes the gradual transformation for the sustainable communities. Awareness might take many forms including curriculum, media, public lectures, conferences and symposiums, etc. However, the researcher feels it is the right time to start. It is urgent; postponing the remedy day after day enlarges the issue. The issue becomes unbearable with further delay. Living in this kind of urban landscape for a further ten years without change will lead to extended problems and more frustration and pain. Teaching our children the notion of sustainability and its role in forming and maintaining our future is becoming a basic demand. Educating children in kindergarten and primary schools this year ensures the right application of sustainability after 20 years when the oil might run out.

The unique design of the sustainable city has to save on the cost of living. People have to live adjacent to their work, education, and places of worship and recreational to limit their mobility costs and reduce the burden on natural resources. Therefore our cities have to be restructured in order to attain the sense of place and sense of community. Improving the quality of place is a great challenge to attain sustainable urban growth in Oman. The urban landscape in Muscat and elsewhere in the Sultanate leaves the urban edges unrecognized. Therefore, urban patterns in those areas are characterized by anarchism in which edges are blend into highways and blur the effectiveness of land use. However, in Muscat and all Oman's cities, districts are not recognizable. The zoning boundaries are blurred throughout the urban chaos as a result of the urban sprawl and patchy development. The absence of the district's identity has contributed to emerging analogous urban prototypes that have nothing to add to the city other than the rapid expansion of urban areas. Obviously, the existing urban policies have largely contributed to the branding of deterritorialization which has apparently added the decay of several socio-economic and environmental elements that were characterized by the local communities at pre-oil age. Therefore, territorialization or re-territorialization could be utilized as an instrument to emphasize the urban edges and thus increase the local identity.

The vast vacant lands that are kept undeveloped due to the land granting system should be utilized to attain proper density. As discussed earlier in this thesis, density is an essential factor for achieving a sustainable urban form. The owners of these lands have to verify either that they will develop their lands with the new regulation that comply with sustainability, or sell them to investors or land developers. We have to take advantage of the fact that the quantity of vacant lands exceeds the developed lands in most planning areas in Muscat, as a particular case, and other areas in Oman in general. Therefore, it is possible to utilize them as a motivation element for creating a better urban landscape. Consequently, every area should have a particular study according to the existing urban and socio-economic conditions which can promote the sustainable urban growth that will help local communities shift to the post-oil age. The studies should apply infill schemes that attain the reasonable density, mixed-use development to ensure clustering within and around the public realm. The infill scheme should focus on providing apartment buildings to meet the increasing demand of housing and to eliminate the rapid consumption of lands that are mostly developed for free-standing detached houses. The infill schemes should take into account the spatial hierarchy to improve the quality of place.

The spatial identity of a place should be enhanced in the infill schemes and in future developments. Local identity cannot be fulfilled except by reforming the current zoning policies. The local identity should start at the neighborhood level so as to be a powerful part in of the city in which the local inhabitants can share their ideas with local authorities and effectively contribute to the decision-making that will shape their local urban patterns in a manner that they want. The infill schemes and future developments should take into consideration that our cities should be designed for people, not for automobiles. Thus, the schemes must focus on creating a walkable society to eliminate the current car-dependent urban form. The new planning policies should be motivated to reform the quality of space and life standards by justifying the negative impact of urban growth and the consequences of poor urban management.

As it has been argued in this thesis, the decentralization of power emerges as one of the most essential priorities to ensure a successful progression towards the post-oil age. Once the decision-making is gradually decentralized, the urban management will be shared between the central government, the local authorities and the public. The planning policies are gradually applied according to local conditions. As a result, metropolitans will gradually become self-governed to reach an optimal level of democracy. The public and local governors will gradually gain a sense of satisfaction. Figure [151] indicates the progress of urban governance.

It is required to revive the role of Sablah as a predominant component for political and social practices as well as a primary booster for socio-economic development. Sablah has to be activated as a local actor for practicing democracy and involving the civil society in decision-making.

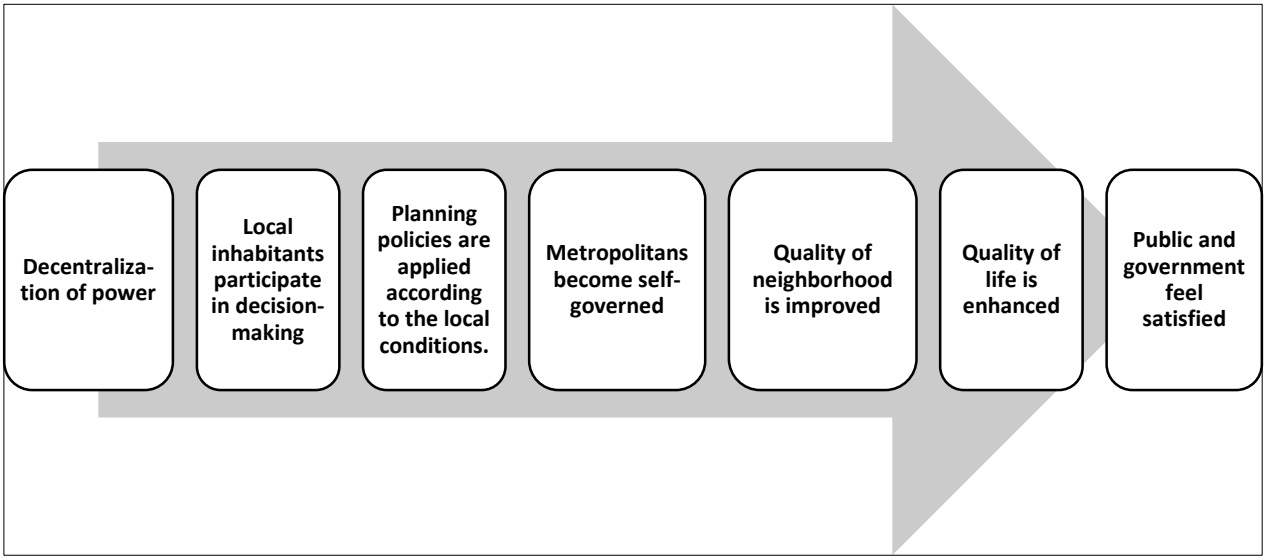


Figure 151: The progress of urban governance. Source: The author

6.2.4 Towards walkable cities and efficient public transport

Shifting a community from being a car-dependent sprawl to a walkable one with viable public transit represents the one of the top priorities for attaining a successful move towards sustainability. Reducing the number of cars will not be achievable without offering a viable public transport system. As public transport becomes more viable, the number of cars, length of travel time, and the number of trips will be largely reduced. Consequently, this will lead to the extreme reduction of energy consumption. Meanwhile, by reducing travel time, the ecological footprint will be decreased, which will lead to a reduction in pollution and waste and reduce the overall rate of natural resource depletion. Land degradation will be notably reduced. Following the policies of energy efficiency and the gradual utilization of renewable energy, consumption of natural resources is gradually decreased.The energy crisis which result from the depletion of oil resources will encourage people to minimize the use of private automobiles.

As transport is considered the most powerful factor of shaping cities, it should take top priority in future planning policies. Without establishing a proper public transport system, or without restructuring the road network system, it will really lead to difficulties and this will contribute to the deterioration of other well-doing factors. Moreover, efficient public transport will be the most influential factor to cope with rapid population growth. Meanwhile, high density development will make contrary results without integrating public transport system. The reform in the transport sector will largely contribute to alleviating many socio-economic and environmental problems. For instance, integrating an efficient public transport system into the urban fabric will notably reduce the number of car accidents and deaths, as well as reduce carbon emissions which cause climate change. Establishing an efficient public transport system will largely reduce the quantity of cars as people will have other transport choices rather than just private automobiles. The reduction of the number of cars will help to conserve large areas required for car-utilities which can be used for enhancing the public realm or boosting the local investments and businesses. It does not have to integrate all public transport modes at one time, but they can be merged gradually within a long-term strategy.

At the initial stage, priority should be given for workplace transit. The primary action could be establishing bus routes that enable employees to get to their workplaces safely. This will notably reduce the quantity of cars on roads which will reduce the traffic jams, car accidents, gas emissions, etc. The second step could be the integration of tram routes that connect major population centers. Tram routes can solve many traffic-related problems and serve vast majorities of inhabitants. The second priority could be utilizing more sustainable transportation modes such as energy-efficient cars and water taxis along coastal cities. In addition to public transport, safe and climatic-comfortable pedestrian pathways could be also integrated into the new urban pattern as one of the top priorities. Pedestrian pathways do not only contribute to reducing traffic and car-dependence but also to creating healthier cities. Consequently, diseases which result from the lack of physical activities and the associated costs to the government will be remarkably reduced.

