URBAN EXPANSION AND ITS IMPLICATIONS UPON AGRICULTURAL LANDS IN BAHRAIN: A PLANNING PERSPECTIVE

A thesis submitted to fulfill a part of the Master of Architecture Degree

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وَقُل رَّبِّ أَدْخِلْنِي مُدْخَلَ صِدْقٍ وَأَخْرِجْنِي مُخْرَجَ صِدْقٍ وَاجْعَل لِّي مِن لَّدُنكَ سُلْطَانًا نَّصِيرًا(80)

سورة الإسراء

And say, “My Lord! Grant me an honourable entrance and an honourable exit and give me a supporting authority from Yourself.”

Al-Isra – Ayat (80)

Statement of Original Authorship

I declare that this thesis and all its contents are my original work along with referring to the literature, data source and participants. This thesis has not been previously submitted to any educational institution, nor do they contain any material previously submitted for any academic degree.

Mohamed Ali

Thursday, April 10, 2025

Keywords

Bahrain, Urban expansion, Agriculture, Urban planning, Satellite Imagery, Smart agriculture

Abstract

Urban expansion is a global phenomenon and cannot be limited to a specific country. The population boom and the migration from rural areas to cities are among the main causes of the increase in the urban expansion phenomenon. Studies have shown that this has negatively affected societies, economies, and the environment. This is what researchers warned of in Bahrain, where they explained that neglecting the environment and land-use in urban expansion will cause many economic, environmental and social issues. Accordingly, this thesis was conducted to analyze the implications of urban expansion in Bahrain, to come up with recommendations and proposals to develop and enhance the urban planning and land-use.

Mixed methods were used to analyze the research. Satellite imagery of multiple areas in Bahrain was analyzed to identify and to map the geographical changes over the years. Furthermore, interviews were conducted with specialists in urban planning to understand the causes and consequences of urban expansion and come up with comprehensive recommendations. The interviews were analyzed using a thematic analysis due to the ability to build theories and develop comprehensive recommendations.

After analyzing the satellite images, it was found that there was a significant decrease in agricultural areas. For example, between 1968 and 2023, agricultural areas decreased in Segaya from 77% to 10% of the total area. The satellite images analysis was consistent with the results of the thematic analysis. It was revealed that the decrease of agricultural areas is due to several reasons, including the demand of horizontal urban expansion, and lack in oversight from the responsible authorities. Therefore, the decrease in agricultural areas leads to deteriorating air quality and increasing pollution which is negatively affecting the environment. The third participant emphasized that the approach adopted in Bahrain for urban expansion will result in major problems for the future generations, including land shortages. However, several proposals were extracted, including controlling urban expansion, adopting smart agricultural technologies, and raising awareness. In the end, this thesis emphasizes that preserving and enhancing the remined agricultural areas in Bahrain is of the utmost importance and the opportunity still exists.

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Thesis structure chart

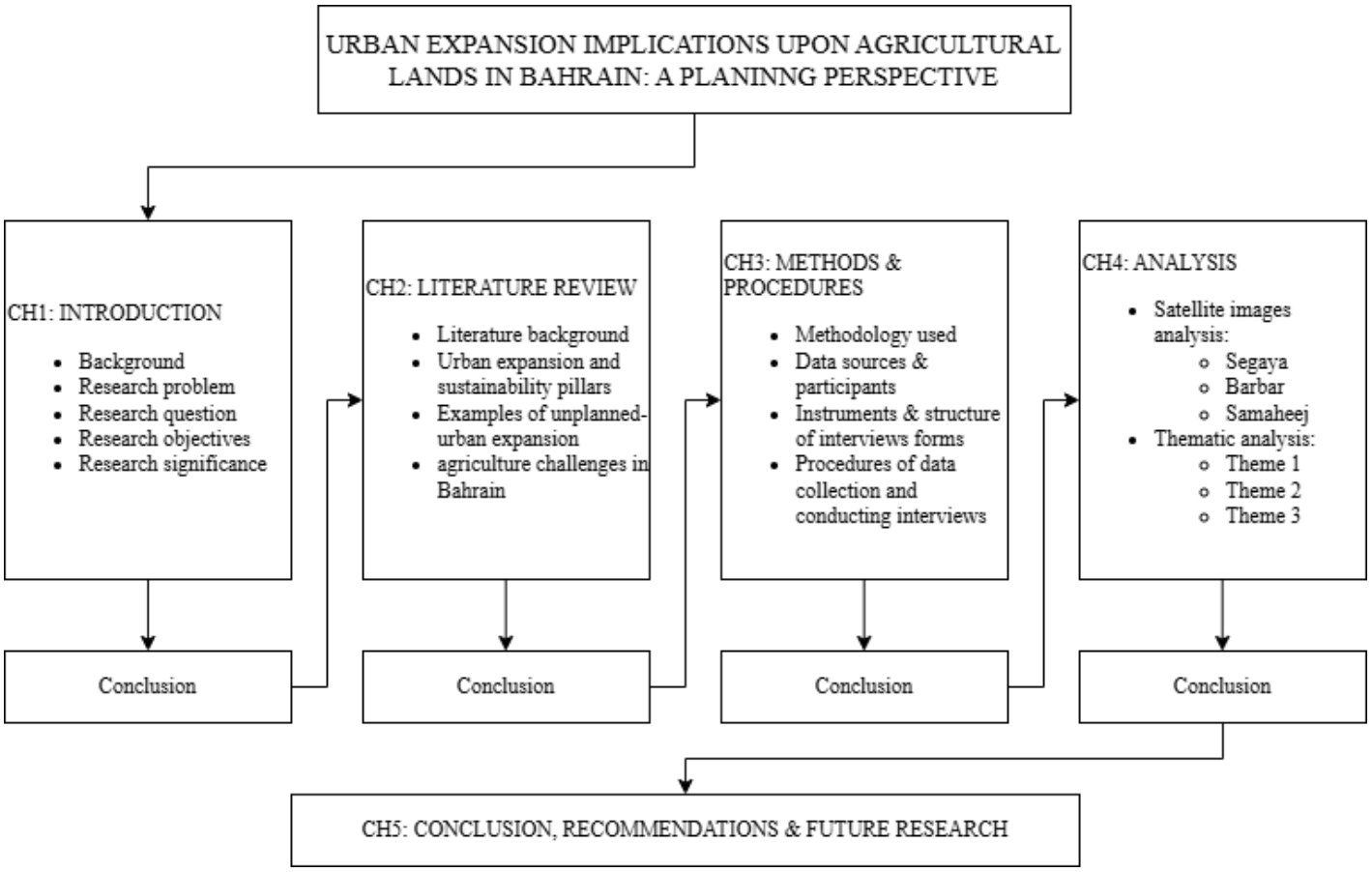


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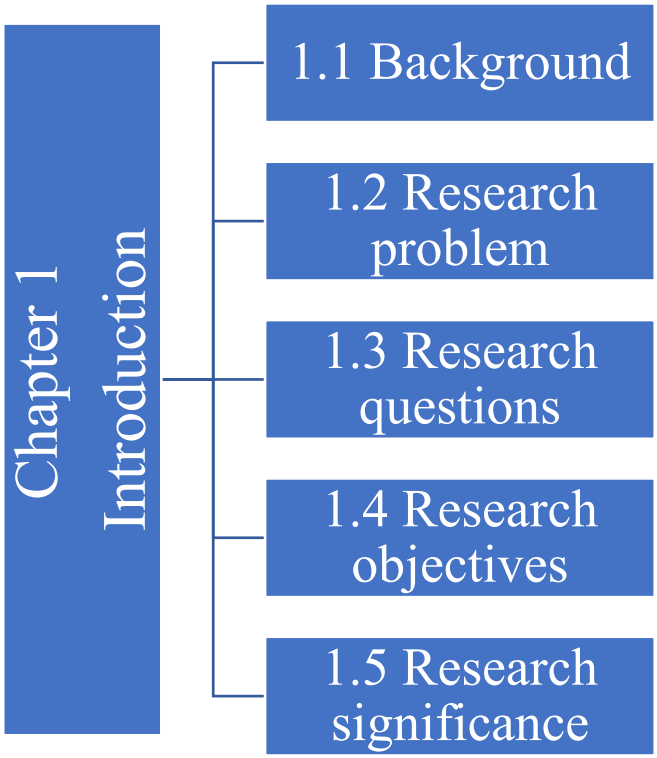
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List of Abbreviations

Abbreviation	Meaning
SLRB	Survey & Land Registration Breau
CRPEP	The Council for Regulating the Practice of Engineering Professions
UPDA	The Urban Planning & Development Authority
QGIS	Quantum Geographic Information System
AutoCAD	Auto Computer Aided Design
Ha	Hectares
E	Empty lands & roads
AG	Agricultural areas
B	Built-up areas

CHAPTER ONE:
INTRODUCTION



Chapter 1: Introduction

1.1 Background

Urban expansion and its impact on agricultural areas is a global issue not limited to Bahrain, many countries around the world are experiencing this issue, particularly due to population booms and migration from rural areas to cities (Fazal, 2000) (Angel, 2023). But specifically in Bahrain, after the development of the oil industry in the early 1930s, rapid urban expansion and the expansion of the roads network led to a decrease in the agricultural regions (Fuccaro, 2000). This has become a source of societal concern in recent years (Al-Tarawneh, 2014) (Liu, Huang, Xu, Li, Li, Ciais, Lin, Gong, Ziegler, Chen, Gong, Chen, Hu, Chen, Wang, Wu, Huang, Estes, Zeng, 2020) (Angel, 2023).

The definition of agriculture is the practice or science of soil cultivation, crops production, livestock rising and resulting products marketing. Greenification is the process of increasing the green areas and enhancing the environment through cultivation of trees and other crops. In summary, agriculture is the production process while greenification is the application of agriculture to increase the green areas and enhance the environment. Therefore, agriculture is a main instrument to achieve greenification (Plaku, 2024), Velasco-Muñoz, Mendoza, Aznar-Sánchez ,Gallego-Schmid, 2021). In Bahrain, agriculture considered as one of the main sectors and agricultural areas were 20% of the total area of Bahrain till 1971 (Shqlyh, 1972). With the steady population increase (from 0.16 million in 1960 till 1.57

million in 2023 as per World Bank Data), Bahrain suffers from numerous problems, the most significant and dangerous of which is the urban expansion, which has led to a significant decline in agricultural areas in Bahrain along with disappearance of the green corridors and boundaries between towns and cities. The decline and deterioration of agricultural areas will have negative social, economic, and environmental results on the country. Other problems include a decline in the labor force, limited development in agricultural technologies, weak marketing of agricultural products, scarce rainfall, water salinity, soil salinity, high temperatures, and generally harsh weather conditions. Bahrain's environmental conditions are harsh, with sandy, salty soil that does not retain water for long periods. These conditions are only suitable for desert plants that can withstand said weather conditions. Some Bahraini farmers have highlighted the weakness of the agricultural market in Bahrain due to the lack and decrease in agricultural areas, and the lack of support from relevant authorities after Tamkeen's support was suspended for unknown reasons (Shqlyh, 1972), (Al-Taisan, 2022), (Alrowaili, Aldulaimi, Abdeldayem & Hasan, 2024), (Bani, 2020), (Fuccaro, 2000), (Shebeb, 2006). However, as previously mentioned, the primary problem facing the agricultural sector is urban expansion. Accordingly, this thesis will address the impact of urban expansion on agricultural regions of Bahrain.

1.2 Research problem

The problem addressed by this thesis is the decline and deterioration of agricultural areas in Bahrain due to urban expansion. This urban expansion, in many cases is unplanned, and has led to numerous economic, social, and environmental issues. For example, within 55 years, the agricultural areas of Segaya, Manama decreased from 77% of the total area to only 10%. Within 46 years, the agricultural areas of Samaheej, Muharraq decreased from 38.6 Ha to only 2.1 Ha. If this problem continues to be neglected, this will only worsen in the future, potentially further impacting the country's food security and the environment.

1.3 Research Questions

There are several questions in this thesis, which are:

- What is the history of the agricultural sector in Bahrain and what are its types?
- What are the social, economic and environmental aspects of urban expansion in Bahrain and its impact upon agricultural areas?
- What are the strategic aspects that can contribute to preserving and enhancing the agricultural areas in Bahrain?

1.4 Research objectives

There are several objectives in this thesis, which are:

- To gain a comprehensive understanding of the agricultural sector in Bahrain, including its modern history, types, and uses which will result in raising societal awareness.

- To document the expansion of Bahraini cities and towns.
- To understand the social, economic and environmental causes of urban expansion in Bahrain and its impact on the agricultural sector.
- To obtain recommendations and proposals for improving urban planning in Bahrain, and for developing and preserving agricultural areas with regards to the three sustainability pillars.

1.5 Research significance

The importance of this thesis lies in the fact that it is the first to discuss and examine the impacts of urban expansion on agricultural areas in Bahrain. Previous research has examined the effects of urban expansion on the coastal areas of Bahrain. Moreover, Bahrain 2030 vision prioritizes the agricultural sector in Bahrain, with the aim of developing and preserving it. Therefore, this thesis will produce multiple recommendations and proposals to preserve and enhance the economy of the country, and to provide a suitable environment for Bahraini society.

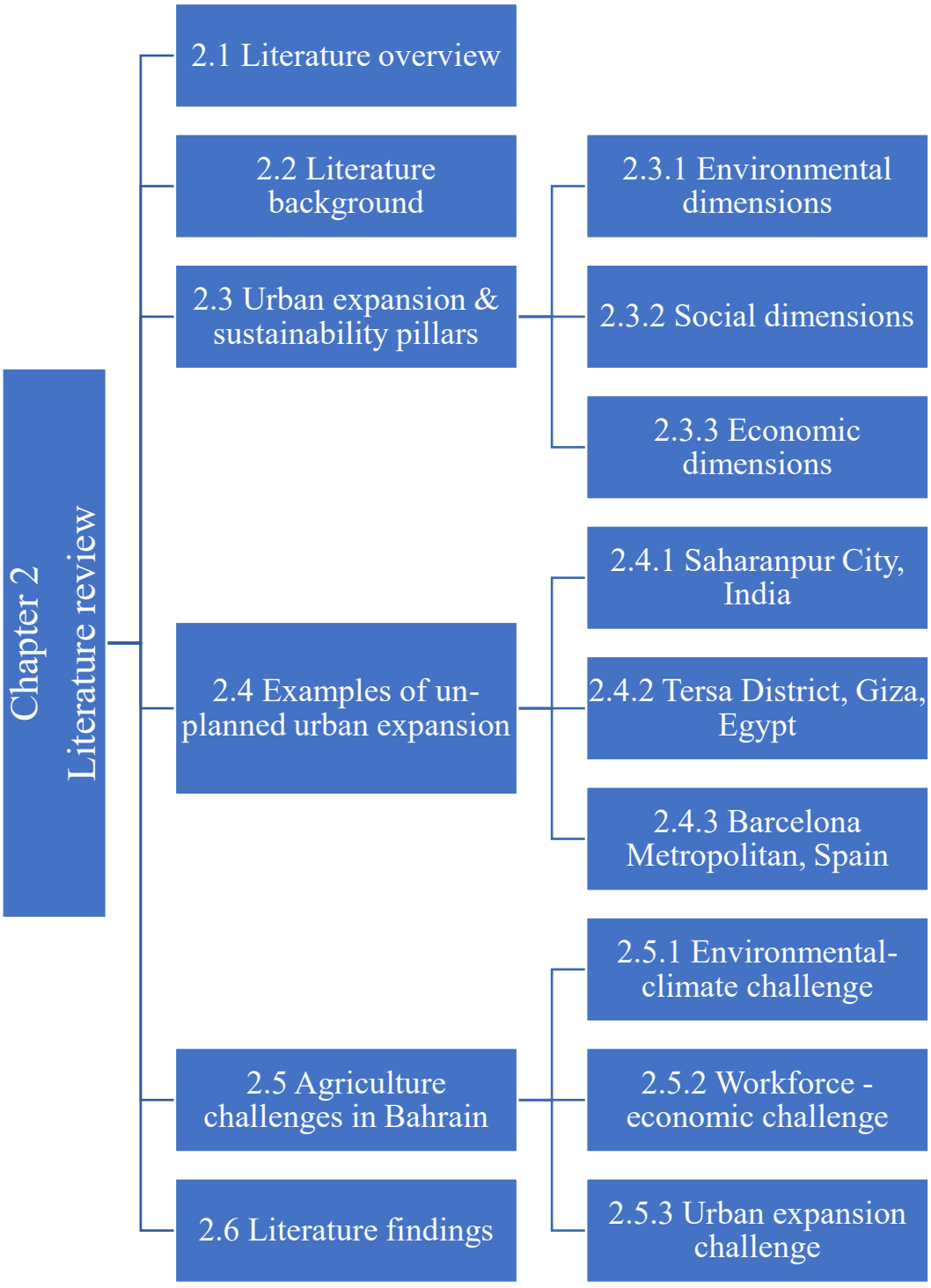
1.6 Research framework

This thesis includes four chapters. The first chapter introduces the problem in a clear and comprehensive manner with its historical background. Additionally, it clarifies the importance of the thesis and its objectives while linking it to sustainability. The second chapter presents a broad understanding of global urban expansion and the decline of agriculture. It also presents the dimensions of urban expansion through the eyes of the sustainability development pillars.