As shown previously in the thesis, the urban pattern in Muscat engages linearity. Public transport is still very lacking in major urban centers and sub-centers in Muscat. Hence, providing viable a public transit network could be an essential solution to integrate all Muscat's fragmented urban nodes. Public transport could be one initiative solution for the

city's main issues such as traffic jams, the high rate of ecological footprint (as a consequence of the extreme consumption of energy) and the rapid-increasing rate of car accidents. As indicated already, Metro Dubai, which was launched recently, carries about 355 million passengers per year through its two lines. These two lines occupy about 12% of all trips in Dubai. Muscat's local authorities have recently celebrated launching a six-lane highway which cost a great deal of money because it cuts through mountains. The money which has funded this highway -- intended to cope with the rapid increase of traffic in Muscat -- could have been utilized to enhance the local public transport system. Because of the rapid increase of population and automobiles, this road will also be subject to additional traffic jams very soon similar to other roads like Sultan Qaboos Highway.

It is obvious that the absence of public transport is a predominant promoter of urban sprawl. As it was shown previously in this thesis, Muscat, which holds a third of Oman's total population, lacks viable public transportation. Auto-dependency is not only the origin of traffic jams but it involves many social, economic and environmental dimensions. Finding solutions for this issue requires the modification of current transport policies. The rapid growth of car accidents and death rates is a result of the rapid growth of private car ownership. Reducing the trend for this attitude will require a potent and extensive framework involving the collaboration of government, stakeholders and individuals. For example, the travel to workplaces can be reduced by following a very simple method. It was found earlier in this thesis that workplaces are normally reached by single-car journeys. As Muscat is considered the administrative and business hub in Oman, it holds the majority of private cars. Using group transport for every institution is a must for the coming stage. For example and at initial step, utilizing a25-passenger bus to and from workplaces will exempt 25 cars from streets by each bus. Consequently, 500 cars will be excluded from streets in contrast of using only 20 buses and 20,000 cars by using only 800 buses.

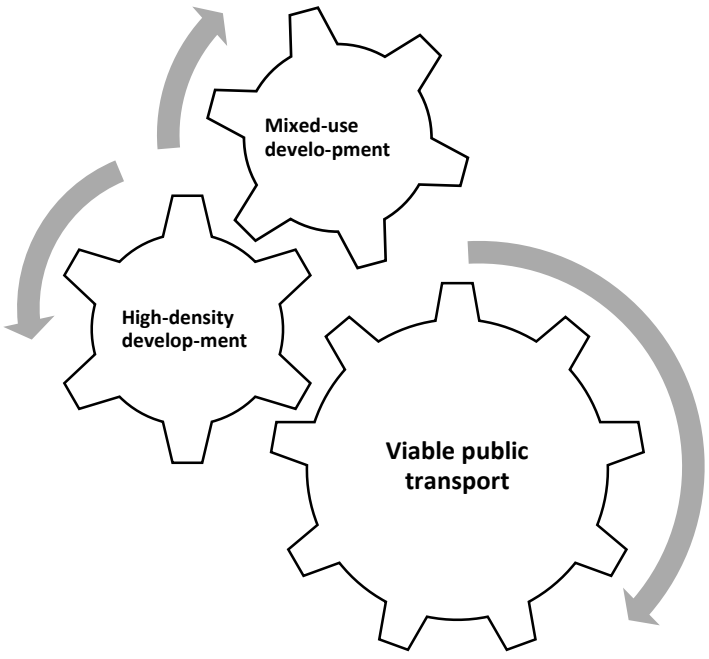


Figure 152: Mixed use development, high density and public transport can't work separately.

Viable public transport is considered the predominant factor for sustainable urban development.
Source: The author

According to the traffic authority statistics, 7,719 accidents occurred in Oman in 2011[1]. It is found earlier in this thesis that 94% of employees use private car to get workplaces and nearly 53% of them commute to their workplaces alone. According to statistics, the total governmental employees in 2009 are 159,538 employees which means nearly 150,000 of them use private automobiles to get workplaces (79,481 employees travel alone). This means that merely 6,000 buses (4%) are needed in contrast to 150,000 cars. This indicates that 144,000 cars that are utilized for workplace travel will be removed from our streets. Consequently, the rate of car accidents, deaths and injuries will be largely decreased. Ecologically, the footprint will be largely minimized by reducing the consumption of natural resources, which includes a notable reduction in the amount of gas emissions. Note that these calculations are exclusive for governmental employees. For instance, while about 3,575 accidents were recorded in Muscat in 2011[2], it means that nearly 229 accidents occurred during the journeys to and from workplaces when considering the average ratio of car accidents during the journeys to and from workplaces is 0.064%. This amount could be reduced to merely nine accidents when utilizing mass transit mentioned above to and from the workplaces.

The second step is using a tram line to connect the residential areas with the workplaces. To treat the fragmentation of land use nodes in Muscat, tram lines could be a powerful solution. The tram line is not only a physical anchor that could connect urban nodes in Muscat but also could reduce the amount of traffic accidents, traffic jams, death rates, injuries and notably reduce the overall transit time. It has been found in this thesis that around 82% of governmental employees live in three major urban centers: Seeb by 42%, Baushar by 27% and 13% by Muttrah. Fortunately, the location of these centers is on a linear level which will simplify the accessibility of tram lines.

Pedestrians and cycling have to be encouraged through making shaded pathways and comfortable and safe corridors. These attitudes not only reduce the car-dependent trips but also contribute to reducing the illnesses that occurred due to the lack of physical movements such as diabetes, obesity and heart disease.

Picture 62: A tree-shaded pedestrian pathway that connects the main building of Royal Hospital in Muscat with adjacent residential units.

Source: The author. Taken: 14/5/2012

[1]Muscat dominates about 38% of them (2978 accidents). Source: Facts and figures ROP 2011, found in:http://www.traffic.gov.om/files.php?force&file=pdf/Facts%20and%20figures%20ROP%202011.pdf 28/6/2012

[2]Facts and figures ROP 2011, Found in: http://www.traffic.gov.om/files.php?force&file=pdf/Facts%20and%20figures%20ROP%202011.pdf Retrieved on 28/06/2012

6.2.5 Towards an energy-efficient lifestyle

There are many factors that have influenced the sharp increase in energy consumption. Most debates relate the increase of energy consumption to population growth. No doubt, as the population increases, the demand for energy increases. However, there are many other factors that might be vague for many people but are authentic factors that play a part in the reasons that lead to increasing demand for energy. These factors include the increase of temperature, the modest tariff that is paid for electricity and the lack of public awareness of the overuse of energy. According to the Ministry of National Economy statistics, houses consume about 55% of total energy in Oman. In addition to the lack of pronounced rule that forces developers to integrate the thermal insulation in buildings, villas with their free standing built-form are considered the most energy consuming structure among other types of buildings. The major challenge at the post-oil age is not only to reduce the consumption of energy but to generate 'greener' energy at low cost. This target cannot be obtained without following new policies of energy efficiency.

Renewable energies should be taken into consideration as the most promising sector that can alter the existing dependence on fossil oil energy. In addition to its economic benefits for providing endless energy, renewable energies such as solar and wind turbine also help to create healthy communities. As it was discussed earlier in this thesis, Oman holds one of the world's most promising sites for solar, wind turbine and tidal power. The strategic utilization of these sites should be taken as top priorities by future planners and decision-makers. We have to take advantage of the same benefits as other countries that integrate the renewable energies in their future plans as the most promising sector, not only to have cheap and clean energy but to have endless energy for the future generations.

As indicated in part three, Oman has potential sites for renewable energy. In addition to its prime location as the world's most appropriate site for solar energy, Oman also is a suitable place for wind and tidal powers. Al Hajar Mountains, which represents more than 15% of the Sultanate's total area, is up to 3000 meters in altitude in volcanoes and inhabitable mountains. These mountains, which overlook the most populated areas in Oman, can be utilized for installing wind turbines and solar panels to generate renewable energy. Similar work can be followed in Dofar, the southern part of Oman which houses about 9% of the Sultanate's total population. Wind turbines could be planted in Dofar Mountains that are located just at the region's northern approach. The advantage of the annual *Khareef Season,* when wind reaches its speed peak from late June until late September, should be taken into account. It is believed that the amount of electricity that could be generated by wind turbines in *'Khareef season'* is sufficient to supply *Salalah* City, which is the most populated city in Dofar. It was mentioned earlier in this thesis that Oman has wide, long oceans extending from Musandam Island in the north, crossing the Gulf of Oman in the middle and reaching the Arabian Sea in the south, forming about 3,200 kilometers of coastline. These enormous offshore areas can be partially invested as an initiative for generating energy by tidal turbines. The notion of utilizing renewable energies should be enhanced to cover the individual users. In addition, the huge areas of inhabitable deserts that are located between Batinah Coast and Al Hajar Mountains can also be partly utilized as farms for solar panels and wind turbines. Figure [153] simulates the transformation of urban pattern from pre-oil age to the inevitable post-oil age in coastal cities.

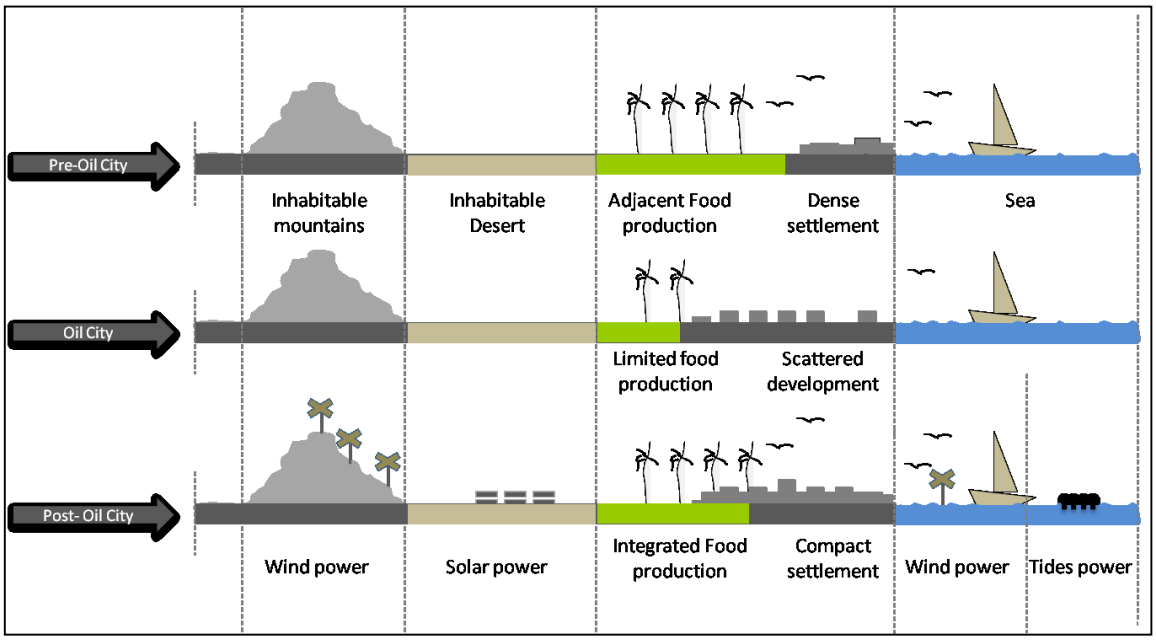


Figure 153: Schematic-sectional diagram shows simulation of the transformation of urban pattern from pre-oil age to the inevitable post-oil age in coastal cities. Source: The author

Renewable energies can be integrated at the level of neighborhoods and individual houses. This step does not have to be at an initial stage but it has to be there at the post-oil age. We have to look at the experiences and the progress of other countries in developing this promising sector. For example, as it was shown in part three, Abu Dhabi which is just 140 kilometers away from Oman has made tremendous strides towards integrating renewable energies in its long-term strategic plans. Masdar City which is based on zero-carbon compact urban form represents most of Abu Dhabi's pragmatic practice of utilizing renewable energies an alternative to fossil-oil energies. Abu Dhabi also merges utilizing renewable energies in building construction through a local scheme called *Estidama* (means sustainability) which represents a significant step towards the construction of eco-friendly buildings.

The use of eco-friendly materials, active thermal envelopes, recycling and reuse methods, along with the utilizing of renewable energy to generate electricity will ensure a decrease in the amount of energy used by houses. Urban growth has to integrate sustainability to attain smart growth and liveability in the post-oil age. In addition to strategic management of land and energy, the recycling schemes of waste have to be enhanced. The private sector can take the role of developing this target. Figure [154] shows recycling processes that have to be followed to attain sustainability. The optimization of sustainability requires massive efforts and limitless competences. It is obvious that there are many things that would be nice to have but we cannot have them all. However, there are certain mandatory tasks which are a must and can be classified as priorities. Figure [155] indicates most significant priorities that attain sustainability in urban growth.

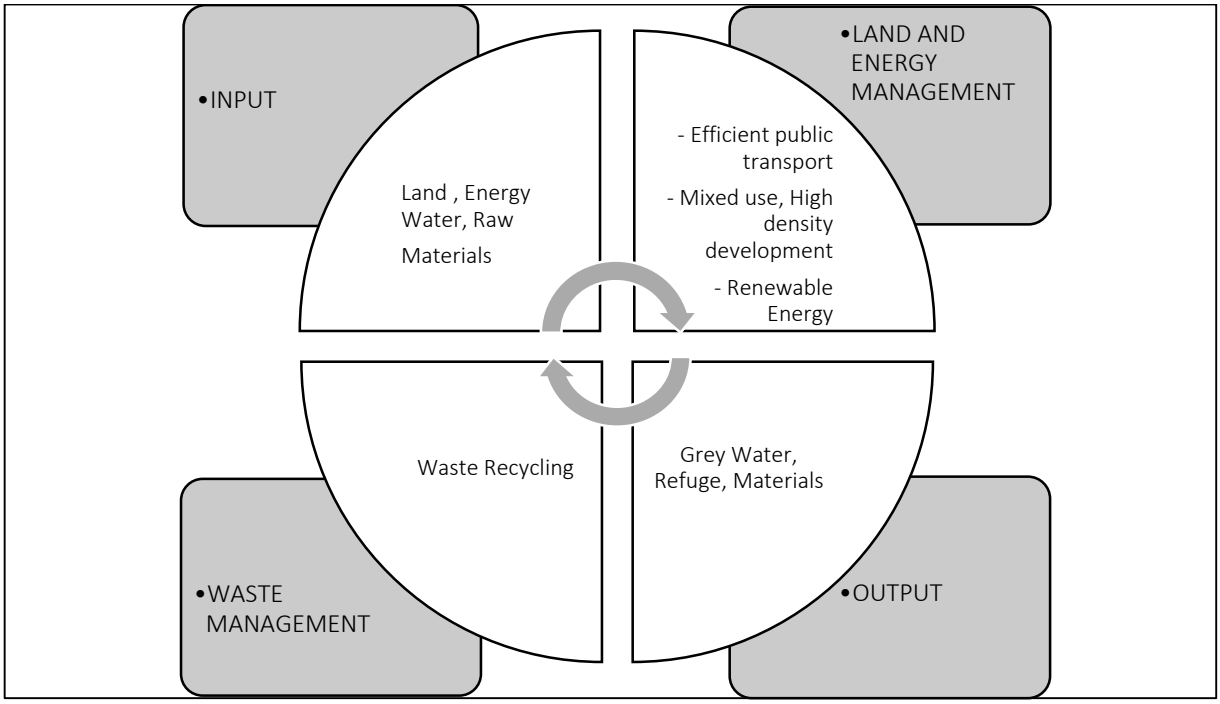


Figure 154: **Recycling process to attain sustainability**
Source: The author

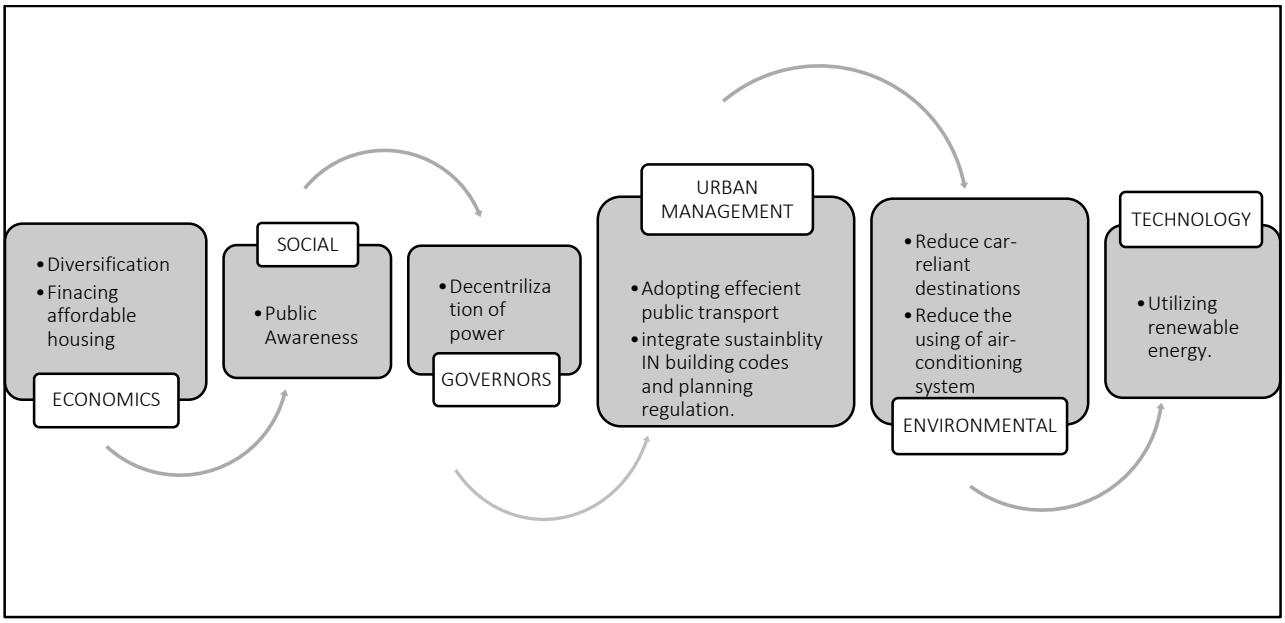


Figure 155: Top priorities to attain sustainability
Source: The author

In Oman building regulations and planning standards have influenced the urban growth pattern. For example, the setback policies no longer work with sustainable built environments. Thus, the buildings' arrangements have to take another shape rather than the current detached structures which are outlined by the setback proximities mainly to attain privacy.