Besides, several global case studies were presented as examples of urban expansion and agricultural decline. Moreover, this thesis showcases the challenges that Bahrain faces in the agricultural sector which displayed that urban expansion is its biggest threat. Therefore, the research methods were divided into two to analyze the impact of urban expansion in the agricultural regions of Bahrain. The quantitative method was chosen to analyze the satellite images of several areas in Bahrain over the years. The qualitative method (thematic analysis) was chosen to analyze the interviews that were conducted. The fourth chapter illustrates the analysis through the two types (Satellite images mapping & thematic analysis). The final chapter illustrates and presents the conclusion and recommendations for the problem. Furthermore, thoughts were depicted to conduct future research

CHAPTER TWO:

LITERATURE REVIEW



Chapter 2: Literature Review

2.1 Literature overview

In this chapter, the literature is presented by dividing the chapter into four sections: Section 2.2 will provide a general background and introduction to urban expansion. Section 2.3 will then present the literature that discusses urban expansion, and its impact based on the pillars of sustainable development (environment, society, and economy). Section 2.4 will then review three examples of cities in different countries around the world whose agricultural areas have been affected by urban expansion. Section 2.5 will then present the challenges facing agriculture in Bahrain, leading up to urban expansion. Section 2.6 will then review the findings of the literature, which will reveal a lack of information regarding urban expansion and its impact on agricultural areas in Bahrain.

2.2 Literature background

The term urban sprawl or expansion became a general concern before the spread of sustainable development concepts and people have misinterpreted the term due to the understanding from different disciplines (Yasin, Mohd Yusoff, Abdullah, Mohd Noor, Mohd Noor,2021).

Urban expansion has become a source of concern especially for environmental specialists, economists, urban planners, and designers. Many researchers highlight the growth of cities, urban expansion, urban sprawl and the un-systematic growth of the cities in their writings (Shirazi, 2020), (Angel, 2023), (Shao, Neema, Aleksei, Fanan, Walter, Mandela, 2021), (Al-

Tarawneh, 2014),(Xie, Hunter, Sorensen, Nogeire-McRae, Murphy, Suraci, Lischka, Lark 2023) .

Unlike in the academia where the meanings of the terms such as urban expansion, urbanization, growth and sprawl mean different things, people that are not specialized in urban planning and design use the terms urban growth, urban expansion, and urban sprawl synonymously (Al-Tarawneh, 2014). Urban expansion is considered a physical form of urban growth, while there is economic expansion and other forms [Fig.1]. In fact, the term urban sprawl (synonym of urban expansion) is often used as a negative connotation of urban growth such as the cities that expanded towards agricultural areas which results in an environmental issues (Al-Tarawneh, 2014).

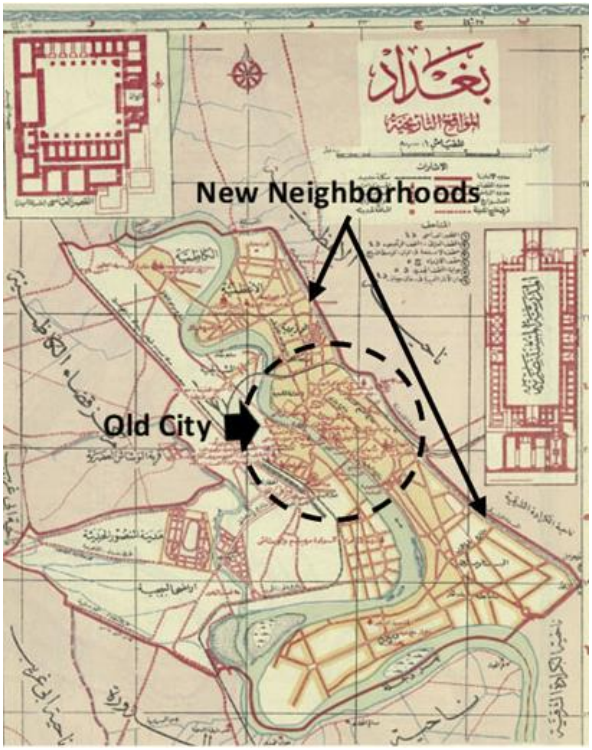


Figure 1: A map of Baghdad showing the old city and new neighborhoods (expansion). Source: (Sousa, 1952) & (Yashoaa, Noori, Alsilk & Kharrufa, 2023).

Currently, all urban planning specialists agree that un-planned urban expansion has a negative impact on cities and their peripheries. According to Sheydayi & Dadashpoor (2023), urban expansion has impacted social life and the environment from different perspectives and this impact can't be explained by geo-spatial approach only but also by taking the opinions of specialists. Shirazi (2020) stated that compacted urban form and dense cities with mix land-use are characterized with more social interaction and activities which is the opposite of low-density urban form were it is with less social interaction due to the long span between people. Guerrieri (2020) confirmed that adopting urban planning strategies from different countries with different cultures will face difficulty in implementation which is may fail to built-environment degradation. Moreover, Catalán, Sauri, Serra (2008) argued that urban expansion is a driving force of environmental change. one of the environmental change forms was mentioned by Narducci, Quintas-Soriano, Castro, Som-Castellano & Brandt (2019) they argued that agricultural regions are at a higher risk due to urban expansion. Furthermore, Wen, Yang, Chen, Tu, Wang, Chen, Dong, Xu (2024) confirmed that the decrease in agricultural land and changes in the usage of lands around cities was a result of urban expansion. Xie, Hunter, Sorensen, Nogeire-McRae, Murphy, Suraci, Lischka, Lark (2023) point out how the critics argued that urban expansion led to an undesirable sacrifice of agricultural land. This occurred due to the high demand for housing projects. Therefore, we understand that the impact of urban expansion is affecting the environment, economy and social life of the communities around the world.

2.3 Urban Expansion & sustainability pillars:

"Sustainable development has been adopted by the United Nations as a guiding principle for economic, environmental, and social development that aspires to meet 'the needs of the present without compromising the ability of future generations to meet their own needs'." (Kaur and Garg ,2019)

The impact of urban expansion on the agricultural regions may be explained from three main dimensions which are: environmental, economic and social. According to Kaur and Garg (2019), environmental, social and economic dimensions are the main pillars in the sustainable development. These pillars are also considered as the components of the quality of life. In addition to the previous components, heritage and culture are important aspects that contribute to enhancing pillars such as the economic pillar and social pillar as well. Therefore, any development process that takes into account the environmental, economic and social pillars, while integrating cultural and heritage characteristics, contributes to raising the quality of life. The following sections will demonstrate the environmental, social and economic dimensions of urban expansion and the decrease of agriculture.

2.3.1 The environmental dimensions:

According to Narducci, Quintas-Soriano, Castro, Som-Castellano & Brandt (2019), around 60% of the world population will live in cities by 2030. However, the increase of population in cities will expand the cities to fulfill the needs of the residents to have places to stay. Therefore, there is a notable risk that the expansion of these cities could have effects on agricultural areas. The research of Narducci, Quintas-Soriano, Castro, Som-Castellano & Brandt (2019) showed that the agricultural lands are at a high environmental risk due

to urban expansion and it's significant decrease in the future. Furthermore, urban expansion and the decrease of agricultural regions will directly impact the climate, temperature and air quality due to the increase in carbon emissions which is a result of the increase of the use of automobiles. On the other hand, the environment does not have the ability to purify the air due to the decrease of the agricultural regions which is the primary factor in air purification. According to Zhou, Zhang, Wang, Zhang, Cao, Zhang, Jia, Tang, Li & Liu (2024), un-planned urban expansion will cause an increase in climate warmness and temperature. However, this increase is impalpable because it's a long-term increase. The higher density urban areas will have higher temperature (Kim, Yeom & Hong, 2025). Therefore, the phenomena of the increase of temperature may be explained by two main factors. The first factor is the expansion of the cities as Narducci, Quintas-Soriano, Castro, Som-Castellano & Brandt (2019) argued. The second factor is the decrease of agricultural regions, which is obviously considered as a result of urban expansion. This decrease is considered as a loss of vegetation and this will reduce the ability of cooling the temperature. Kim, Yeom & Hong (2025) argued that planting vegetation and trees around a city, especially if it is in a systematic way, will result in reducing the temperature [Fig.2]. If planting the trees around a city will reduce heat and therefore, there is no question that deforestation and the removal of farmland will contribute in increasing the temperature which will result in unlivable cities.

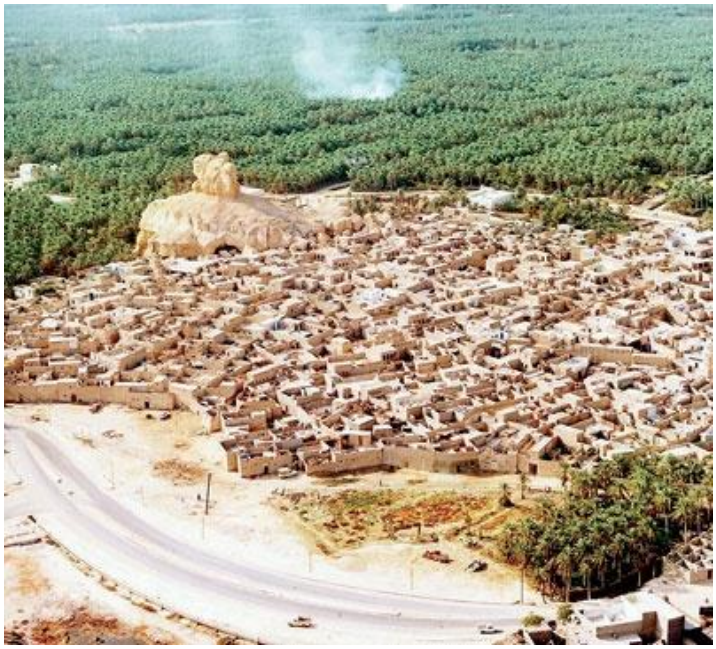


Figure 3: A picture of Al-Qarrah town in KSA shows agricultural areas beside the town. Source: https://www.aleqt.com/2012/05/24/article_660010.html

However, the changes in temperature and climate (which are considered a result of urban expansion and the decrease of agricultural regions) have a significant impact on the lives of animals and birds, not to mention human beings. According to Chen & Khanna (2024), climate change is one of the main driving factors on the life, distribution and abundance of the bird species. Moreover, urban expansion and the decrease of the agricultural regions has led to a lack of biodiversity and extinction of some of the bird species whenever urban expansion reached a specific rural location. On the other hand, McKinney (2008) argues that urban expansion may affect and decrease the richness of the plant species yet sometimes this will increase the richness of species [Table.1], [Table.2] and [Table.3] show that high density urban expansion will decrease the richness of bird and plant species while low to mid density urban expansion will increase the richness of bird and plant species. Therefore, it depends on the size of expansion; if it is high, it will affect negatively. On the other hand, if it is a low to a mid expansion, it may affect positively. Low-mid urbanization change is the transformation

of rural or semi-rural areas into small towns while mid-high urbanization is the transformation of secondary cities into metropolitan cities.

Table 1: Low-mid urbanization change.

	Increase	Decrease	Same
Plants	+11 (64.7%)	−1 (5.9%)	5 (29.4%)
Vertebrates	+2 (11.8%)	−14 (82.4%)	1 (5.9%)
Invertebrates	+14 (29.8%)	−30 (63.8%)	3 (6.4%)

Number (and percentage) of studies showing increase (+), decrease (−) or no change in species richness going from low to middle levels of urbanization

Source/ Effects of urbanization on species richness: A review of plants and animals by McKinney

Table 2: Mid-high urbanization change.

	Increase	Decrease	Same
Plants	+0 (0.0%)	−7 (50.0%)	7 (50.0%)
Vertebrates	+0 (0.0%)	−21(100%)	(0.0%)
Invertebrates	+1 (2.6%)	−29 (79.3%)	8 (21.0%)

Number of studies showing increase, decrease or no change in species richness going from middle to low levels of urbanization

Source/ Effects of urbanization on species richness: A review of plants and animals by McKinney

Table 3: Number of studies showing a Peak in species richness at low, middle and high levels of urbanization.

	Low	Mid	High
Plants	1 (7.7%)	9 (69.2%)	3 (23.1%)
Vertebrates	6 (66.6%)	3 (33.3%)	0 (0.00%)
Invertebrates	21 (72.4%)	6 (20.7%)	2 (6.9%)

Source/ Effects of urbanization on species richness: A review of plants and animals by McKinney

2.3.2 Social dimensions:

In a similar situation to many countries including Bahrain, The USA is losing lots of agricultural regions per year. To be noted, It is stated that the decrease in farmland in parallel with the increase of population may create an enormous logistical issue which will lead to many negative consequences. The basic needs for farming such as materials, equipment and tools of farming activities became scarce due to urban expansion. Things became unavailable because most of the farmlands and the farming equipment shops in the surrounding areas were sold and converted to residential housing projects. Therefore, farming materials distributors and equipment dealers were no longer interested in staying and providing their services. This is considered a huge risk affecting society and confirms that the loss of the agricultural regions has many consequences, which affects the communities indirectly and directly such as leaving work in the agricultural sector, which will result in an increase in the unemployment rate which is considered as both social and economic impacts. [Fig.3].



Figure 3: Farmers protest in India / source: Arab News

Moreover, the farming families are forced to close their farms after changing the land usage of their area. This happened because they are not able

to sell farm products because factories were over-dominating the market. Indeed, the factories sold products similar to their farm products at lower prices. The products are farm-made, which are better but more costly in comparison to the factory products. Moreover, farmers generally feel a sense of belonging to the farm and how important it is for them as a rural community. Furthermore, all these feelings and reactions of the farmers show that the social life of the small rural towns used to be better for them in comparison to the new one after expansion (Narducci, Quintas-Soriano, Castro, Som-Castellano & S. Brandt, 2019), (Xie, Hunter, Sorensen, Nogeire-McRae, Murphy, Suraci, Lischka, Lark, 2023).

According to Oliveira (2021) & Amirusholihin, Rahadiantino, Nilasari, Rakhmawati and Fatoni (2024), the sense of family in sub-urbans has often declined in contrast to the rural towns. Therefore, if the urbanized area does not follow sufficient sustainable procedures in developing the urban places, the health of the community members will be negatively affected. Another negative impact on the rural area where it has been urbanized is the increase of crimes due to the increase of population and migrants. However, people in cities can have more contact with the labor market, which is easier for people to find jobs (Oliveira, 2021) (Amirusholihin, Rahadiantino, Nilasari, Rakhmawati and Fatoni, 2024). Furthermore, argued that there is more justice and equity in the domestic relations such as the increase of women community participation rates compared to the rural areas. Another positive impact is the abundance of the educational centers with ease to access (Oliveira, 2021) (Amirusholihin, Rahadiantino, Nilasari, Rakhmawati and Fatoni, 2024).

Manzoor and Imtiyaz (2016) argue that urban expansion essentially leads to social change and transformation. Manzoor and Imtiyaz (2016) did their research to assess the society in the city of Srinagar, India in relation to urbanization. The result of the research showed that there is a social decrease in the sense of family with a change in the structure of the family because of the reduction in the number of members. The concept of the nuclear family is the family that consists of the two parents and children who live independently in separate houses. spread out in the cities with a lack of authority from parents on their children. Furthermore, there is more independence and equity for women in comparison to the rural areas with better childcare.

Shao, Naeema S, Aleksei, Fanan, Walter & Mandela (2021) stated that urban expansion results in social issues. For example, the houses in some expanded areas (example: USA sub-urbans) are built in big empty lands where the houses built-up will only cover a small area of the land. Therefore, the distance between one house to another is long which will decrease social interaction between neighbors.

2.3.3 Economic dimensions:

According to Singer and Thorbecke (1971), the traditional role of agriculture such as providing food and producing primary commodities have received attention of decision makers for a long time due to its economic importance. Chebokchinova, Kapsargina (2021) confirmed that agriculture was one of main sectors that contributed in preserving the economy and the food security of Khakassia during the economic sanction [Fig.4].

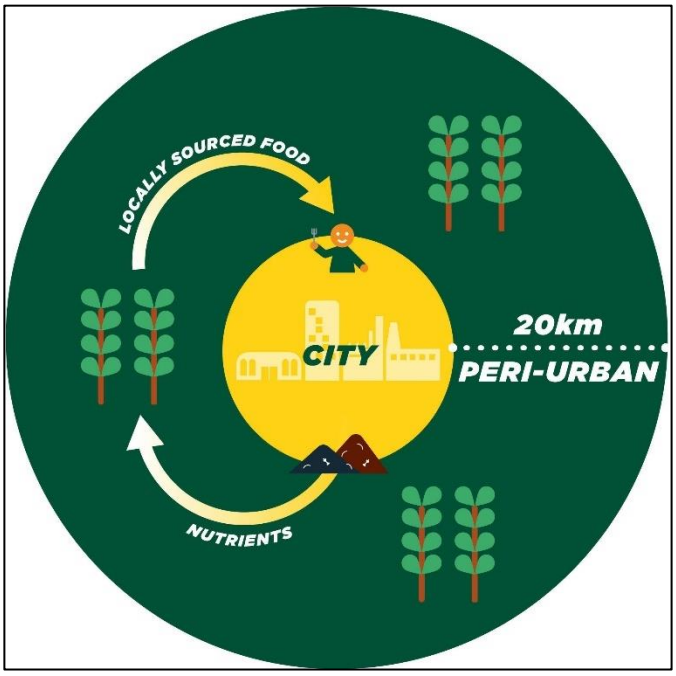


Figure 4: The circle of agriculture and the city show the inter-dependent. Source: www.ellenmacarthurfoundation.org

However, the essential role of agriculture goes beyond that of food security, and reduction of poverty rates. Gollin (2023) and Chu, Peretto, Wang (2022) argues that agriculture played a historically major role in economic growth and development. They indicate that many industrialized and fast developing countries depend on agriculture as an engine that will contribute to enhance and develop the other non-agricultural sectors of cities. Moreover, the economy that originates in agriculture can affect in reducing the rates of poverty and hunger while increasing the employment rates.