The advantage of compact form is to save energy because as the houses are close to each other it means that the planes which are exposed to external air are minimized. The researcher advocates the idea of activating the role of the courtyard that characterized the traditional Omani houses, see Figure [156]. In the current detached-housing model where more planes are exposed to the external air flows consume more energy in order to keep the thermal comfort in the inner space. In order to preserve privacy, the arrangement of buildings can be varied as shown in figure [157] below.

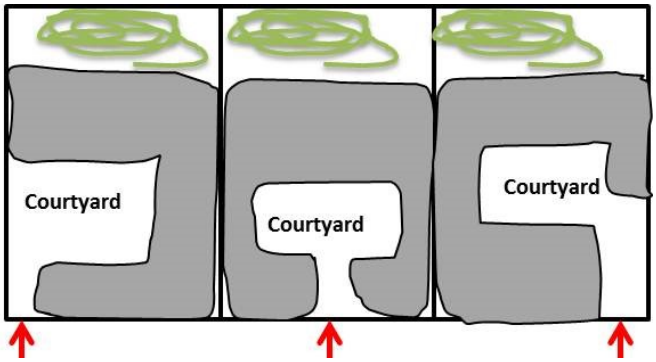
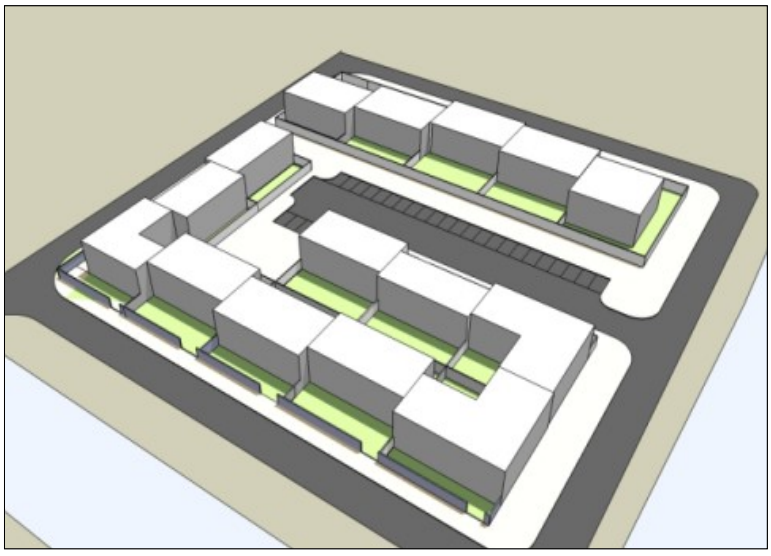


Figure 156: Reviving the role of the courtyard at houses

Source: The author



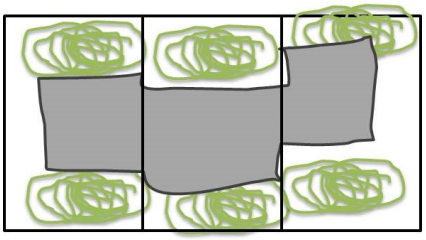


Figure 157: Conceptual sketch to better densification while keeping the same planning sequence but changing the built form.

Source: The author

6.3 Conclusions

6.3.1 Summary of what was found

It is obvious there are many factors that have largely contributed to the current patchy urban pattern. The land distribution system, which relies on random lottery, is the predominant factor that has contributed to the emergence of patchwork and scattered urban growth. This thesis has shown the bulky transformation of the built form in Oman since oil-production. Unlike the oasis settlement with its high-density mixed-use built form, which was considered as unique model of energy-efficiency, the contemporary city with its low-density and scattered urban pattern is entirely based on energy consumption. The traditional settlement with its distinctive urban fabric was efficiently capable of managing the day-to-day pattern in spite of local harsh weather conditions. In contrary, the contemporary urban pattern is designed for car utility more than for public transit as it mostly fails to meet all the requirements of healthy environment and the quality of space. The spaces which are considered as the best that can be utilized for the public realm are obligatorily given for the utilities of private automobiles. As the public transport system is apparently inefficient, the construction of new roads or the widening of existing roads are the only choices to cope with the increasing prevalence of cars. Nevertheless, as car ownership is increasing and more drivers wish to escape from traffic jams, these roads will not take long until they are filled. The absence of comprehensive and vivid long-term strategies to cope with the urban growth has led to the emergence of many social and environmental problems. The increase in traffic accidents and the car-related death rate has apparently alarmed the local authorities and civic society alike. Most local authorities relate the burgeoning number of car accidents and death rates to the lack of drivers' sustainability awareness about driving cars.

However, it is believed that the current urban management system has greater influence. The segregation of land use raises the number of trips and time consumed in cars. The separation of basic destinations from the living places forces people to use their private automobiles. For instance, separating home places from workplaces, places of worship, schools, shops, parks and clinics will increase the number of trips which impact various social and climatic problems that have been discussed already throughout this thesis. According to the primary and secondary data that was evaluated in this thesis, many points have been found in relation to the transformation of lifestyle since the beginning of the oil-age. *At the economic level*, the arable lands which were utilized for food production have been transformed into residential purposes and for car utilities. The abandoning of agro-fishing sectors which were the fundamental sectors for the national economy has increased the ratio of oil-sector dependency. The lack of financial subsidies for these sectors and the effortless careers that were offered to citizens are the main factors that have largely contributed to the abandoning of these significant sectors. Although Oman's Economic Vision 2020 proposed to reduce the oil contribution to the Gross Domestic Product to merely 9% in 2020, according to the 2012 National Budget, oil products are still dominating the GDP as it represents 81% of the total sectors while only 7 years are left to reach the 2020 target. While the investment sector is considered one means for economic diversification, the high rate of private land ownership reduces the appropriate land availability for attracting investments. Since the car has become the dominant form of mobility, large sums of money are given annually from the general budget to the enhancement of roads and car utilities.

*At the social level***,** the transformation of national economy has led to a rapid immigration of population from rural areas to urban areas. It is found that Muscat has experienced a rapid population growth during the past four decades. Muscat's population has doubled more than 32 times since 1970 and is estimated to reach two million in 2030. Currently, Muscat houses about one third of Oman's total population and the highest population density by 243 person/square kilometers though it represents merely 1.3% of the total area of the Sultanate (the second smallest governorate in Oman). The nuclear family is the most common in Muscat over the extended family type. This is indicative of a high rate of single family household occupancy in Muscat and elsewhere in the Sultanate. It is also found that most of Muscat's population are immigrants from other parts of Oman (62% of interviewees originally are not from Muscat). The transformation of built form has largely influenced the social interactions.

Unlike the traditional urban pattern which was based on social cohesion, the spatial segregation of contemporary urban form has lessened the family and relative interactions. Since the early Seventies, when the urban form was transform from high-density compact houses to segregated low-density and villa-based houses, the social interactions have reached a minimal level. In contrast to the traditional, or *hara,* houses, which were based on clustering houses around public and semi-public spaces, the contemporary villas with their linear outline and direct car-accessibility have encouraged people to directly conceal themselves inside their properties. As a result, people have become separated from each other even at particular social occasions. It is not surprising if you find a wedding ceremony and a funeral ceremony at two adjacent houses at the same time. The villa-based land subdivision, with lack of public or semi-public spaces, reduces the chance for people to be in contact. Additionally, the lack of spatial hierarchy in the current urban form, which was a unique characteristic in the traditional settlement, has led to the drop of local identity and quality of place.

At the urban management level, it is found that the land-use is segregated due to poor urban management. It is found that about 42% of Muscat's populations live in Seeb/Khoad areas which are 40 kilometers from Khuwair, where the vast majority of the governmental employees work in the Ministries District. Ruwi embodies the Central Business District (CBD) houses the most banks and companies headquarters. This land use segregation has led to an increase in the quantity of trips and travel time. There is also a high rate of private land ownership due to the land granting system for citizens. It is also found that the residential lots are fairly large as 65% of the plots' size are 600 square meters and up. Meanwhile, there is no correlation among the plot's size and the household's size. It is also found that 65% of interviewees live in single detached family houses. Whereas, villas represent about 37% of the total housing type in Muscat.

In Muscat, the development of new urban centers and sub-centers at the city's fringe has blurred the urban growth to the extent that you could not verify the city's core. The car-corridors that are lined from Muscat towards Northern Batinah by more than 350 kilometers have supported the scattered development on both sides of the highway. Various urban centers and sub-centers have emerged in the Seventies and Eighties such as Qurum, Midinat Qaboos, Othaibah, Baushar and Khuwair while Mawalih, Khoad and Mubailah have emerged from early Nineties. The development boom of the first division of urban centers has raised the cost of land, which forced people to purchase lands in low density areas that lack basic services because they are cheaper than the lands in developed

areas. This designates the emergence of low-density residential areas such as Seeb/Khoad areas which house more than half of Muscat's population. This decentralization of urban development has enlarged the urban sprawl to an unbearable level. The emergence of these scattered urban centers has not only increased the consumption of natural resources, such as land as a particular resource, but also has contributed to deteriorating the quality of space and the quality of communal life alike. At the economic level, these areas require huge money to subsidize the basic infrastructural services such as electricity, roads, water, sewage though they serve very low population densities. At most times these services do not arrive at one time and normally take years to reach the sites.