Yogi, Thalal & Bhandari (2025) examined the contribution of agriculture in economic growth and stated that in parallel with industry, agriculture has an important role in economic development and growth. He argues that this evidence supports the argument of developing and protecting agricultural regions because agriculture protects the community. Furthermore,

Singer and Thorbecke (1971) showed that urbanization and the growth of population in urban areas has a positive effect on agricultural regions which will contribute to:

1- Encouraging economic growth by raising investment in infrastructure which will contribute to an increase in employment rates in the related sectors such as infrastructure, contracting and real estate.
2- Attracting local and foreign investors due to the availability of land and infrastructure.
3- Not focusing on a specific area for economic development, which contributes to diversification.

However, the research of Singer and Thorbecke (1971) was not during urban expansion movements at the higher levels, while urban expansion in the 1990s till this day is at the highest levels. Urban expansion has an impact on the agricultural regions which has led to economic consequences. Al-Tarawneh (2014) highlights the five main negative effects of urban expansion and the decrease of agricultural regions.

1- Changing agricultural land usage will reduce food production which will affect national food security.
2- Taxes rise which will negatively affect the economy.
3- Transportation is more costly.
4- Higher costs for infrastructure and an increase in the usage of individual vehicles.
5- The services for urban large areas with longer distances is more costly and higher.

Mao, Feng & Zhou (2025) examined the impact of urban expansion and diminishing farmland in several locations in China. They argue that diminishing farmland is considered a major issue especially if the city population is high. Population growth and real-estate development are the two main factors in losing agricultural land. Furthermore, inadequate laws and acts of urban planning do not prevent farmland from real-estate development. Huang, Liu, He, Gou, Bai, Wang and Shen (2020) argued that rapid urban expansion causes a decrease in the agricultural regions which can put food security in danger which pushes the dependency on exports rather than agricultural self-sufficiency. Moreover, un-systematic economic growth of cities and urban expansion contribute to the migration of farmers and owners of agricultural regions to the cities who abandoned their farmland (Al-Maruf, Pervez, Sarker, Rahman & Ruiz-Menjivar, 2022). According to Fazal (2000), farmland owners who own agricultural land near an expanded area sell their land to real-estate developers who do not have any interest in farming. At the end of the day, they change the land usage from agriculture to different projects.

2.4 Examples of un-planned urban expansion:

Many academic research and articles have been written using examples from different countries around the world to clarify and review the impacts of urban expansion on agricultural areas from different perspectives. To give greater credibility for the research, the authors selected areas from different continents such as (Stanek, 2020) who studied Europe, Africa and Asia and (Boarin, Martinez-Molina, Juan-Ferruses, 2020) who compared three universities in different continents: Oceania, North America & Europe. In this part of the literature, the examples of un-planned urban expansion are

selected from different continents (Asia, Africa and Europe) to result in higher credibility and understanding of urban expansion and its impact on agricultural areas.

2.4.1 Saharanpur city, India:

In India, Fazal (2000) examines the real land usage of Saharanpur city which is suffering from urban expansion [Fig.5], [Fig.6] & [Fig.7]. He concludes that the impacts of urban expansion on the agricultural regions in Saharanpur city are the following:

- The study recorded that around 1683 ha of agricultural lands were lost and converted for other activities.
- Agricultural landowners face economic issues because of the migration of people to the cities. Therefore, they devoted less capital to farms and agriculture management and maintenance. As a result, productivity of the farmland decreased, which forced the owners to sell the land to real-estate developers. At the end of the day, most of the real-estate developers do not have an interest in farming and they changed the land usage to other activities.

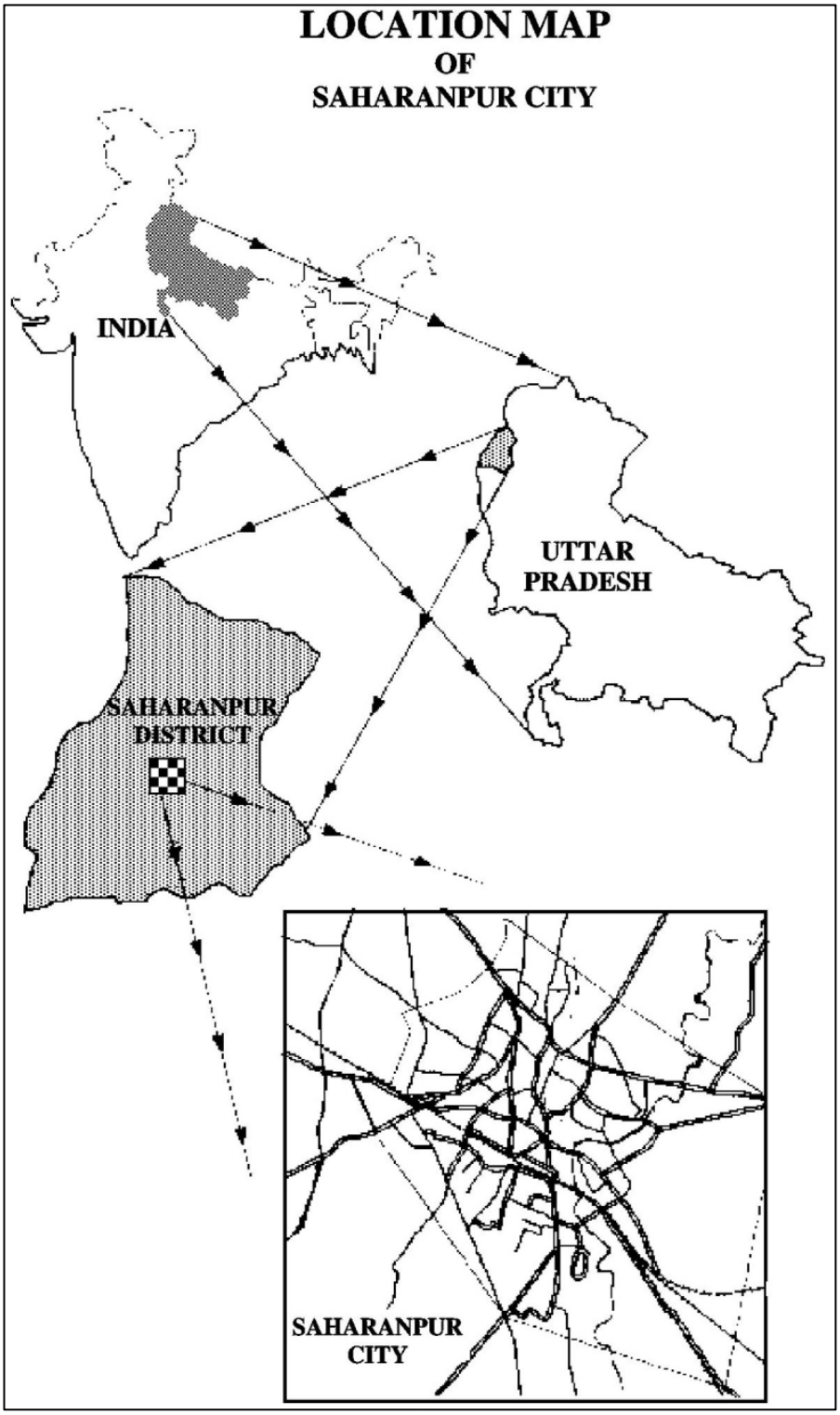


Figure 5: Location of Saharanpur city/ source: (Fazal, 2000)

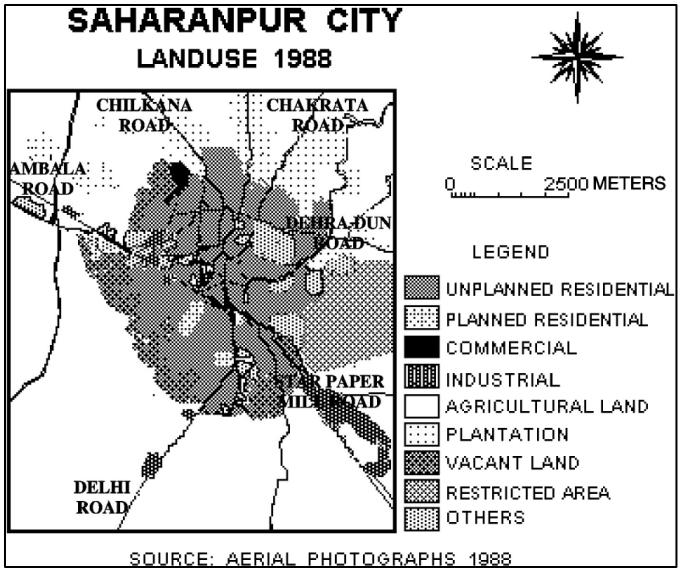


Figure 6: Land use of Saharanpur city in 1988/ source: (Fazal, 2000)

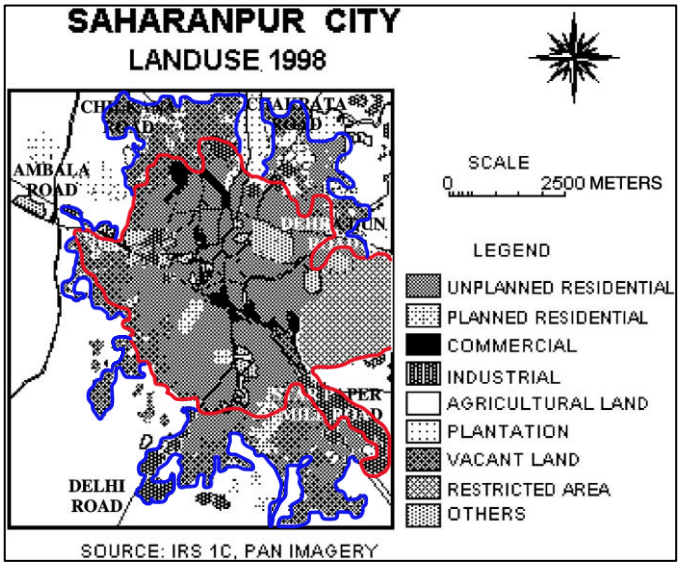


Figure 7: Land use of Saharanpur city in 1998 which is show the expansion of the city. Red line shows the old boundaries of the city, blue line shows the extension/ source: (Fazal, 2000). Edited by the student.

2.4.2 Tersa District, Giza, Egypt:

In Egypt, Youssef, Sewilam & Khadr (2020) clarify the effects of urban expansion on the agricultural lands of Tersa District, Giza. They stated that the main negative impacts of urban expansion on the agricultural lands of Tersa District are the following:

- Tersa lost about 19% of agricultural lands between 2007 to 2017 [Fig.8], [Fig.9] & [Fig.10]
- Water irrigation suffers from pollution due to un-systematic land use change.
- Decrease of soil fertility due to polluted irrigation water.

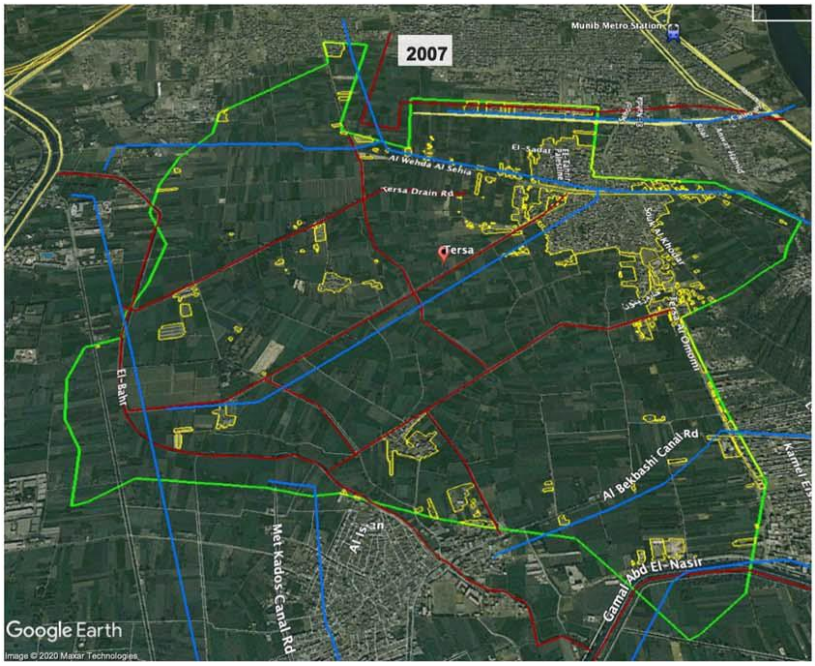


Figure 8: Tersa District in 2007/ source: Youssef, Sewilam & Khadr (2020)



Figure 9: Tersa District in 2017/ source: Youssef, Sewilam & Khadr (2020)



Figure 10: Illegal land use change in Tersa District between 2007 to 2017/ source: Youssef, Sewilam & Khadr (2020)

2.4.3 Barcelona Metropolitan, Spain:

In Spain, Catalán, Sauri & Serra (2008) reviewed and analyzed the urban expansion phenomena in the Barcelona Metropolitan Region and the main results were the following:

- Cities increased about 27.7% mostly towards agricultural lands [Fig.11] & [Fig.12].
- Decrease of agricultural land and forest led to a great loss of natural habitat.
- Decline in urban density due to un-studied urban expansion planning.

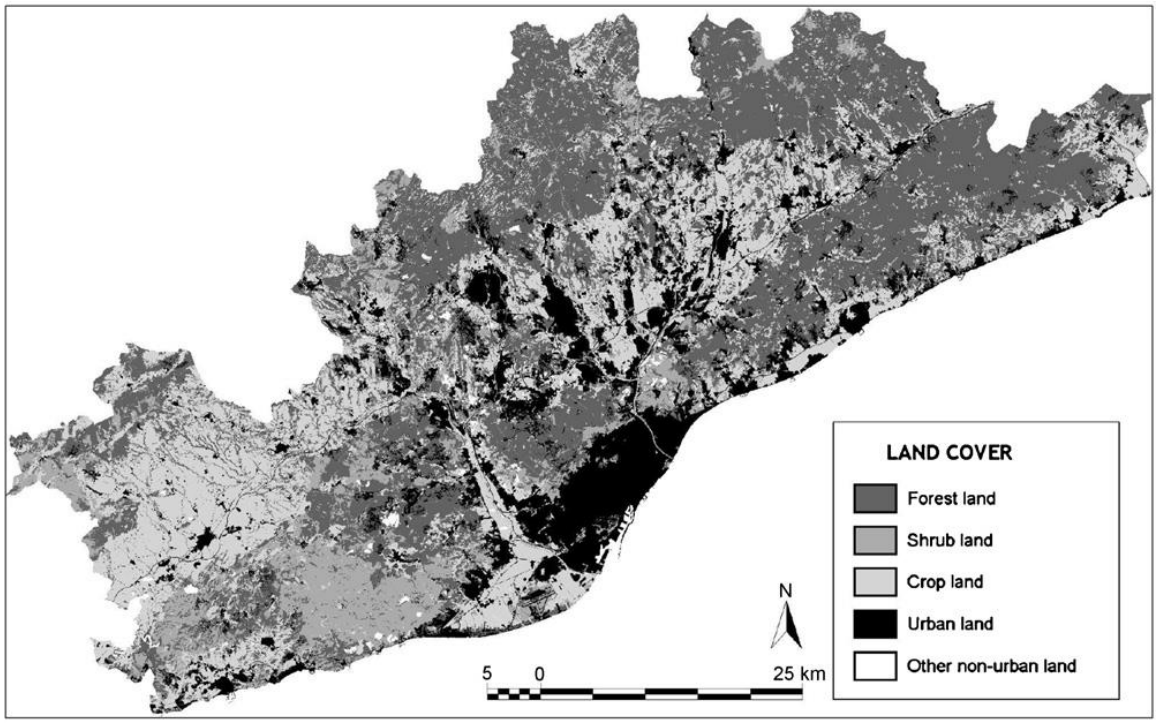


Figure 11: Barcelona land use in 2000/ source: Catalán, Sauri & Serra (2008)

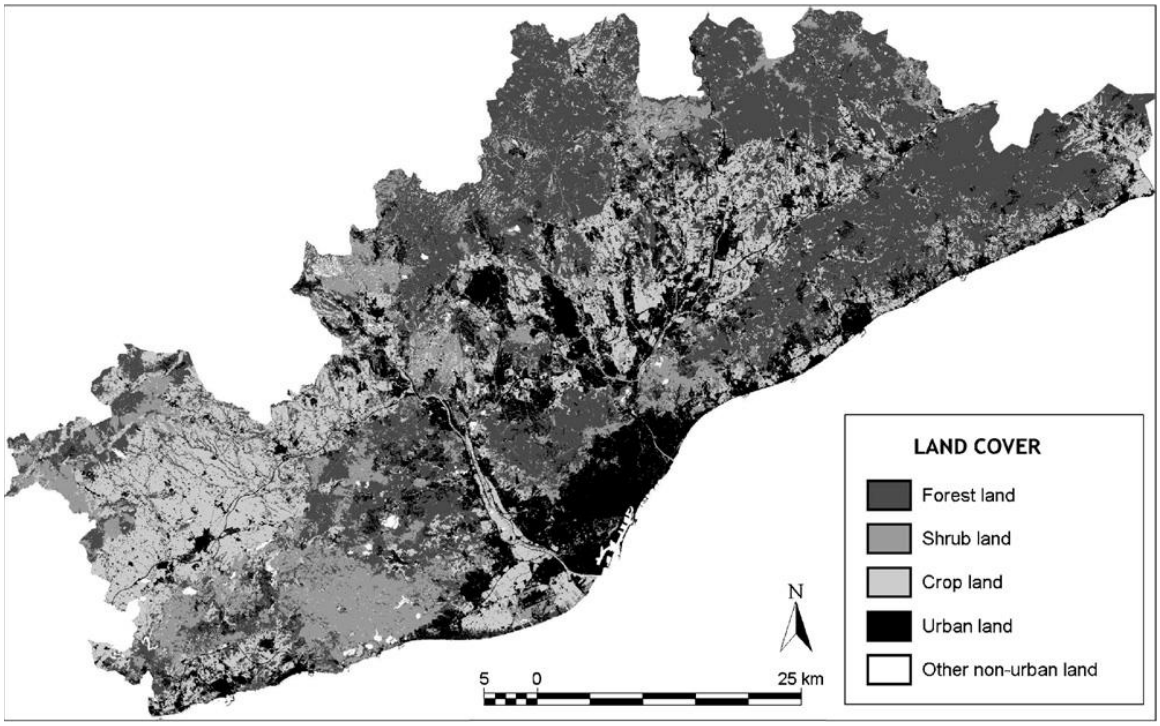


Figure 12: Barcelona land use in 1993/ source: Catalán, Sauri & Serra (2008)

2.5 Agriculture challenges in Bahrain:

According to Shqlyh (1972), after 1783 AD, Bahrain's economy was depending on traditional crafts such as pearl diving, trading, fishing, agriculture, boating industry, pottery, manufacture of marine fishing tools, textile industry and government revenues from pearl diving taxes. In the 1930s some traditional crafts were developed like trading and new professions appeared as a result of using Bahrain's resources such as crude oil and natural gas. On the other hand, pearl diving-trading and textile industry disappeared. Some professions such as fishing, boat industry and agriculture were deteriorating but still resisting the disappearance.