At the transport level, like other GCC countries, private car ownership in Oman represents the favored type of transport. It is found that about 95% of interviewees own at least one car. According to the interview, the private car performs around 94% of the total trips to get to the workplaces in Muscat while walking and cycling are rare. It is also found that more than half of the interviewees take more than half an hour to commute to their workplaces. It is also found that about 48% of interviewees spend more than OMR100[1] monthly on car expenses. Safe and comfortable pedestrian pathways encourage people to walk and cycle. However, about half of the interviewees indicate that their living areas lack pedestrian sidewalks, and 46% of them showed that the existing street sidewalks are not safe from traffic flows. It is also found that public transport is apparently inefficient as evaluated by more than half of the interviewees.

At the environmental level, according to Ministry of National Economy's statistics, nearly 55% of the total energy is consumed by households. For instance, about 75% of interviewees' households use the air-conditioning system nonstop in the summer time. This is partly due to the free standing cubic design and lack of thermal insulation in the houses' external envelops. It is found that 79% of total interviewees' houses lack thermal insulation in their exterior envelopes.

At technology level, despite the world's recent trend for increasing attention on investing in renewable energy sector as it can replace the energy derived from fossil oil, the Sultanate's energy policies still entirely rely on the oil sector. Although, Oman has all the ingredients that could make the country one of the world's leaders in renewable energy, the country's future policies were free from any attempts of developing this promising sector. This globally growing sector is not only ensuring the provision of sustainable energy, but also helping to protect the environment by reducing greenhouse gases which are the main reason for climate change and global warming.

Despite the modern technologies which are represented in car and air conditioners which are preliminarily used to enhance quality of life, once they are not efficiently utilized, they contribute to deteriorating the basis of life. To sum up, urbanization and technology can deteriorate our life in the whole country if not well managed on both environmental and urban levels.

[1] Omani Riyal(OMR)100= nearly $330

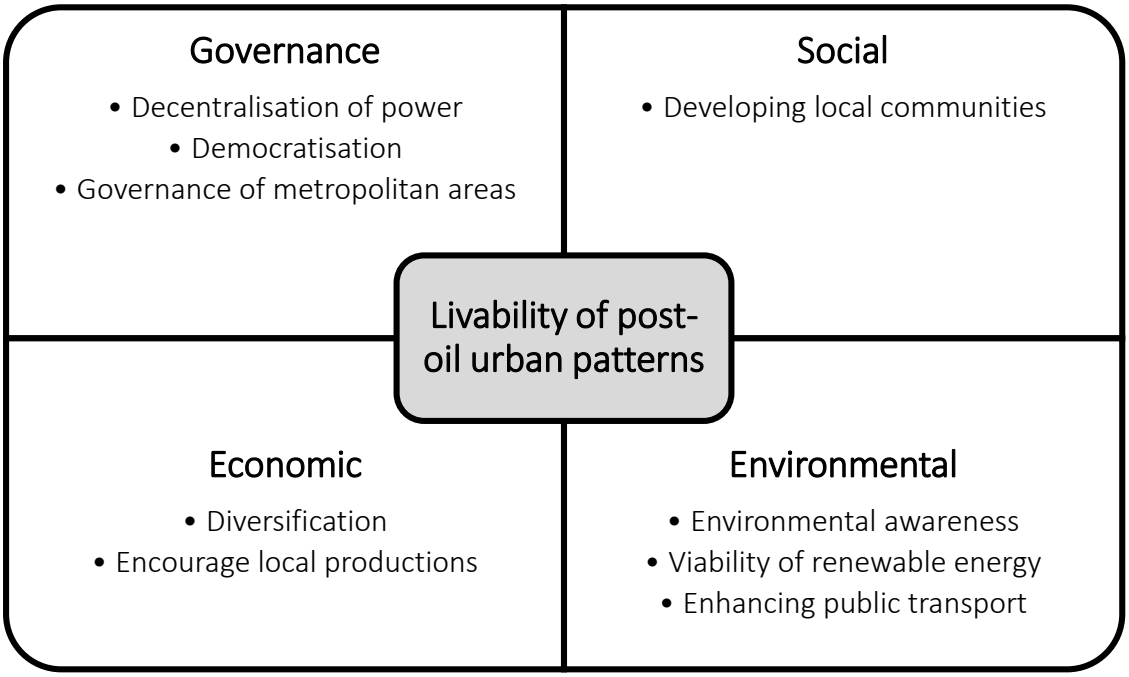


Figure 158: Liveability of Urban Pattern at Post-oil Age

Source: The author

6.3.2 Final Remarks

This thesis has introduced an overview about the transformation of urban development in Oman as a holistic sphere and in Muscat as a particular condition. The transformation of urban pattern convoyed with multiple socio-economic trends which have influenced the entire lifestyle. It also visualized the majority of driving forces that have largely contributed to the emerging current patchwork urban pattern in Oman. Although the thesis has analyzed some aspects that are considered the basis of current unsustainable urban management system, the researcher believes that the country's political decisions have taken the largest portion of current messy urban patterns which normally lack simple characteristics of life comfort. The thesis demonstrates that the chaos that normally characterizes the current urban pattern in Oman is commonly a result of political decisions that control financial and administrative major schemes and projects in the country. Normally, these schemes and projects create deficiency in urban management systems. For instance, the Land Granting System which is based on public random lottery has contributed to emerging dispersed urban pattern in Oman. The political decision which has enabled women to gain land as well as men has broadened the dilemma of intensive land consumption. Also, some projects that were adopted unilaterally such as the Batinah Coastal Highway have not only devoured plenty of money from the national budget but also created an imbalanced equation between urban development and allocating services. Therefore, the current urban development in most parts of the country is observed as vague and disoriented.

Now we come to answer the research's three questions:

- How to describe urban growth in Oman during pre-oil and oil-age?
- How to understand the current urban development in Oman?
- How to guide the future urban development towards sustainability?
-

The first key question reveals a mysterious subject as up until the commencement of the research, urban development in Oman was largely environed by ambiguity. The research assumes that Oman has been undergoing unsustainable development since the early 1970s. It attempted to verify this hypothesis whether it is true or merely an incorrect observation. The research utilized various methodological approaches to prove these assumptions. Taking the advantages of analyzing the urban pattern before the economic boom since the early Seventies has largely revealed the drastic transformation in the socio-economic and environmental conditions. The analysis of the four dimensions that constitute the urban sphere in Oman streamlined the mission of understanding the origin and evolution of urban growth and the impacts that have been left behind.

How the urban development is characterized and what are the driving forces that have led to the current urban pattern? How can one turn around to solve this dilemma to reach sustainability? At the beginning, I didn't know whether these assumptions were right or wrong. However, according to the analysis of methodical approaches of the primary and secondary data that have been gathered in my research, including the interviews, field surveys, and official statistics in addition to my personal background, I found that there is a high threat to urbanization in Oman. The characteristics of urban development that have been detected including dispersed urban pattern, single land use, car-dependency and single-family villa-type housing, all are consequences of the poor management of natural resources. These driving forces have shown a very strong impact on the lifestyle pattern in Oman. The research has shown that the urban management is not only leading to dispersed urban development but also boosting the dispersal in family relations and social interactions. The new urban system has encouraged people to give up some worthy aspects that usually characterized the Omani society up until to just before the oil boom. It has also been shown that the lack of pre-planning strategies for population growth has led to extreme consumption of the existing natural resources, mainly land and water.

The research proved that the urban governor authority has emerged as the principal player in shaping our cities. It has become the largest actor for many contemporary socio-economic and ecological issues. These problems have been gradually observed in the time of urban evolution. The nature of urban government has clearly demonstrated the extraordinary impact of the four dimensions of urban Oman. No doubt, although the government-driven renaissance era attempted to shift the local society from distress to prosperity in a very limited time, the poor urban policies have been pursued have led to various problems which have placed additional stresses on the entire society while moving to the post-oil age. The unilateral decisions that decide the regime and lifestyle of people aggravated the rate of dissatisfaction among the civic society.

In answering the second key question '*How to understand the current urban development in Oman?*' taking Muscat as a case study was significant to have a better understanding of the ongoing urban development in Oman. In this thesis, Muscat with its socio-economic and

environmental issues offered a very rich subject for research. Consequently, Muscat has demonstrated what has been achieved in the urban sphere so far and what has to be achieved in the future. By this, Muscat has been observed as ailing and, with the ongoing poor urban planning, getting worse day by day. Muscat stands in front to tell the local authorities and decision makers that time is running out while the problems are magnified to an unbearable level and require troubleshooting to solve these problems. The thesis visualized multi-disciplinary indicators that anticipate a dark future for the city and comparable cities in Oman if they adhere to the current urban management system.

The third question, *how to guide the future urban development towards sustainability?* Sustainability is a major word that can treat most issues associated with extreme consumption of natural resources. Urban development is always associated by the four significant pillars: social, economic, governance and environment. The thesis demonstrated a large weakness in how these pillars are interrelated in urban Oman. For instance, poor urban governance will definitely influence the rest of the three pillars and vice versa. However, guiding the future development to sustainability requires research on solutions that cope with the existing socio-economic and environmental conditions. For instance, the research presents a detailed description of the issues associated with unsustainable activities that have been committed either by the decision maker or even by the individuals. The reform motivation that this thesis adopted is compliant with facts and figures that are available locally.

Although the research went over the major issues associated with urban development in Oman, I reached a stage where I could not intervene as political ordinances remain the principal motivator of urban development in the country. The supreme governance continues to declare some laws and regulations that are believed to be worthy for urban development but in fact work against people's needs and in contradiction of existing circumstances. The evidence for my arguments is the high proportion of amendments to those ordinances that are issued almost daily in local media.

6.3.3 Future researches

Future research could include many branching materials from the main subjects that constitute this research. For instance, detailed research could be held on the subject of the impact of urban sprawl in social life or in economic performance or local environment.
Future research might include developing an energy model based on the implications and recommendations of this research. For instance, to what extent can the notion of 'compact city' be applied in entire parts of the Sultanate, or it might take different dimensions in accordance with the social and environmental conditions of each region.

My research deals with the driving forces and the impacts of unsustainable urban development in Oman as it observed horizontal urban growth. However, future research can be undertaken in some neighboring countries such as UAE and Qatar that follow vertical urban development and have different economic elements but are observed to be suffering from comparable problems that have been experienced in Oman.

References

Adams, W. M. and Jeanrenaud, S. J. (2008). Transition to Sustainability: Towards a Humane and Diverse World. Gland, Switzerland: IUCN. 108pp.

Al-Awadhi T. (2008), Analysis, Assessment and Modelling of the Urban Growth in Grater Muscat, Sultanate of Oman, Using Geographical Information Systems & Remote Sensing. Egypt. J. Remote Sensing & Space Sci., V.11 PP 3-22 (2008) Cairo, Egypt.

Alexander, C. (1977), A Pattern Language, Oxford University Press: New York

Al-Rawas, M. (1989), Urban Transportation Problems in the Muscat Area, Sultanate of Oman, PhD Dissertation, Department Of Geography University Of Salford: UK

Al Sulaimani, Z. et al (2007), The Social Importance and Continuity of Falaj Use in Northern Oman, International History Seminar on Irrigation and Drainage: Tehran-Iran, found in http://www.irncid.org/GetFileArticles.aspx?FilePrm=8446_41917.pdf downloaded on 21/9/2012

Ames, S. 1997. Community visioning: Planning for the future in Oregon's local communities. In Contrasts and Transitions: Conference Proceedings of the American Planning Association

Arbury, J., From Urban Sprawl to Compact City: An analysis of urban growth management in Auckland.

Archnet-IJAR: International Journal of Architectural Research, Climate, Cities and Sustainability In The Arabian Region: Compactness as a New Paradigm in Urban Design and Planning in - Volume 2 - Issue 2 - July 2008

Ascher, K. (2005), Anatomy of a City, The Penguin Press: New York

Aurigi A. & De Cindio, F., (2008). Augmented Urban Spaces: Articulating the Physical and Electronic City. Ashgate Publishing Limited: Hampshire, England

Badcock, B, (2002), Making Sense of Cities: A Geographical Survey, Arnold: London

Banerjee, T. and Sideris, A. (2011), Companion to Urban Design, Routledge

Banfield, E (1974), the Unheavenly City Revisited, Little, Brown and Company Ltd.

Barnes, K.B., Morgan, J.M., III, Roberge M.C. and Lowe, S. (2001). Sprawl Development: Its Patterns, Consequences, and Measurement. A white paper, Towson University. URL: http://chesapeake.towson.edu/landscape/urbansprawl/download/Sprawl_white_paper.pdf.

Barnett, J. (2001). Planning for a New Century: the Regional Agenda, Island Press

Beigel, F & Christou, P. (2010), Architecture as City Saemangeum Island City, Springer-Verlag/Vienna

Bekele H.(2005) , Urbanization and Urban Sprawl (Master Thesis), Kungliga Tekniska Högskolan, Stockholm

Ben-Hamouche, M. (2008) in Archnet-IJAR, International Journal of Architectural Research - Volume 2 - Issue 2 - July 2008, Climate, Cities and Sustainability In The Arabian Region: Compactness as a New Paradigm in Urban Design and Planning

Ben-Joseph, E. & Szold, T. (2005), Regulating Place: Standards and the Shaping of Urban America, Routledge: New York

Bhatta, B (2010). Analysis of Urban Growth and Sprawl from Remote Sensing Data. Springer-Verlag Berlin Heidelberg

Blewitt, J. (2008), Understanding sustainable development, Earthscan: London

References

Boarnet, M. (2001), Travel by Design: the Influence of Urban Form on Travel, Oxford University Press: New York

Brebbia, A. & Beriatos, E. (2011), Sustainable Development and Planning V, WIT Press: Southampton, UK

Bruegmann, R. (2005), Sprawl: A Compact History, The University of Chicago Press: Chicago

Buder, S. (1990), Visionaries and Planners; The Garden City Movement And The Modern Community, Oxford University Press: New York

Buerkert, A. & Schlecht, E., Oases of Oman: Livelihood Systems at the Crossroads, 2nd ed. (2010). Al Roya Press & Publishing House: Muscat

Bullard, R (2007) Growing Smarter: Achieving Livable Communities, Environmental Justice, and Regional Equity, The MIT Press: Cambridge, Massachusetts

Burchell, R. (2005), Sprawl Costs: Economic Impacts of Unchecked Development, Island Press

Burtless, G. & Pack, J. (2009), Brookings-Wharton Papers on Urban Affairs, Brookings Institution Press: Washington, D.C.

Calthorpe P. & Fulton.W. (2001). The Regional City: Planning for The End Of Sprawl. Island Press

Carmona, M. & Tiesdell, S.(2007), Urban Design Reader, Architectural Press: Oxford

Cawood, P. et al (2006), Designing Greenways: Sustainable Landscapes for Nature and People, Island Press: Washington

Cerreta M., Concilio, G. & Monno V. (2010), Making Strategies in Spatial Planning: Knowledge and Values, vol. 9, Springer: London

Chiras, D. & Wann, D. (2003), Suburbia: 31 Ways to Create Sustainable Neighborhoods, New Society Publishers: Canada

Clark, D.(1996), Urban World, Global City, Routledge: London

Condon, P. (2008), Design Charrettes for Sustainable Communities, Island Press: Washington

Connerly, C. et al. (2007), Growth management in Florida: planning for paradise. Ashgate Publishing Limited: Hampshire, England

Cullingworth, B. & Caves, R. (2003), Planning in the USA: Policies, Issues, and Processes, 2nd ed., Routledge, London

Dannenberg, A. et al. (2011), Making Healthy Places: Designing and Building for Health, Well-Being, and Sustainability, Island Press: Washington

Davoudi, S et al. (2009), Planning for Climate Change: Strategies for Mitigation and Adaptation for Spatial Planners, Earthscan: London

Department of the Environment, Transport and the Regions (1999), Towards an Urban Renaissance – Final Report of the Urban Task Force Chaired by Lord Rogers of Riverside. : HMSO/E & F Spon: London.

Devas, N. (2001) Urban Governance and Poverty: Lessons from a Study of Ten Cities in the South, Birmingham: University of Birmingham.

Devuyst, D. (2001), How Green Is The City?: Sustainability Assessment and The Management of Urban Environments, Columbia University Press.

Dierwechter, Y. (2008), Urban Growth Management and Its Discontents: Promises, Practices, and Geo-Politics In U.S. City Regions, Palgrave Macmillan: New York

References

Dimitriou, H. (1993), Urban Transport Planning, Routledge: New York

Dinep, C. & Schwab, K. (2010), Sustainable Site Design: Criteria, Process, and Case Studies for Integrating Site and Region in Landscape Design, John Wiley & Sons, Inc.: Hoboken, New Jersey

Doucet, C. (2007) Urban Meltdown: Cities, Climate Change & Politics as Usual, New Society Publishers: Gabriola Island: Canada

Downton P. (2009), Ecopolis: Architecture and Cities for a Changing Climate , Springer Science and Business Media B.V., Dordrecht, The Netherlands and CSIRO Publishing, Collingwood, Australia

Duany A. et al (2000), Suburban Nation: The Rise of Sprawl and the Decline of the American Dream, North Point Press: New York

Edward Ng. (2010), Designing High-Density Cities for Social and Environmental Sustainability, Earthscan: London

Edwards, A., (2005), the Sustainability Revolution: Portrait of a Paradigm Shift, New Society Publishers: Canada

Ellin, N. (2006), Integral Urbanism, Routledge: New York

Erickson, D. (2006), MetroGreen: Connecting Open Space in North American City, Island Press: London

European Commission (1998), Sustainable urban development in the European Union: A framework for action, European Commission: Brussels

Flint, A. (2006), This Land : The Battle Over Sprawl and The Future of America, The Johns Hopkins University Press: Baltimore

Foran, M. (2009), Expansive Discourses: Urban Sprawl in Calgary, 1945-1978, AU Press, Athabasca University: Canada