As per Shqlyh (1972), agriculture specifically faces many challenges and risks. These challenges may be summarized from Shqlyh (1972) into three challenges: Environmental-climate challenge, working force-economical challenge and urban expansion challenge.

2.5.1 Environmental-climate challenge:

During the summer and due to the high temperature, there is damage to Bahraini agricultural crops which results in postponing seed planting and rising prices of agricultural products in the local market. On the other hand, well water which is considered as a main source for irrigation works in Bahrain agriculture (about 95% of the total water production of wells). Unfortunately, agriculture in Bahrain needs big amounts of water due to the climate and the old-school irrigation (Shqlyh, 1972).

2.5.2 Work force- economic challenge:

Shqlyh (1972) showed the decrease in the work force of agriculture and fishing between 1959 till 1971 and the increase of the other fields [Table.1]. The farmers in Bahrain are very active in the national economy due to their percentage of Bahraini manpower despite the chances they face to leave their profession to work in the new industry such as oil industry. The new industrial work is characterized by high salaries and job stability. This phenomenon forced the farms owners to recruiting dozens of farmers from Oman and Al-Ahsa to work in their farms after they proved their technical superiority over the Bahraini farmer. Farmers number in Bahrain decreased from 3057 farmer to 1959 farmer between 1959 till 1971 [Fig.13]. On the other hand, non-Bahraini farmers number increased from 351 farmer to 722 farmer between 1959 till 1971. After 7 years of establishing the ministry of Municipalities and Agriculture in 1971, it still lacks sufficient funds or experts necessary to provide its services to all agricultural lands. This ministry carries out limited activity in leveling agricultural lands and preparing them for cultivation with plows and machines at its experimental center, in return for farmers paying the costs only.

Table 4: Agriculture workforce / Source: (Shqlyh, 1972).

Year	Bahraini	Non-Bahraini	Total
1959	3057	351	3408
1965	2321	858	3179
1971	1959	722	2681



Figure 13: Two brothers working in their farm in Buri village, Bahrain / Source: Al-Wasat News Paper - Issue: 4853

2.5.3 Urban expansion challenge:

It is noted that the role of the responsible authorities in agricultural production is not at a sufficient level, as agriculture in Bahrain faces the risk of deterioration (Shqlyh, 1972). Lack of seriousness in oversight agricultural regulations to landowners. According to Shqlyh (1972), 20% of the total lands of Bahrain are used for agriculture. The main island (Manama) has the highest

percentage of agriculture, Sitra island comes in second, Muharraq in third. The area of land exploited for agriculture is decreasing in most areas of Bahrain, especially in the areas surrounding Manama, Jidhafs, and Sitra. All of these areas face the risk of being covered by new exploitation patterns, especially the residential urban pattern, with the establishment of dozens of residences and even entire neighborhoods, then several factories and mechanical workshops. All of them are stable patterns and are not exploited, meaning it is not possible to re-cultivate these lands, especially since the authorities are absent from alerting to this danger and supervising it in order to preserve agricultural lands as an important natural resource that cannot be replaced on these desert islands. Based on the literature, it has been proven that if the authorities in Bahrain had paid attention to this phenomenon. Those who confront agriculture and supervised the settlement of these patterns creeping on agricultural lands could have settled these patterns in areas that are less dangerous to the country's economy, and are even more appropriate from an economic standpoint, which are the cheap neglected barren lands located south of the capital and near Isa Town.

2.6 Literature findings:

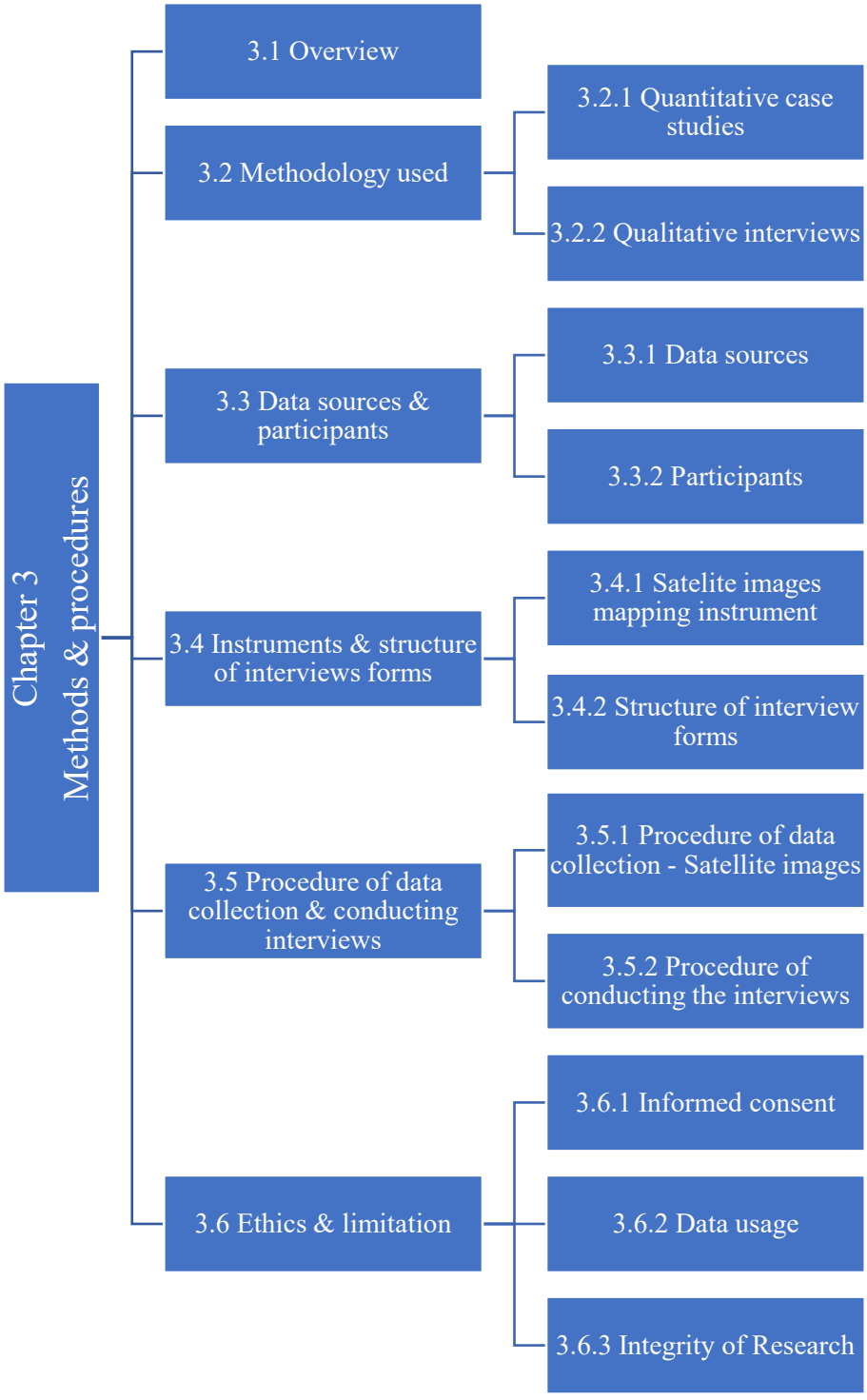
In literature findings, it is clear that un-systematic urban expansion has had a negative impact on the three pillars of sustainability which are represented by the world economy, social life of people and the natural environment. Agricultural regions are wealthy and must be preserved well due to their importance in serving societies from different perspectives. Starting from the 20th century, agricultural regions suffer from poor urban planning and bad urban expansion in many countries around the world. In many

countries, agricultural regions have diminished due to the growth of cities. Thus, different consequences appear as a result of diminishing agricultural regions. These consequences are the opposite of sustainable development.

However, many researchers have investigated and analyzed the causes and the impacts of this phenomenon from different perspectives. Unfortunately, there is a lack of knowledge about urban expansion and its impact on agriculture in the Arab Gulf countries, especially in Bahrain. Only a few researchers have written about urban expansion and urbanization in Bahrain such as, Fuccaro (2000) and Mohammed, Aljibori, Al-Tamimi, Alfiras, Alani, Qusay, Khaled, Abdelgnei & Abdullah (2024) and they did not focus on the impact of urban expansion on agriculture except Shqlyh (1972) who discussed that for the reason of studying the economy of Bahrain. Therefore, it is an opportunity to investigate, study and analyze this phenomenon in Bahrain from different perspectives due to the importance of agriculture as a valuable asset of the country and people, and to support the vision of Bahrain.

CHAPTER THREE:

METHODS & PROCEDURES



Chapter 3: Methods & Procedures

3.1 Overview

This chapter will describe the methodology used in this thesis to achieve the aims and objectives mentioned in the introduction chapter. Section 3.2 will describe the methodological approach adopted in the thesis with clarifying the reasons for choosing the methods. Section 3.3 details the thesis data sources and participants and the reasons for including them in the thesis. In section 3.4, the instruments of the analysis will be listed and described along with the structure of interview forms description. In section 3.5, the procedure of data collection and conducting the interviews is described and shown. Finally, ethical and limitation consideration will be outlined in section 3.6.

3.2 Methodology used

The thesis used mixed methods which includes quantitative method and qualitative method. The quantitative will be by selecting cases for study and analysis, while the qualitative method is by combining the interviews, quantitative case studies and the literature and analyzing all of them to understand the problem and come up with recommendations for its solution.

3.2.1 Why & how quantitative case studies?

Case studies methodology are widely used in architecture researches (Kalua, 2024). A case study defined as an empirical investigation on specific

phenomenon and it can accommodate both historic and contemporary phenomenon's and settings (Akšamija, 2021). According to Akšamija (2021), there are five characteristics of case study research in architecture field:

- Case study will focus on multiple or single phenomenon or cases that have been studied in its contexts.
- The ability to explain and describe reasons links.
- The significance of developing theory during the research design stage.
- Relying on many different sources to get the evidence.
- Ability of generalization to theory.

On this basis, this thesis studies the impact of urban expansion on the agricultural regions of Bahrain through selecting multiple areas in Bahrain (each area is considered as a separate case study) and providing satellite images of these areas from the oldest to the current one. The satellite images will be mapped and analyzed to clarify the changes of the land cover throughout the years. According to Burke, Driscoll, Lobell and Ermon (2021), predicting the outcomes and results of sustainable development by using satellite based performance is strong, improving and contributes in decision making in some cases. Moreover, Burke, Driscoll, Lobell and Ermon (2021) suggested to measure and test the changes over time to support in predicting the outcome of sustainability. Furthermore, utilizing satellite imagery to collect ground data (Burke, Driscoll, Lobell and Ermon 2021). On this basis, many researchers have conducted studies of urban change cases by identifying and mapping agricultural and urban areas and determining their percentages, which will yield significant and very important results. It is possible to put

forward proposals and make better-informed decisions after analyzing and discussing these results. Liu, Huang, Xu, Li, Li, Ciais, Lin, Gong, Ziegler, Chen, Gong, Chen, Hu, Chen, Wang, Wu, Huang, Estes, Zeng (2020) are among those that have studied urban change cases by using satellite images from different years and analyzing them.

3.2.2 Why & how qualitative interviews?

As a qualitative method and according to Cohen, Manion and Keith (2000) and Pratt and Dane (2007), interviewing specialists will clarify the issue and will contribute to getting solutions due to:

- Specialists having significant knowledge and experience in their specialization.
- They can provide effective solutions that may be implemented.
- They can identify and clarify underlying reasons of the issue.
- Citing specialists' suggestions and recommendations will give more credibility which will make the suggestions more persuasive.

On this basis, comprehensive interviews is conducted with urban planning specialists in Bahrain to understand urban expansion and the agricultural sector in Bahrain in terms of history and types, as well as to understand the causes and results of urban expansion and also to come up with recommendations to preserve agricultural areas and enhance the process of urban expansion.

These interviews will be analyzed through thematic analysis in same pattern that adopted by Salman (2016). The analysis is divided into three main sections:

- The history and types of agriculture in Bahrain, as well as its existence as a profession. This section of the analysis will provide an overview of the agricultural sector in Bahrain.
- Urban expansion and its relationship to the decline of agriculture in Bahrain. This section will present an overview of urban expansion in Bahrain and its patterns. The reasons and results of urban expansion and the decline of agricultural areas will also be discussed.
- Suggestions and recommendations for developing and preserving agricultural areas in Bahrain.

The chart below [Fig.14] shows the connections between both methods: the quantitative (case studies – satellite images mapping) and the qualitative (interviews).

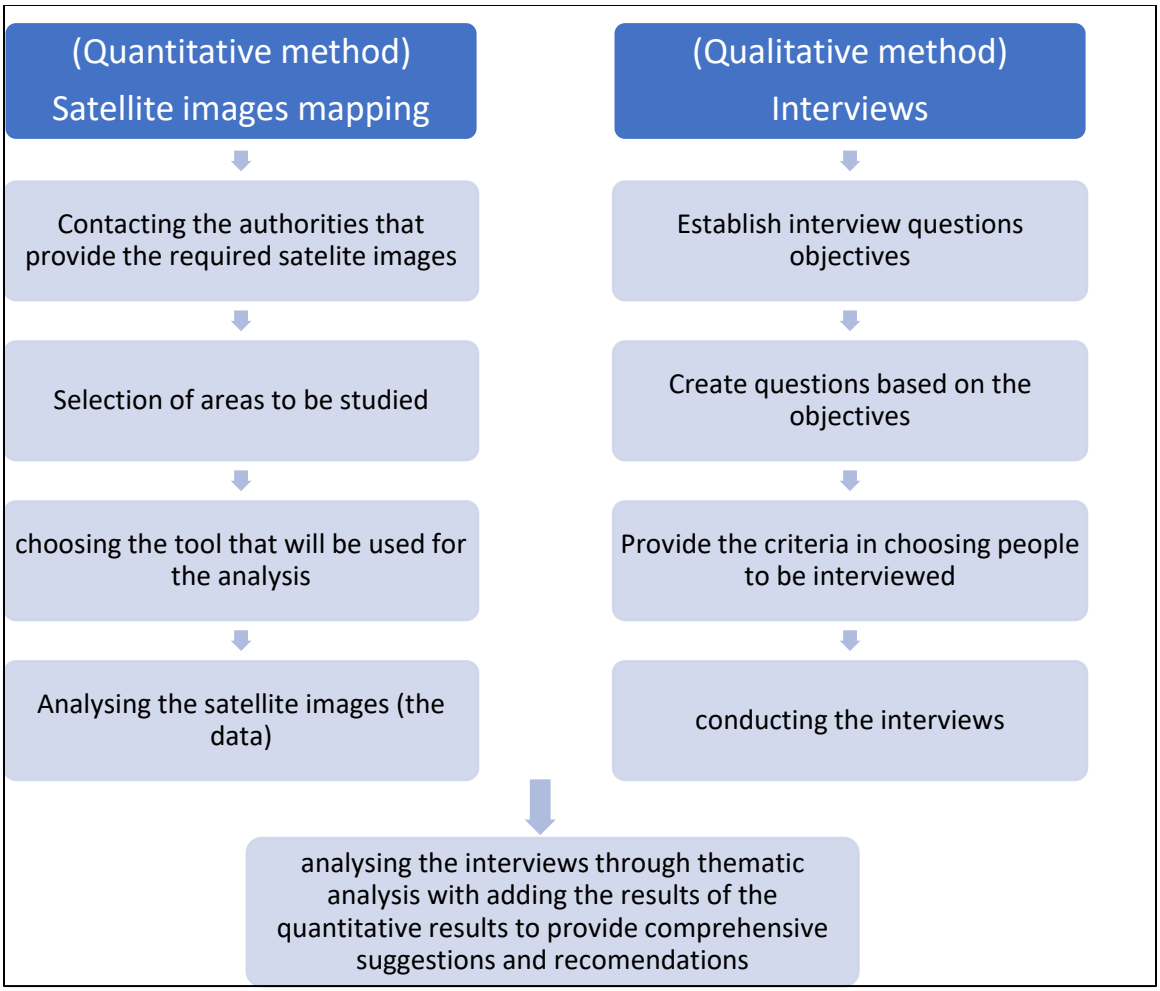


Figure 14: The process of the thesis from the research methods till the findings and recommendations

3.3 Data sources & participants

3.3.1 Data sources

The data source is the Topographic Survey Department of the Survey and Land Registration Bureau SLRB. They were selected because they are the official governmental authority which is responsible for topographic surveys, aerial photographs, and satellite images in Bahrain. They can provide huge accurate data for different years. SLRB will provide the satellite images for several locations in Bahrain to be analyzed in this thesis as was previously

mentioned in 3.2.1. Geo-Data engineering (a private sector engineering office registered in CRPEP) was also consulted and they provided some satellite images of Bani Jamra and A'ali for different years, but these images were insufficient and less accurate [Appendix.1] & [Appendix. 2]. Therefore, they were not used in the analysis.

3.3.2 Participants

The participants in the interviews are the private sector specialists in the field (Urban planning-design). The private sector was chosen as a participant in the interviews to give a balance to this thesis, where the data source was from the public sector. Hence, the two sectors were involved in the thesis.

According to article 2 of the general provisions for The Council for Regulating the Practice of Engineering Professions in Bahrain (CRPEP):

"It is prohibited to practice any engineering profession without a license obtained from the council in accordance to the provisions of this Law, its Implementing Regulation and Decisions issued in accordance to its provisions. A licensed engineer may not practice any engineering profession in any field or branch or category other than the field, branch, or category in which he/she is licensed to practice."

Therefore, all licensed engineering offices in Bahrain have been listed on the website of CRPEP. There are three licensed engineering offices in Bahrain that can practice Urban planning-design [Fig.15]:

1. Gulf House Engineering Co. W.L.L

2. Urban Vision CO. W.L.L
3. Madaen – Urban Planning & Civil Engineering W.L.L

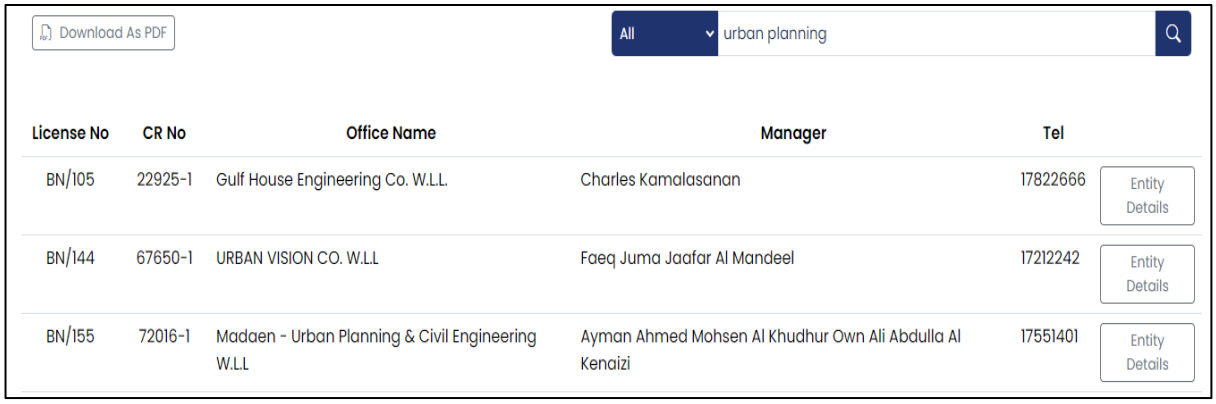


Figure 15: The only licensed and registered engineering offices that can practice urban planning-design in Bahrain / Source: https://www.crpep.bh/ (CRPEP official website).

Therefore, the interviews had been conducted with all mentioned engineering offices to clarify the issue, support the satellite images mapping results and analysis, and provide comprehensive solutions and suggestions.

3.4 Instruments & structure of interview forms

This thesis is using mix methods. Therefore, the instrument is used for the quantitative method, while the structure of the interviews will be shown in this section.

3.4.1 Satellite images mapping instrument

The instrument will be used for satellite images mapping and outlining the different zones in the selected study area such as agricultural lands, buildings and empty lands. Therefore, the area of each zone will be measured

from different eras to clarify the urban change. According to Song and Jing (2020), Jablonska, Czajka (2021) and Sato (2023), Computer-Aided Design (AutoCAD) have been widely used in different fields such as urban planning, engineering architecture etc. They also mentioned that AutoCAD is well known for its easy transmission, communication and modification. Moreover, they mentioned that the usage of AutoCAD aids and has a massive impact on urban planning and design. To be noted that the student experience QGIS and Google Earth but it revealed that AutoCAD is the best instrument due to its speed and accuracy. Therefore, AutoCAD will be used for satellite images mapping. The results will be shown in a table that shows the location, year and each zone area [Appendix. 3].

The technique in using AutoCAD as an instrument in satellite images mapping was by the following:

- Importing images into AutoCAD with georeferencing them with the real-world coordinates.
- Visual interpretation within AutoCAD.
- Drawing polylines and calculating areas.

3.4.2 Structure of interview forms and thematic analysis techniques

The interview form mainly consists of personal information about the participant, questions and answers.

The importance of showing the participant's personal information (after obtaining participant’s approval) is to contribute in strengthening this thesis

because the participants are chosen in the research due to the relation of his/her specialization, qualifications and experience to the issue of the thesis.

As for the interview questions, they were designed as a semi-structure to reach answers that related to this thesis objectives which are to present and understand the history and types of the agricultural sector in Bahrain and the professions associated with it. Furthermore, to gain an understanding of the history of urban expansion in Bahrain and its patterns, along with the reasons and results, and to arrive at solutions and recommendations for preserving and developing agricultural areas in Bahrain. However, the questions of the interview will refer mainly to (Shebeb, 2006), (Fuccaro, 2000) (Fazal, 2000), (Youssef, Sewilam, Khadar, 2020), (Catalán, Sauri, Serra, 2008) (Al-Tarawneh, 2014). Table 5 shows interview questions and the goals that are related to it.

Table 5: interview questions and the goals that are related to.

Question	Goal
Q1: According to Shebeb (2006), agriculture in Bahrain is considered as a primary sector but, starting from the 1970s it declined dramatically. Does agriculture in Bahrain remain as a primary sector? Why?	History, types and profession of the agricultural sector in Bahrain.
Q2: According to Lorimer (1915), Bahrain's rural areas in the 1910s are mostly composed of palm trees. were there other types of trees and crops? What are they?	History, types and profession of the agricultural sector in Bahrain.
Q3: Shebeb (2006), confirmed that cultivation was a primary source of Bahraini income. Does cultivation remain as a main source of income? Why?	History, types and profession of the agricultural sector in Bahrain.

Q4: According to Fuccaro (2000), rapid urban expansion led to a decline in agricultural areas in Bahrain. When did the decline begin? What are the environmental, economic and social reasons?	Background, reasons & results of the urban expansion and agriculture decline in Bahrain.
Q5: Many researchers in urbanization such as, Fazal (2000), Youssef, Sewilam, Khadar (2020), Catalán, Sauri, Serra(2008) confirmed that urban expansion in many countries led to extinct agriculture. In many cases, such as Youssef, Sewilam, Khadar (2020) case in Cairo, agricultural areas turned to houses projects. Did this phenomenon happen to agricultural areas in Bahrain? Why?	Background, reasons & results of the urban expansion and agriculture decline in Bahrain.
Q6: According to Al-Tarawneh (2014), the decline of agriculture will cause a negative impact on the economy. Has the decline of agricultural areas affected the Bahraini economy? If yes, What are the negative effects on the Bahraini economy?	Background, reasons & results of the urban expansion and agriculture decline in Bahrain.
Q7: What is the role of the authorities in contributing to solving this issue?	Recommendations and proposals to preserve and develop agricultural areas in Bahrain.
Q8: What is the role of traders, real-estate companies, banks and investors in contributing to solving this issue?	Recommendations and proposals to preserve and develop agricultural areas in Bahrain.
Q9: What proposals can be put forward to preserve and develop agricultural areas in Bahrain?	Recommendations and proposals to preserve and develop agricultural areas in Bahrain.

See the interview form in [Appendix 4].

Thematic analysis techniques were the following:

- In-depth reading of the interviews.
- Open coding by coding the transcripts to identify key words and phrases relevant to the research.
- Grouping codes into themes.
- Comparing findings to literature.
- Linking results with satellite images results.
- Reviewing and refining themes.

3.5 Procedure of data collection & conducting interviews

3.5.1 Procedure of data collection – satellite images

In the beginning, Topographic Survey Directorate, has been visited in Sanabis, Manama, Bahrain. The first meeting was with Eng. Mohamed Abdulghaffar AL Murbati, Chief of Geospatial Data Survey in Topographic Survey Directorate, it was a verbal discussion about this thesis and its objectives and goals. Eng. Mohamed AL Murbati expressed SLRB's welcome of the research and the possibility of supporting it with the required data.

Therefore, an official application has been sent to Eng. Mohamed AL Murbati through his email address. The email was the official request for the required data (the satellite images) [Appendix. 5]. The attachments of the email are the following:

1- An official letter written by this thesis supervisor to Topographic Survey Directorate to support the author with the required data

[Appendix. 6].

2- An official letter written by the author to Topographic Survey Directorate. This letter is the official request for the following [Appendix. 7]:

    a. Providing satellite images every 10 years (approximately) starting from the earliest (1960s) till the current or early 2000s.

    b. The required areas were listed in the letter. The areas were chosen due to their important location, history and their historical importance in the agricultural sector. The areas are in all four governorates in Bahrain which are: Capital, Northen, Muharraq and Southern. But these areas changed later as per the request of SLRB. SLRB informed the author (as per the email conversation – check the attached figures below) that only three areas can be given for this thesis. Therefore, the student has chosen three areas from three different governorate which are Segaya in capital, Samaheej in Muharraq, Malkiya in northern. All these chosen areas are considered important locations in Bahrain, rich history and rich in agriculture. The Southern governorate has been excluded due to the lack of agriculture in it unlike the other mentioned governorates. However, SLRB have approved two of the mentioned areas (Segaya & Samaheej) but, they rejected Malkiya. Therefore, another area in the northern governorate has been requested to SLRB which is Al-Jasra but it has been rejected. Finally, SLRB decided to choose the remaining

area of the northern governorate which is Barbar. The satellite images provided were in seven different decades for each area (1960s, 1970s, 1980s, 1990s, 2000s, 2010s, 2020s).

In the end of the day, the three chosen areas are:

- Segaya / Capital governorate.
- Samaheej / Muharraq governorate.
- Barbar / Northern governorate.

3.5.2 Procedure conducting the interviews

The student has directly contacted the participants which are Dr. Souheil Daoud El Masri (Urban planner – architect) from Gulf House Engineering Co.W.L.L, Mr. Faeq Juma Al-Mandeel (Urban planner) from Urban Vision CO. W.L.L and Mr. Oun Ali Al-Khunaizy (Urban Planner) from Madaen – Urban Planning & Civil Engineering W.L.L.

The interviews were conducted face to face by the student and the interviewee. Before each interview, the author requests to record a video or voice for the interview and the questions' answers will be extracted from the recorded interview. Therefore, this is written in the interview form by the student.

3.6 Ethics and limitations

3.6.1 Informed Consent

Research participants and data providers were formally informed that their opinions and data would only be used for the purpose of this thesis, and

they had the right to withdraw them from this thesis at any time.

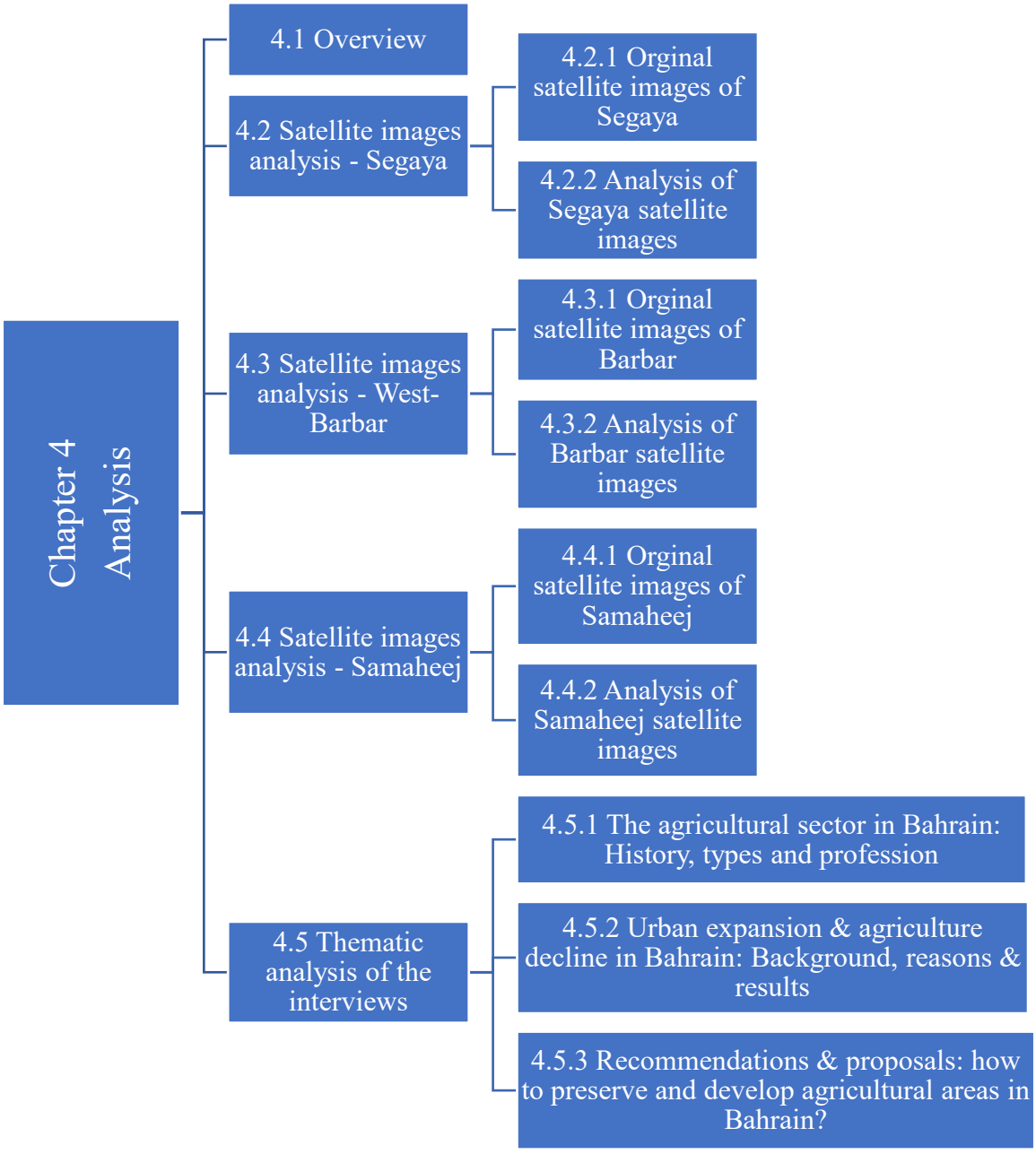
3.6.2 Data Usage

SLRB and the participants were informed that their data would be used only for academic purposes and would not be used for any other purpose without obtaining their formal approval.

3.6.3 Integrity of Research

The student declares to present and analyze all results and data in this thesis without any bias.

CHAPTER FOUR: ANALYSIS



Chapter 4: Analysis

4.1 Overview

In this chapter, the inventory of Segaya satellite images including the analysis is displayed in 4.2. The inventory of West of Barbar satellite images including the analysis will be displayed in 4.3. The inventory of Samaheej satellite images including the analysis will be displayed in 4.4. The analysis of the interview through thematic analysis will be presented in 4.5.

4.2 Satellite images analysis – Segaya, Manama

Segaya is an area located in the south of Manama city in the Capital Governorate [Fig.16], [Fig.17]. About a hundred years ago, Segaya was described by Lorimer (1915) as a village located 200 yards in the south-east of Manama fort. It has 40 huts for Al-Baharnah who work in palm trees. Moreover, it has many alfalfa farms and about 700 palm trees and it has a water well in the east side of the village.