Forman, R. (2008), Urban Regions: Ecology and Planning Beyond the City, Cambridge University Press: New York

Frey, H (1999), Designing the city: towards a more sustainable form, Spon Press: London & New York, p.p.77-78

Frey,H. (1999), Designing The City: Towards A More Sustainable Form, Spon Press

General Secretariat for Development Planning. (GSDP), (2009), Qatar National Vision 2030: Advancing Sustainable Development Qatar's Second Human Development Report, GSDP: Doha

Gilbert, R. & Perl, A.(2008), Transport Revolutions: Moving People and Freight Without Oil, Earthscan: London

Gillham, O. (2002), The Limitless City: A Primer on the Urban Sprawl Debate. Island Press: Washington

Girardetp, H (2007), Surviving the Century :Facing Climate Chaos and Other Global Challenges, Earthscan: London

Grant, J. (2006), Planning the Good Community: New Urbanism in Theory and Practice, Routledge: New York

Hojer, G et al (2011), Images of the Future City: Time and Space For Sustainable Development, Springer: London

Hart, S. (1993), The Elephant in the Bedroom. Pasadena: New Paradigm Books

Harvey, R.O. and Clark, W.A.V. (1965). The Nature and Economics of Urban Sprawl. Land Economics

Hulsbergen E.D., Klaasen I.T, Kriens I. (2005), Shifting Sense: Looking back to the future in Spatial Planning, Techne Press: Amsterdam, The Netherlands

Hutchison, R. (2010) Encyclopedia of urban studies. SAGE Publications, Inc.: California

Iqbal, M. (2005), Islamic Perspectives on Sustainable Development, published jointly by Palgrave Macmillan, University of Bahrain, and Islamic Research and Training Institute.

Jayne M. (2006), Cities and consumption, Routledge: London

References

Jenkins P., Smith H. and Wang Y, P (2007), Planning and housing in the rapidly urbanising world , Routledge: London

Jenks M. and Burgess R. (2000), Compact Cities: Sustainable Urban Forms for Developing Countries, Spon Press, London

Jenks, M. & and Dempsey, N. (2005), Future Forms and Design for Sustainable Cities, Architectural Press: Oxford

Jenks, M. et.al. (2005), The Compact City: A Sustainable Urban Form, Taylor & Francis e-Library

Johnson, E. & Klemens, M.(2005), Nature in Fragments: The Legacy of Sprawl, Columbia University Press: New York

Kennedy, J (2010), New Arab Urbanism, The Challenge of Sustainability & Culture in the Gulf: Final Report prepared for The Kuwait Program Research Fund School of Government Harvard University.

Joseph E. & Szold T. (2005). Regulating Place: standards and the shaping of urban America. Routledge

Kelbaugh, D. & McCullough, K. (2008), Writing Urbanism: A Design Reader, Routledge: New York

Kemp R. & Stephani. C. (2011) Cities Going Green : A Handbook of Best Practices, McFarland & Company, Inc., Publishers: North Carolina, USA

Knox, P. (2008), Metroburbia, USA, Rutgers Press

Knox P. (2011), Cities and Design, Routledge: London

Léautier, F. (2006), Cities in a Globalizing World: Governance, Performance, and Sustainability, The World Bank: Washington, DC

Lindgren, M. & Bandhold, H. (2003), Scenario Planning: The Link Between Future and Strategy, Palgrave Macmillan: New York

Maciocco, G (2008), Urban and Landscape Perspectives: Fundamental Trends in City Development, Vol.1, Springer

Mander, Ü.et al. (2006), The Sustainable City IV: Urban Regeneration and Sustainability, WIT Press: Southampton

Martine, G. et al. (2008),The New Global Frontier: Urbanization, Poverty and Environment in the 21st Century, Earthscan: London

Mauch. J and Park. N,(2003), Guide to the Successful Thesis and Dissertation: A Handbook for Students and Faculty, 5th Ed. Marcel Dekker, NY

McCann, B. & Ewing, R. (2003), Measuring the Health Effects of Sprawl: A National Analysis of Physical Activity, Obesity and Chronic Disease, Smart Growth America, Surface Transportation Policy Project

McDonnell.M. et al,(2009), Ecology of Cities and Towns: A Comparative Approach, Cambridge University Press: New York

Mees, P. (2010), Transport for Suburbia: Beyond the Automobile Age, Earthscan: London

Mega, V. (2010), Sustainable Cities for the Third Millennium: The Odyssey of Urban Excellence, Springer: New York

Ministry of National Economy, Oman Development and Investment, 6th Ed. 2008

Moor, M. & Rowland, J. (2006), Urban Design Futures, Routledge: New York

Morris D. (2005), It's A Sprawl World After All: The Human Cost of Unplanned Growth and Visions of A Better Future, New Society Publishers: Canada

Mortada, H. (2003), Traditional Islamic Principles of Built Environment, RoutledgeCurzon

Moughtin, C. & Shirl, P. (2005). Urban Design: Green Dimension. Architectural Press.

References

Næss, P. (2006), Urban Structure Matters: Residential Location, Car Dependence and Travel Behaviour, Routledge: Oxfordshire

Næss, P. (2006), Urban Structure Matters: Residential Location, Car Dependence and Travel Behaviour, Routledge: Oxfordshire

Neal, P. (2003), Urban Villages and the Making of Communities, Spon Press: London

Nelson and Dawkins (2004), Urban Containment in the United States: History, Models and Techniques for Regional and Metropolitan Growth Management. American Planning Association: Chicago

Nelson, A. (2007), The Social Impacts of Urban Containment, Ashgate Publishing Limited: Hampshire, England

Newman, P. and Jennings, I. (2008), Cities as Sustainable Ecosystems: Principles and Practices, Island Press

Newman, P. and Kenworthy, J. (1999). Sustainability and Cities. Island Press: Washington, D.C

Newman, P.et.al. (2009). Resilient Cities: Responding To Peak Oil and Climate Change. Island Press: Washington

Nozzi, D (2003), Road to Ruin: An Introduction to Sprawl and How to Cure It, Praeger: London

Office of the Deputy Prime Minister (2000) Millennium Villages and Sustainable Communities. London: ODPM.

Organisation for Economic Co-operation and Development (OECD) (2001), Sustainable Development Critical Issues, OECD: Paris

Organisation for Economic Co-operation and Development (OECD) (2009), Regions Matter: Economy Recovery, Innovation and Sustainable Growth , OECD: Paris

Organisation for Economic Co-operation and Development (OECD) (2010), Cities and Climate Change, OECD Publishing. http://dx.doi.org/10.1787/9789264091375-en

Orr, D. (2006), Design On the Edge: The Making of A High-Performance Building, MIT Press: Cambridge

Ots, E. et al. (2011), Decoding Theoryspeak : An Illustrated Guide To Architectural Theory, Routledge

Ottensmann, J. (1977). Urban Sprawl, Land Values and the Density of Development. Land Economics

Oxford Dictionary (2000).

Pacione M. (2009), Urban Geography: A Global Perspective, 3rd ed, Routledge: London

Parker, S. (2004), Urban Theory and the Urban Experience: Encountering the City, Routledge: London

Patrick M. Condon (2008). Design Charrettes for Sustainable Communities, Island Press: London

Perlman, D. & Milder, J. (2004), Practical Ecology for Planners, Developers, and citizens. Island Press: Washington, DC

Peterson, J.E (2007), Historical Muscat: An Illustrated Guide and Gazetteer, Brill NV: Leiden, The Netherlands.

Pieterse EA (2008), City futures: confronting the crisis of urban development. Zed Books, London, New York; UCT Press, Capetown South Africa

Pitz, G., (2004), Encyclopaedia of Human Geography, Greenwood Press, Westport, USA

Plowden, S., (1972), Towns against Traffic, Andre Deutsch: London

Porter, D. (2008), Managing Growth in America's Communities (2nd ed.), Island Press: Washington

Preston, L. et al (2010), An Introduction to Sustainable Transportation: Policy, Planning and Implementation, Earthscan: London

Punter J. (1999), Design Guidelines in American Cities: A Review of Design Policies and Guidance in Five West Coast Cities, Liverpool University Press: UK

References

Ribbeck, E. et al, (2001), Oasis Settlement in Oman: Pilot Study 1999 – 2000, St dtebau-Institut (SI) Universitat Stuttgart

Richardson, H. & Bae, C. (2005), Globalization and Urban Development, Springer

Riddell, R. (2004), Sustainable Urban Planning: Tipping the Balance, Blackwell Publishing Ltd

Root, A. (2003), Delivering Sustainable Transport: A Social Science Perspective, Elsevier Science Ltd: UK

Russ, T. (2009), Site Planning and Design Handbook (2nd ed.), McGraw-Hill

Saif I (2009), The Oil Boom in the GCC Countries,2002–2008:Old Challenges, Changing Dynamics, Carnegie Endowment for International Peace: Washington, DC

Sarte, S. (2010), Sustainable Infrastructure: The Guide to Green Engineering and Design, John Wiley & Sons, Inc.: Hoboken, New Jersey

Saunders, W. (2006), Urban Planning Today, University of Minnesota Press: Minneapolis

Schiller P, Bruun E. and Kenworthy J. (2010), An Introduction to Sustainable Transportation Policy, Planning and Implementation, Earthscan, London.P.7

Schmid, H. et al (2011), Cities and Fascination: Beyond the Surplus of Meaning, Ashgate Publishing Limited.