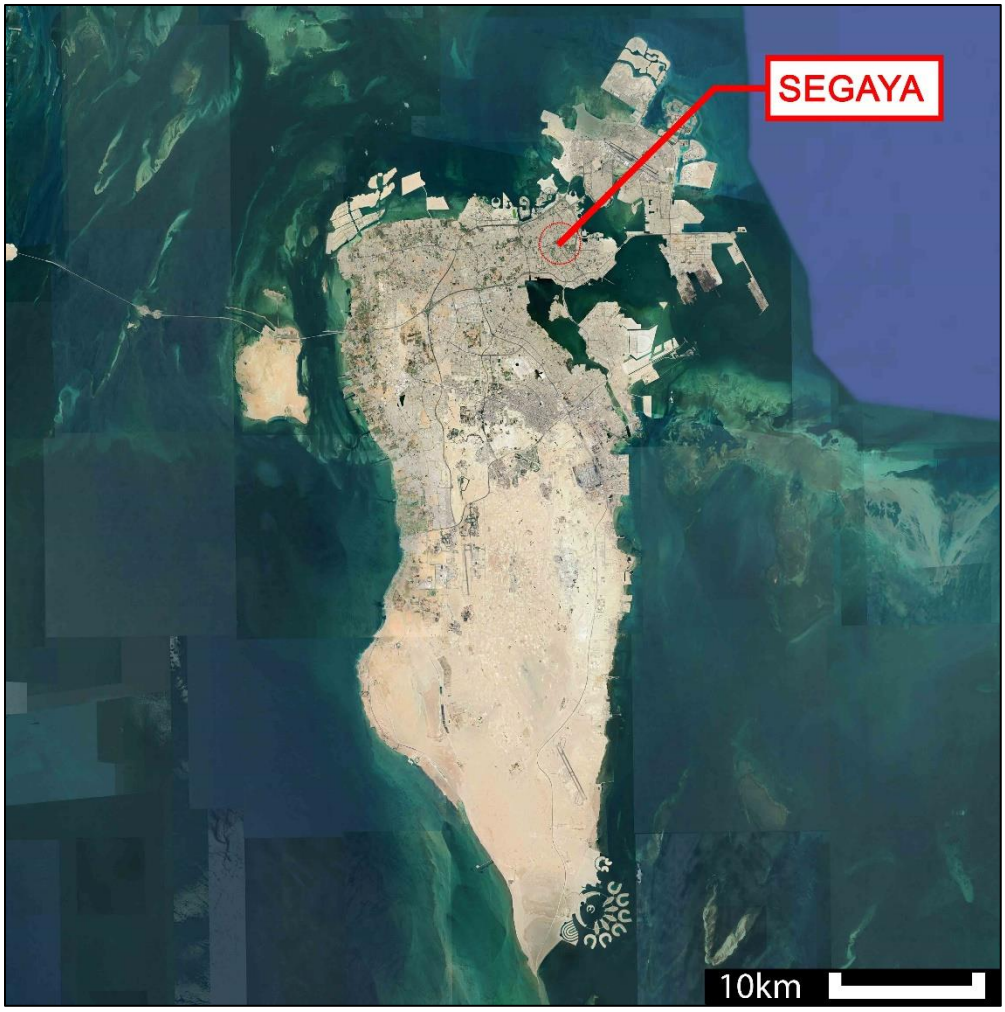


Figure 16: Segaya location in Bahrain map1. Source: Google Earth in 2024



Figure 17: Segaya location in Bahrain map 2. Source: Google Earth in 2024

4.2.1 Original satellite images of Segaya

SLRB Satellite images of Segaya were given for 7 decades and specifically 7 years, starting from 1968, 1977, 1983, 1998, 2007, 2017 and 2023. The seven images are shown in [fig.18], [fig.19], [fig.20], [fig.21], [fig.22], [fig.23], [fig.24].



Figure 18: Satellite image of Segaya in 1968



Figure 19: Satellite image of Segaya in 1977



Figure 20: Satellite image of Segaya in 1983



Figure 21: Satellite image of Segaya in 1998



Figure 22: Satellite image of Segaya in 2007



Figure 23: Satellite image of Segaya in 2017



Figure 24: Satellite image of Segaya in 2023

4.2.2 Analysis of Segaya satellite images

In this section, the analysis of Segaya, Manama over the years will be shown in figures (to clarify the zoning) [fig.25], [fig.26], [fig.27], [fig.28], [fig.29], [fig.30] [fig.31] and tables (to clarify the areas). The figures will

show Segaya, Manama in seven years: 1968, 1977, 1983, 1998, 2007, 2017 and 2023 as per the given data from SLRB. The zonings will mainly divide into three: Agricultural areas, built-up areas and the third part is empty lands-roads. The analysis is explained and described after the tables.



Figure 25: Zoning of Segaya in 1968

The satellite image of Segaya area in 1968 reveals that the area was predominantly agricultural, with agricultural land comprising 77% of the total area, empty land and roads comprising 15%, and built-up area being the smallest, comprising only 7% [Table.6].



Figure 26: Zoning of Segaya in 1977

The satellite image of Segaya area in 1977 reveals that the area was affected by urban expansion, with agricultural land decreasing to 51%, while built-up areas, empty lands, and roads increased exponentially [Table.7].



Figure 27: Zoning of Segaya in 1983

The satellite image of Segaya area in 1983 reveals that agricultural land continued to decline, reaching only 33%. Meanwhile, built-up areas, empty lands, and roads continued to increase [Table.8].



Figure 28: Zoning of Segaya in 1998

The satellite image of Segaya area in 1998 reveals that agricultural land continued to decline, reaching 19% of the total area, despite the lack of increase in built-up areas. However, the area of empty lands and roads continued to increase, reaching 55% [Table.9].

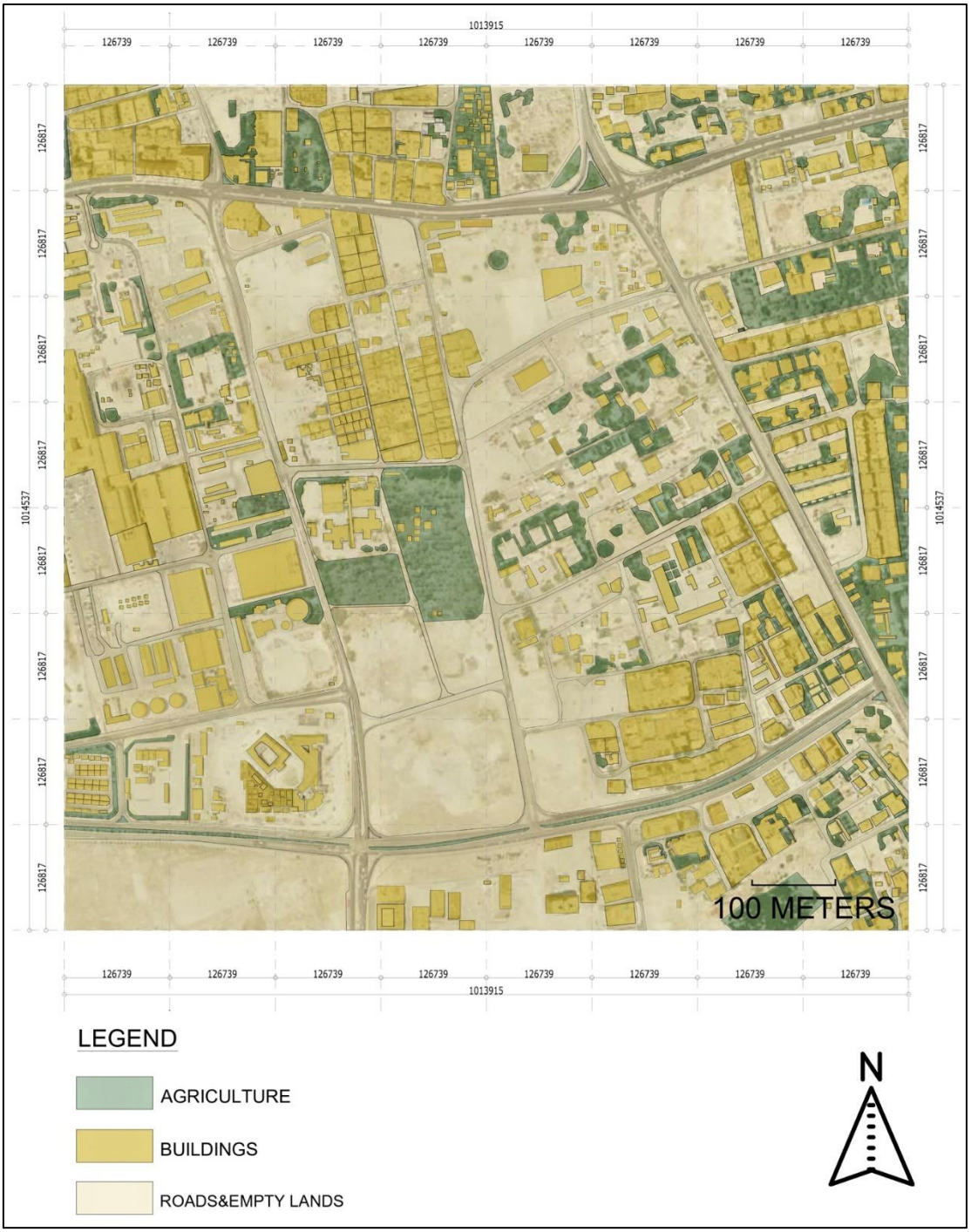


Figure 29: Zoning of Segaya in 2007

The satellite image of Segaya area in 2007 shows that the built-up area has not increased since 1983. However, agricultural areas decreased slightly, reaching 13%, while empty lands and roads increased to 60% of the total area [Table.10].



Figure 30: Zoning of Segaya in 2017

The satellite image of Segaya area in 2017 shows that agricultural areas remained unchanged, but the built-up area increased to 33%, while empty lands and roads decreased to 54% [Table.11].

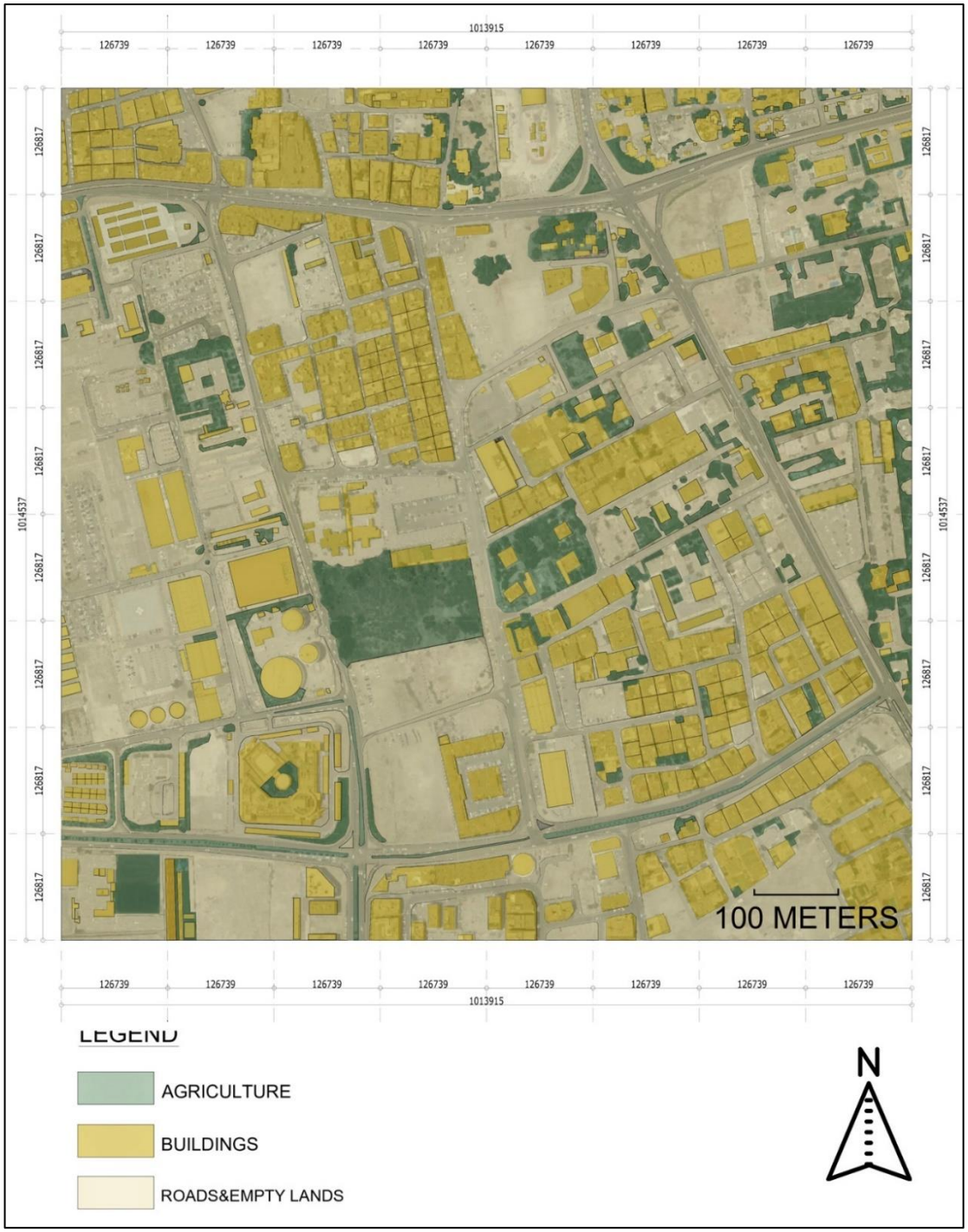


Figure 31: Zoning of Segaya in 2023

The satellite image of Segaya area in 2023 shows that agricultural areas decreased slightly, reaching 10% of the total area, the lowest percentage since 1968. The built-up area reached 29%, while the vacant land and roads reached 60% [Table.12].

Table 6: areas & percentages of Segaya in 1968

Location: Segaya 1968		Study area in Hectare: - 102.8
Usage	Area in Ha	Percentage from the selected area
Agricultural area	79.36 Ha	77.14%
Built-up area	7.5 Ha	7.30%
Roads and empty lands	16.01 Ha	15.56%
Total	102.8 Ha	-

Table 7: areas & percentages of Segaya in 1977

Location: Segaya 1977		Study area in Hectare: 102.8
Usage	Area	Percentage from the selected area
Agricultural area	52.79 Ha	51.32%
Built-up area	17.10 Ha	16.62%
Roads and empty lands	32.98 Ha	32.06%
Total	102.8 Ha	-

Table 8: Areas & percentages of Segaya in 1983.

Location: Segaya 1983		Study area in Hectare: 102.8
Usage	Area	Percentage from the selected area
Agricultural area	34.73 Ha	33.77%
Built-up area	26.81 Ha	26.06%
Roads and empty lands	41.33 Ha	40.17%
Total	102.8 Ha	-

Table 9: Areas & percentages of Segaya in 1998.

Location: Segaya 1998		Study area in Hectare: 102.8
Usage	Area	Percentage from the selected area
Agricultural area	20.24 Ha	19.68%
Built-up area	25.62 Ha	24.91%
Roads and empty lands	57.01 Ha	55.41%
Total	102.8 Ha	-

Table 10: Areas & percentages of Segaya in 2007.

Location: Segaya 2007		Study area in Hectare: 102.8
Usage	Area	Percentage from the selected area
Agricultural area	14.27 Ha	13.88%
Built-up area	26.09 Ha	25.36%
Roads and empty lands	62.51 Ha	60.76%
Total	102.8 Ha	-

Table 11: Areas & percentages of Segaya in 2017

Location: Segaya 2017		Study area in Hectare: 102.8
Usage	Area	Percentage from the selected area
Agricultural area	12.57 Ha	12.22%
Built-up area	34.42 Ha	33.46%
Roads and empty lands	55.89 Ha	54.32%
Total	102.8 Ha	-

Table 12: Areas & percentages of Segaya in 2023.

Location: Segaya 2023		Study area in Hectare: 102.8
Usage	Area	Percentage from the selected area
Agricultural area	11.07 Ha	10.77%
Built-up area	30.00 Ha	29.16%
Roads and empty lands	61.80 Ha	60.07%
Total	102.8 Ha	-

After analyzing satellite images of Segaya, it revealed that urban expansion began in the 1970s, as agricultural areas decreased from 77.1% of the total area to 51.3% within just ten years, at the expense of urban expansion. Urban expansion continued over the years, while at the same time agricultural areas continued to decline until they reached 10% of the total area in 2023, and the largest percentage became empty lands, roads (infra-structure), and built-up areas.

4.3 Satellite images analysis – West of Barbar

Barbar is an area located in the far north of Bahrain's main island (west of Manama city) in the Northern Governorate [Fig.32], [Fig.33]. About a hundred years ago, Barbar was described by Lorimer (1915) as a village surrounded by palm farms and it has 60 huts for Al- Baharnah who work in fishing and weaving. Moreover, it has 2400 palm tree, apricot and pomegranate trees (Lorimer, 1915).

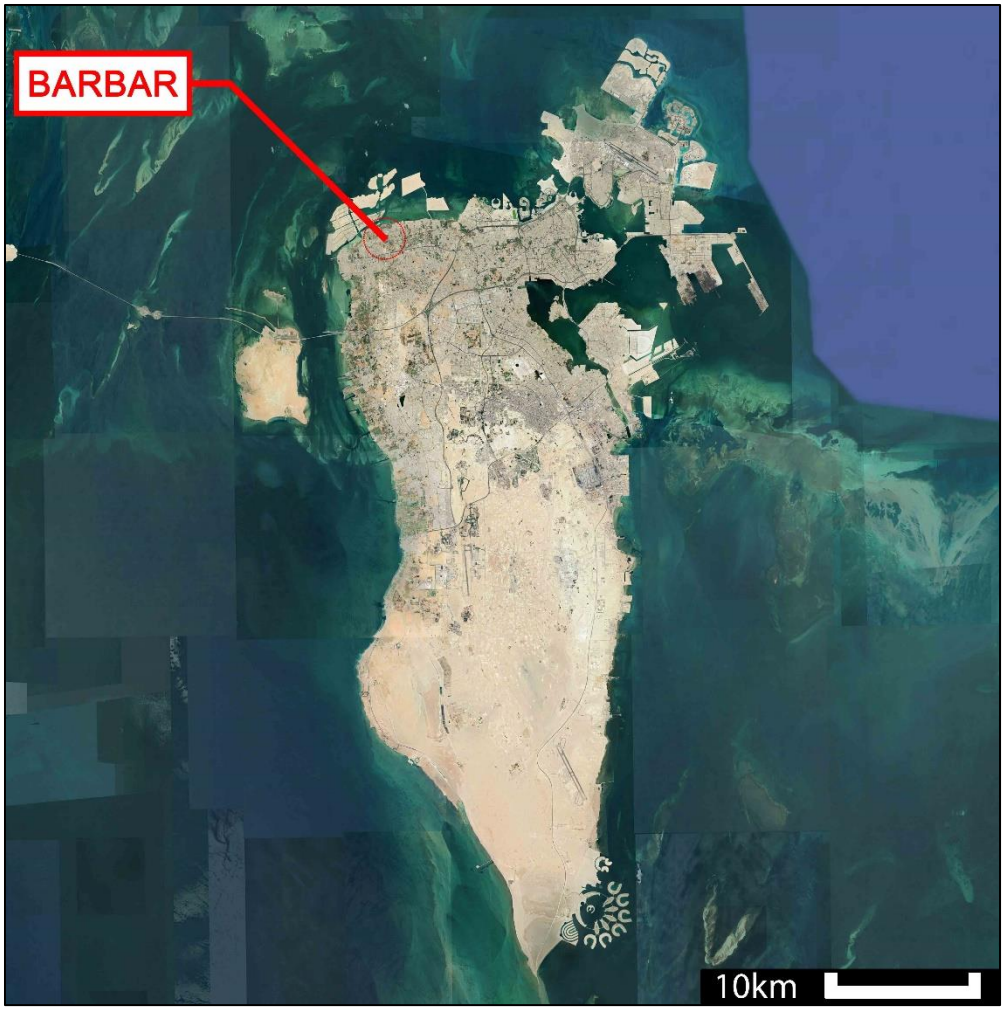


Figure 32: Barbar Location in Bahrain map



Figure 33: West of Barbar location in Bahrain map

4.3.1 Original satellite images of Barbar

SLRB Satellite images of west Barbar were given for 6 decades, starting from 1960s till 2020s. The seven images are shown in [fig.34], [fig.35], [fig.36], [fig.37], [fig.38], [fig.39].



Figure 34: Satellite image of West of Barbar in 1968



Figure 35: Satellite image of West of Barbar in 1977



Figure 36: Satellite image of West of Barbar in 1998

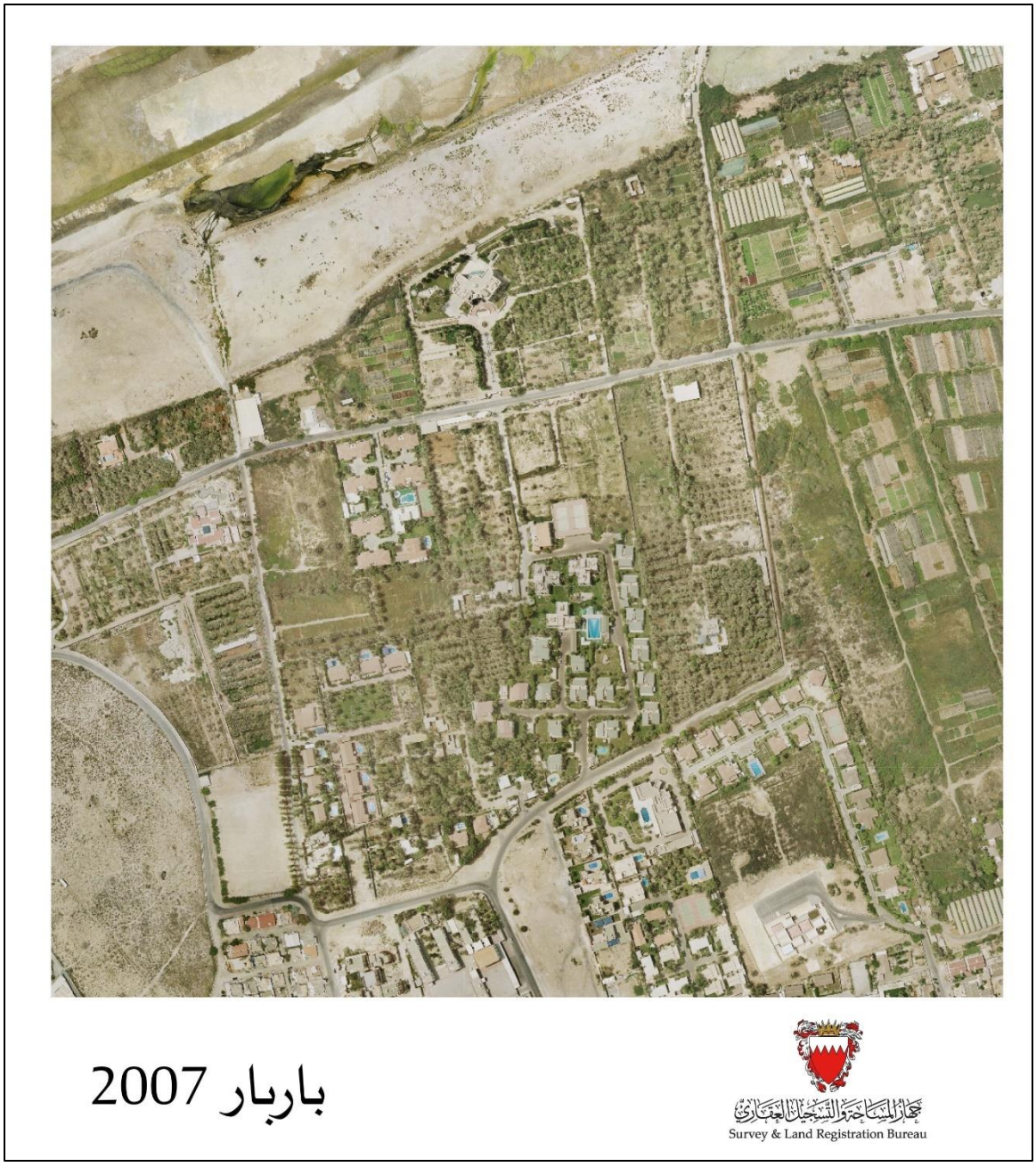


Figure 37: Satellite image of West of Barbar in 2007



Figure 38: Satellite image of West of Barbar in 2017



Figure 39: Satellite image of West of Barbar in 2023

4.3.2 Analysis of West-Barbar satellite images

In this section, the analysis of West of Barbar over the years will be shown in figures (to clarify the zoning) [fig.40], [fig.41], [fig.42], [fig.43], [fig.44], [fig.45] and tables (to clarify the areas). The figures will show West

of Barbar in six years: 1968, 1977, 1998, 2007, 2017 and 2023 as per the given data from SLRB. The zonings will mainly divide into three: Agricultural areas, built-up areas and the third part is empty lands-roads. The sea and reclaimed areas are excluded from the study area. The analysis is explained and described after the tables.



Figure 40: Zoning of West of Barbar in 1968

The satellite image of West Barbar in 1968 shows that the area was agricultural and uninhabited. The agricultural area were 59% of the total area, while the empty lands and roads were 40% [Table.13].



Figure 41: Zoning of West of Barbar in 1977

The satellite image of West Barbar in 1977 shows that the agricultural area decreased to 49%, despite the area remained uninhabited. However, the empty lands and roads increased, and the sea was partially reclaimed. To be noted, the analysis does not include or address the reclaimed area [Table.14].

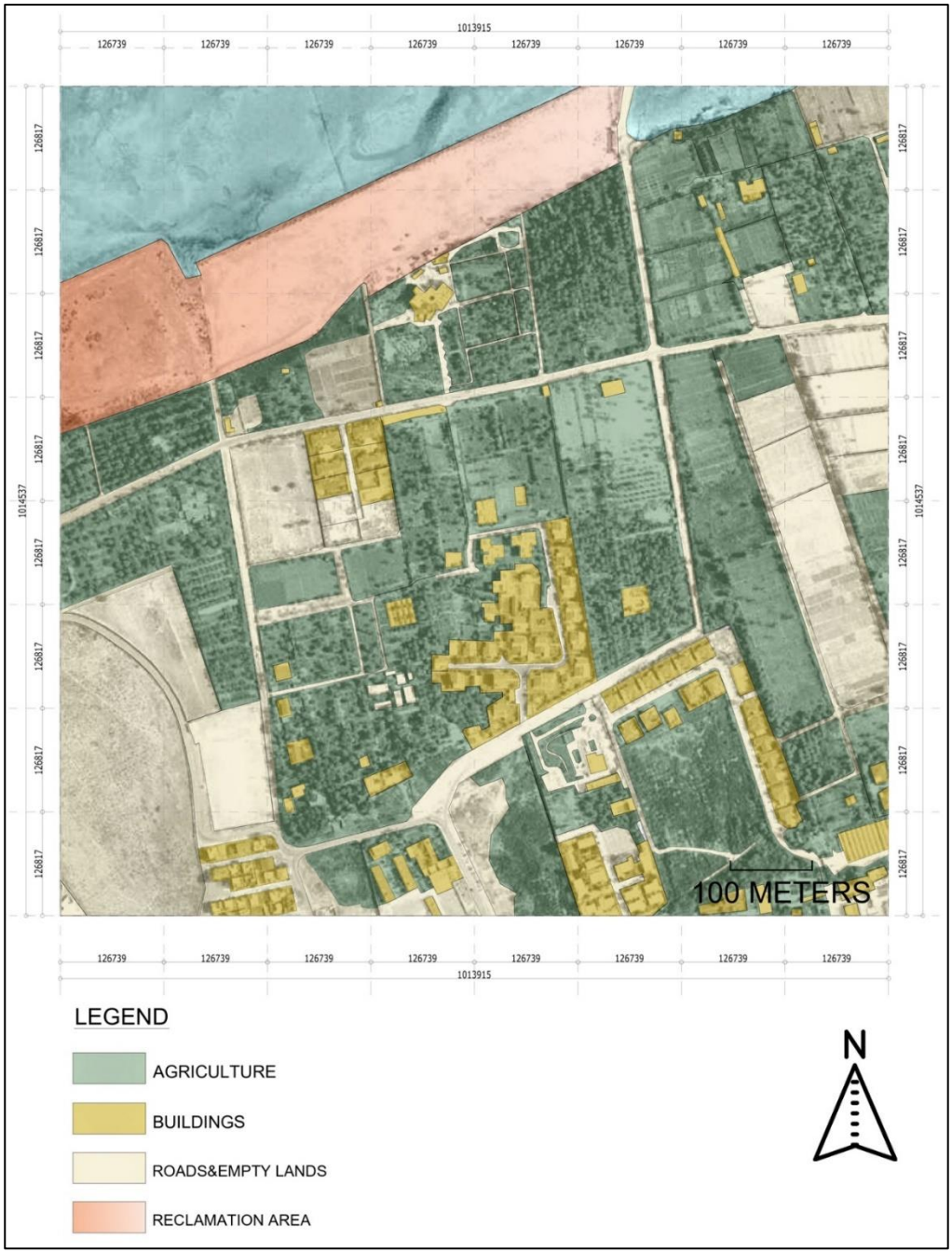


Figure 42: Zoning of West of Barbar in 1998. Edited by the student.

The satellite image from 1998 shows that the agricultural area increased slightly, reaching 54%, and urban expansion began in the area, with the built-up area reaching 9.7%. Empty lands and roads decreased to 36%, and land reclamation activity also increased [Table.15].



Figure 43: Zoning of West of Barbar in 2007. Edited by the student.

The satellite image of West Barbar in 2007 shows that the agricultural area, built-up area, empty lands and roads have not changed since 1998 [Table.16].



Figure 44: Zoning of West of Barbar in 2017. Edited by the student.

The satellite image of West Barbar in 2017 shows that agricultural areas, built-up areas, vacant lands, and roads have not changed since 1998 [Table.17]. Except the roads development in the reclaimed area.

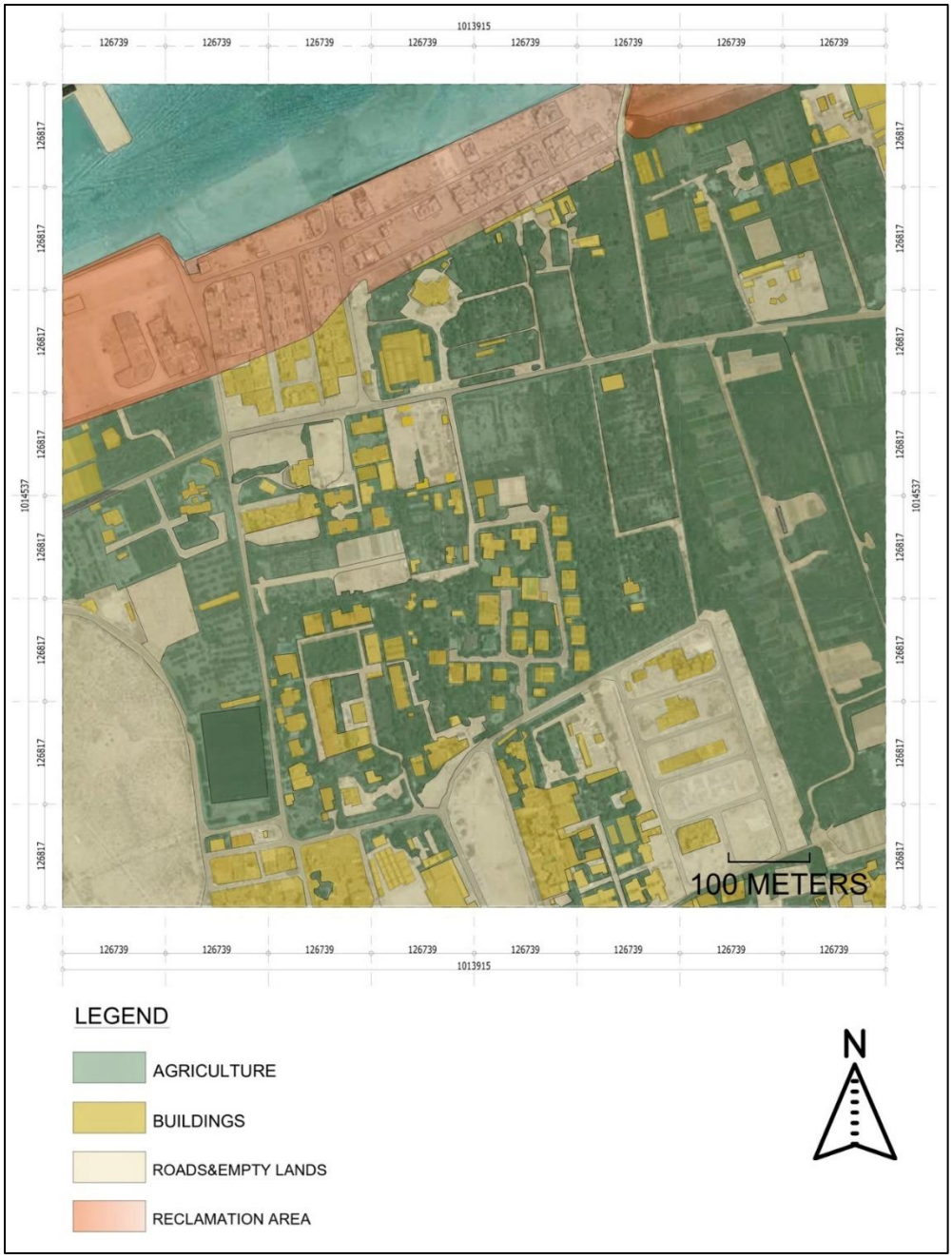


Figure 45: Zoning of West of Barbar in 2023. Edited by the student.

The satellite image of West Barbar in 2023 shows that agricultural areas have decreased slightly, reaching 50% of the total area, while built-up areas, empty lands and roads have increased slightly [Table.18]. The reclaimed area were built.

Table 13: Areas & percentages of West of Barbar in 1968.

Location: West of Barbar 1968		Study area in Hectare: 88.32
Usage	Area	Percentage from the selected area
Agricultural area	52.19 Ha	59.10%
Built-up area	0.29 Ha	0.33%
Roads and empty lands	35.83 Ha	40.57%
Total	88.32 Ha	-

Table 14: Areas & percentages of West of Barbar in 1977.

Location: West of Barbar 1977		Study area in Hectare: 88.32
Usage	Area	Percentage from the selected area
Agricultural area	44.09 Ha	49.92%
Built-up area	1.08 Ha	1.23%
Roads and empty lands	43.15 Ha	48.85%
Total	88.32 Ha	-

Table 15: Areas & percentages of West of Barbar in 1998.

Location: West of Barbar 1998		Study area in Hectare: 88.32
Usage	Area	Percentage from the selected area
Agricultural area	47.73 Ha	54.04%
Built-up area	8.58 Ha	9.72%
Roads and empty lands	32.01 Ha	36.24%
Total	88.32 Ha	-

Table 16: Areas & percentages of West of Barbar in 2007.

Location: West of Barbar 2007		Study area in Hectare: 88.32
Usage	Area	Percentage from the selected area
Agricultural area	49.13 Ha	55.63%
Built-up area	10.58 Ha	11.98%
Roads and empty lands	28.60 Ha	32.39%
Total	88.32 Ha	-

Table 17: Areas & percentages of West of Barbar in 2017.