Schneider-Sliwa R. (2006), Cities in Transition: Globalization, Political Change and Urban Development, Springer: Dordrecht, the Netherlands

Scholz, F. (1980). A geographical Introduction to the Country of Oman, Ernst Klett Printing: Stuttgart, Germany

Schriener, J. & Kephart, M. (2010), Building for Boomers: Guide to Design and Construction, McGraw-Hill Companies, Inc

Shearer, A. et al (2009), Land Use Scenarios: Environmental Consequences of Development, CRC Press Taylor & Francis Group

Sieverts, T. (2003). Cities Without Cities: An Interpretation of the Zwischenstadt (English ed.), Spon Press: London

Simpson, B. (1994), Urban Public Transport Today, E & FN Spon: London

Smith, C, Clayden, A & Dunnett, N (2008), Residential landscape sustainability, Blackwell Publishing: Oxford, UK

Sorensen A. & Okata J. (2011), Megacities: Urban Form, Governance, and Sustainability, Springer

Soule, D (2006), Urban Sprawl: A Comprehensive Reference Guide, Greenwood Pres: Westpoint

Ståhle, A. (2008), Compact Sprawl: Exploring Public Open Space and Contradictions in Urban Density, KTH Architecture and the Built Environment: Stockholm, Sweden

Steef Buijs in Volume Magazine, issue no.18

Sudhira, H. & Ramachandra, T. (2007). Characterising urban sprawl from remote sensing data and using landscape metrics. Proceedings of 10th International Conference on Computers in Urban Planning and Urban Management, Iguassu Falls, PR Brazil, URL: http://eprints.iisc.ernet.in/11834/1/198-final.pdf

Syms, P. (2010). Land Development and Design (2nd Ed.). Blackwell Publishing Ltd

Tachieva, G. (2010), Sprawl repair manual, Island Press: Washington

Talen E. (2008), Design for Diversity: Exploring Socially Mixed Neighborhoods, Elsevier Ltd: Oxford, UK

Tellier, L. (2009), Urban World History: An Economic and Geographical Perspective, Presses de l'Université du Québec: Canada

Thomson, M (1977) Great Cities and their Traffic Harmondsworth: Penguin.

Thorns, D.(2002), The Transformation of Cities : Urban Theory and Urban Life, Palgrave Macmillan: New York

Towers, G. (2005), An Introduction to Urban Housing Design-At Home in the City, Elsevier: Oxford

United Nations Environment Program (UNEP) (2003), Weather related natural disasters in 2003 cost the world billions: Press release, UNEP, Nairobi, 10 Dec.

United Nations Human Settlements Programme (UN-HABITAT), 2008, State of the World's Cities 2008/2009 Harmonious Cities, Earthscan: London

United Nations (2010), Department of Economic and Social Affairs Division, Trends in Sustainable Development: Towards Sustainable Consumption and Production

United Nations Human Settlements Programme, UN-HABITAT, (2008), State of the World's Cities 2008/200

Vermaas, P.(2008), Philosophy and Design: From Engineering to Architecture, Springer

Volume magazine: After Zero, vol. 18, Stichting Archis: The Netherlands

Walters, D. & Luise, L.(2004). Design first: design-based planning for communities. Architectural Press publications

Weidleplan- Muamir (April 1989), Muscat Area Structure Plan Phase 1– Survey Report, Vol. 1-Report

Weidleplan- Muamir (April 1990), Muscat Area Structure Plan Phase 2 – Strategy Report

Weidleplan- Muamir (April 1991), Muscat Area Structure Plan Phase 3 – Draft Final Report ,Volume 1 Report

Weidleplan- Muamir (December 1989), Muscat Regional Plan Phase 2 – Strategy Report

Wheeler, S. (2004), Planning for Sustainability : Creating Livable, Equitable, and Ecological Communities, Routledge

Wiedmann, F. (2010), Post-oil urbanism in the Gulf Case study: Kingdom of Bahrain, PhD Thesis, Universität Stuttgart: Deutschland

White R.(2002), Building the ecological city, Woodhead Publishing Ltd: Cambridge, England

Wong T. &Yuen B.(2011), Eco-city Planning: Policies, Practice and Design, Springer: London

World Commission on Environment and Development (1987) Our Common Future, Oxford University Press, Oxford

Zhang, B. (2004), Study on Urban Growth Management in China, Xinhua Press: Beijing

Websites from Oman

Ministry of information: http://www.omanet.om/

Ministry of Housing: www.housing.gov.om/

Ministry of National Economy: http://www.moneoman.gov.om/

Ministry of Regional Municipalities and Water Resources: http://www.mrmewr.gov.om/

Ministry of Heritage and Culture: http://www.mnhc.gov.om/

Muscat Municipality: http://www.mctmnet.gov.om/

Royal Oman Police: http://www.rop.gov.om/

Oman Census: http://www.omancensus.net/

Oman Newspaper: http://www.omandaily.com/

Al Watan Newspaper: http://www.alwatan.com

Oman Observer Newspaper: http://www.omanobserver.om/

National Centre for Statistics and Information: www.moneoman.gov.om/

Ministry of Environment and Climatic Affairs: http://www.omanw.com/

General Websites

United Nations: URL:http://www.un.org/esa/population/publications/WUP2005/2005wup.htm

Wikipedia: http://www.en.wikipedia.org/

The World Bank: Data: http://data.worldbank.org/

Energy Information Administration: http://www.eia.gov/

World Bank, Oman Data: http://data.worldbank.org/country/oman

BP Statistical Review of World Energy: http://www.bp.com/en/global/corporate/about-bp/statistical-review-of-world-energy-2013.html

ANNEXES

1. Glossary

Hara: The traditional expression of the traditional neighborhood. In other GCC countries is called 'fareej'

Saha: A public space in traditional settlement, normally open as a plaza used for local celebrations and festivals.

Meedan: A public space in traditional settlement, normally open as a plaza used for local celebrations particularly traditional dancing.

Villa: A large house built in centre of a residential plot and surrounded by a lift-over space between the building and a wall.

Arabic house: *Arabic house* was common in 1980's as a typical housing model. The typical plot's area for this housing model was 324m^2 (18m x18m). The typical layout of a building was characterized by a median courtyard which is considered the most functional and collective space that integrates the house's inner and outer spaces. The rooms are built in one half of the plot while the other half remains as an open-to-sky courtyard.

Sikka: The smallest elements of public space, Sikka are narrow streets that link the neighbourhood together. More specifically, they link each home both to neighbours and to community facilities. It is shaded by the buildings they run along, Sikka provide cool, safe, walkable routes to destinations. Sikka is pedestrian-friendly, shaded; enables quick movement from home to saha to other community facility.

Liwan: A Traditional sitting room where household commonly gather and it is commonly in Arabic House

Souq: The common word for the traditional market in Arab countries.

Sabah: Atraditional venue where local people gather every early morning and night to eat and talk. Normally, it is used also to welcoming guests.

Sablah: A particular building that is normally developed in rural and urban areas, owned by one tribe or by a district's residents. It is utilized for meeting males from other tribes in the occasions of weddings and condolence.

Wilayat: A city which is consisted of multiple villages and districts.

Wali: Wali is the wilayat governor. He is normally appointed by the Minister of Interior.

Governorate: It is normally consists of multiple Wilayats.

Governor: A governorate governor, normally appointed by the Minister of Interior excluding the governor of Muscat and Dofar who are appointed by the His Majesty via Royal Decrees.

Emtidad: An Arabic word means 'extension' in English. It is a planning technique used to enlarge the area of land/s for expansionary purposes.

Peak oil: Refers to the 'maximum rate of the production of oil in any area under consideration, recognizing that it is a finite natural resource, subject to depletion.'[1]

Falaj: A falaj in Oman refers to water that runs through a channel dug in the earth. The source of falaj water is groundwater found in the subsoil or valleys. The plural of the word 'falaj' used in Oman is 'aflaj', which is a comprehensive term used to denote a system of irrigation. The falaj is an original Omani irrigation system, deep-rooted in the country's land and history.[2]

2. Abbreviations

EIA: Energy Information Administration

GCC: Gulf Cooperation Council

MNE: Ministry of National Economy

MOD: Ministry of Defence

MoH: Ministry of Housing

MoMA: Ministry of Municipal Affairs

MRMWR: Ministry of Regional Municipalities and Water Resources

MRP: Muscat Regional Plan

MSP: Muscat Structure Plan

NCSI: National Centre for Statistics and Information

ODAC: Oil Depletion Analysis Centre

OECD: Organisation for Economic Co-operation and Development

ONSA: Oman National Survey Authority

PDO: Petroleum Development of Oman

QNV: Qatar National Vision

ROP: Royal Oman Police

SCTP: Supreme Committee for Tow Planning

TRC: Technical Research Council

[1]Newman, P. (2099), p. 19

[2] http://www.omantourism.gov.om/wps/portal/mot/tourism/oman/home/experiences/culture/aflaj retrieved on 06-07-2013