Location: West of Barbar 2017		Study area in Hectare: 88.32
Usage	Area	Percentage from the selected area
Agricultural area	49.22 Ha	55.73%
Built-up area	10.18 Ha	11.53%
Roads and empty lands	28.92 Ha	32.74%
Total	88.32 Ha	-

Table 18: Areas & Percentages of West of Barbar in 2023

Location: West of Barbar 2023		Study area in Hectare: 88.32
Usage	Area	Percentage from the selected area
Agricultural area	44.74 Ha	50.66%
Built-up area	11.19 Ha	12.68%
Roads and empty lands	32.38 Ha	36.66%
Total	88.32 Ha	-

After analyzing satellite images of west of Barbar, it was found that the percentage of agricultural areas decreased slightly over the years, as the percentage of agricultural areas decreased between 1968 and 2023 from 59% to only 50%, while the built-up areas increased from zero to reach 12.6% in 2023. The reason for West Barbar area maintaining its agricultural character is attributed to the fact that the land was classified by UPDA as a garden resident and a green belt areas. These classifications require landowners to reserve between 55% to 70% of their lands for agriculture.

4.4 Satellite images analysis – Samaheej

Samaheej is an area located in the far north of Muharraq island (Northern east of Manama city) in Muharraq Governorate [Fig.46], [Fig.47]. About a hundred years ago, Samaheej was described by Lorimer (1915) as a village hidden in the back of palm farms and it has 150 huts for Al- Baharnah. All the adult males in the village are pearl hunters. It has 1150 palm trees and water wells (Lorimer, 1915).

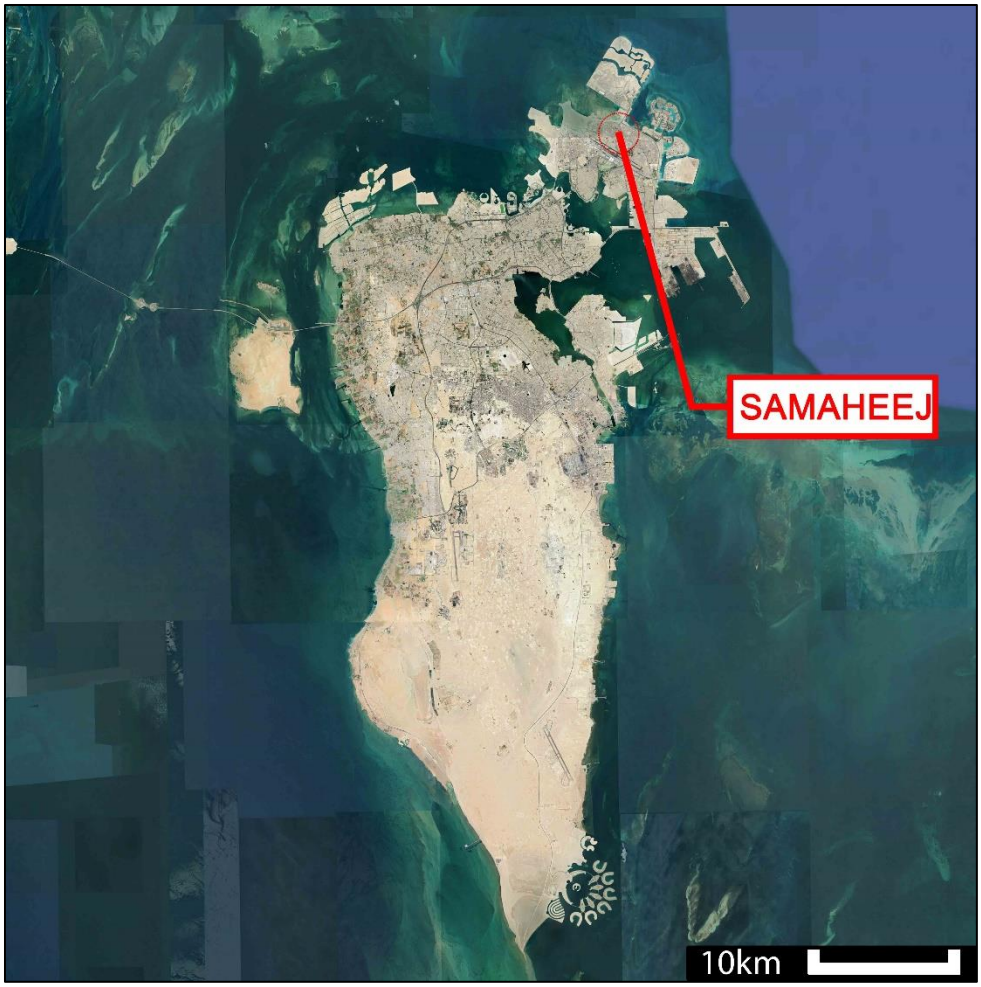


Figure 46: Samaheej Location in Bahrain map 1



Figure 47: Samaheej Location in Bahrain map 2

4.4.1 Original satellite images of Samaheej

SLRB Satellite images of Samaheej were given for 7 decades, starting from 1960s till 2020s. The seven images will be shown in [fig.48], [fig.49], [fig.50], [fig.51], [fig.52], [fig.53], [fig.54].



Figure 48: Satellite image of Samaheej in 1968



Figure 49: Satellite image of Samaheej in 1977



Figure 50: Satellite image of Samaheej in 1983



Figure 51: Satellite image of Samaheej in 1998

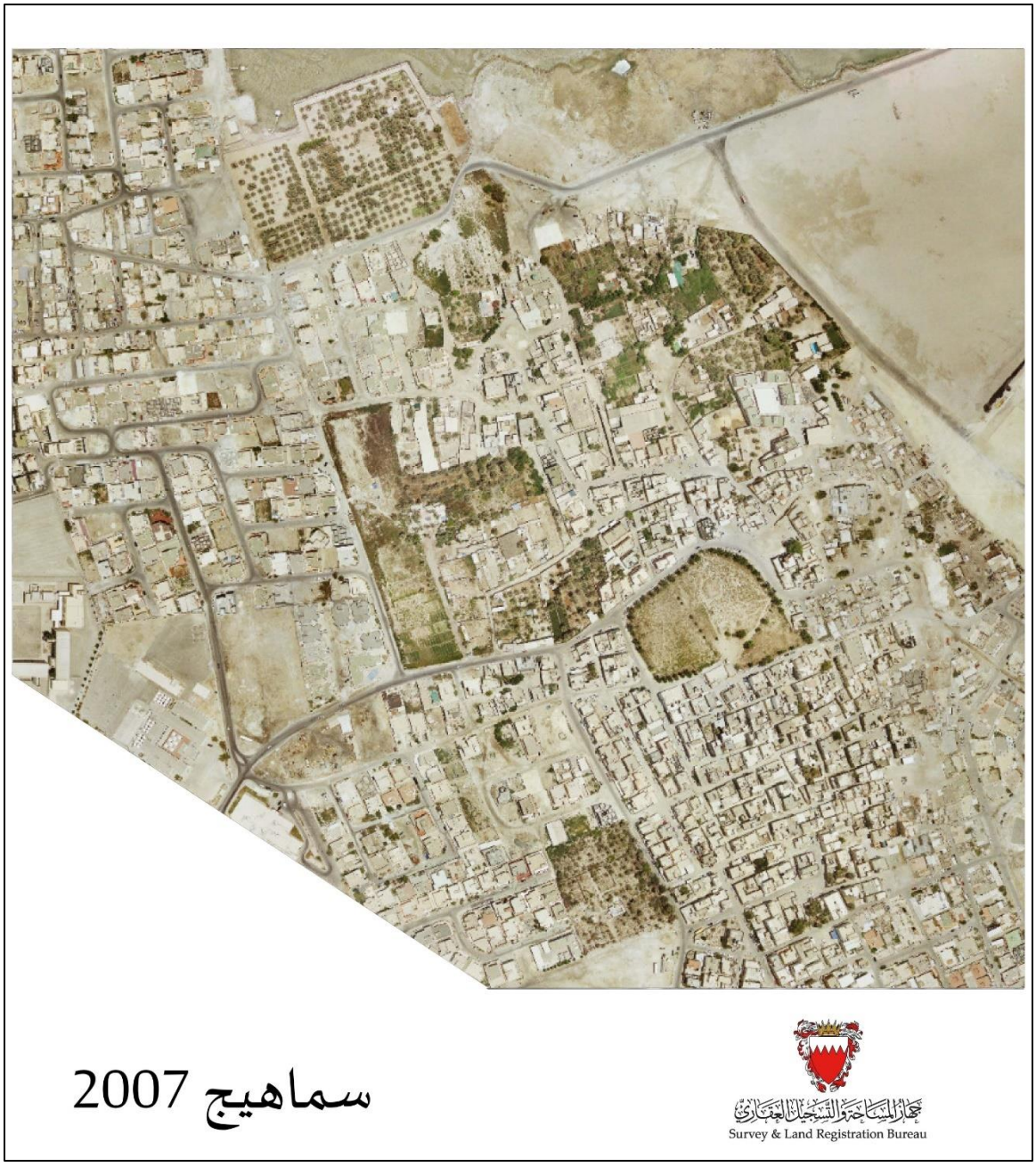


Figure 52: Satellite image of Samaheej in 2007

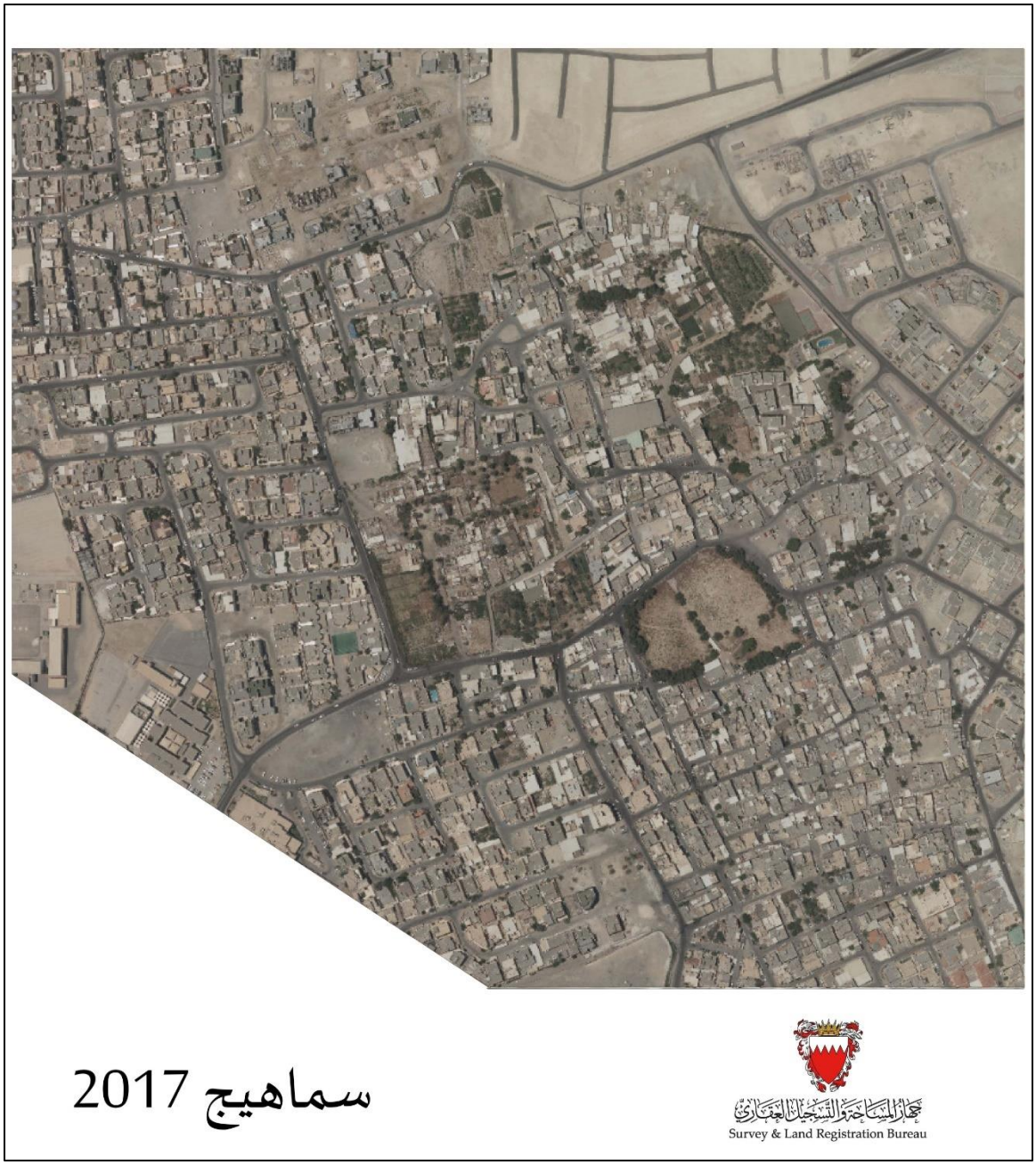


Figure 53: Satellite image of Samaheej in 2017



Figure 54: Satellite image of Samaheej in 2023

4.4.2 Analysis of Samaheej satellite images

In this section, the analysis of Samaheej over the years will be shown in figures (to clarify the zoning) [fig.55], [fig.56], [fig.57], [fig.58], [fig.59], [fig.60], [fig.61] and tables (to clarify the areas). The figures will show Samaheej in seven years: 1968, 1977, 1983, 1998, 2007, 2017 and 2023 as per the given data from SLRB. The zonings will mainly divide into three: Agricultural areas, built-up areas and the third part is empty lands-roads. The sea and reclaimed areas are excluded from the study area. The analysis will be explained and described after the tables.

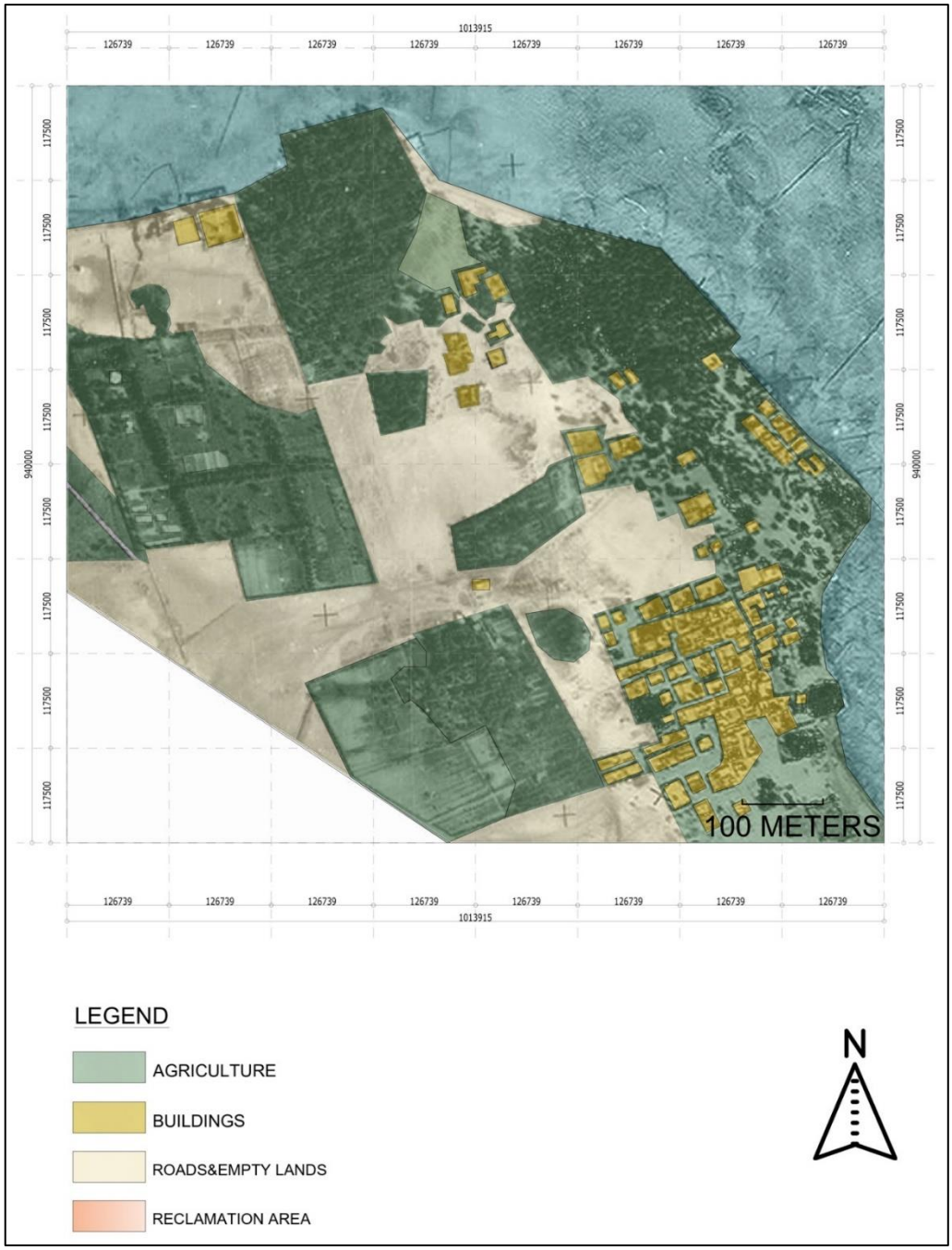


Figure 55: Zoning of Samaheej in 1968. Edited by the student.

The satellite image of Samaheej in 1968 shows that agricultural areas constituted 55% of the total area, while empty lands constituted 40%. Built-up areas constituted only 4% [Table.19].



Figure 56: Zoning of Samaheej in 1977. Edited by the student.

The satellite image of Samaheej in 1977 shows that agricultural areas increased slightly to 58%, while built-up areas also increased slightly. empty lands and roads decreased to 34% [Table.20].

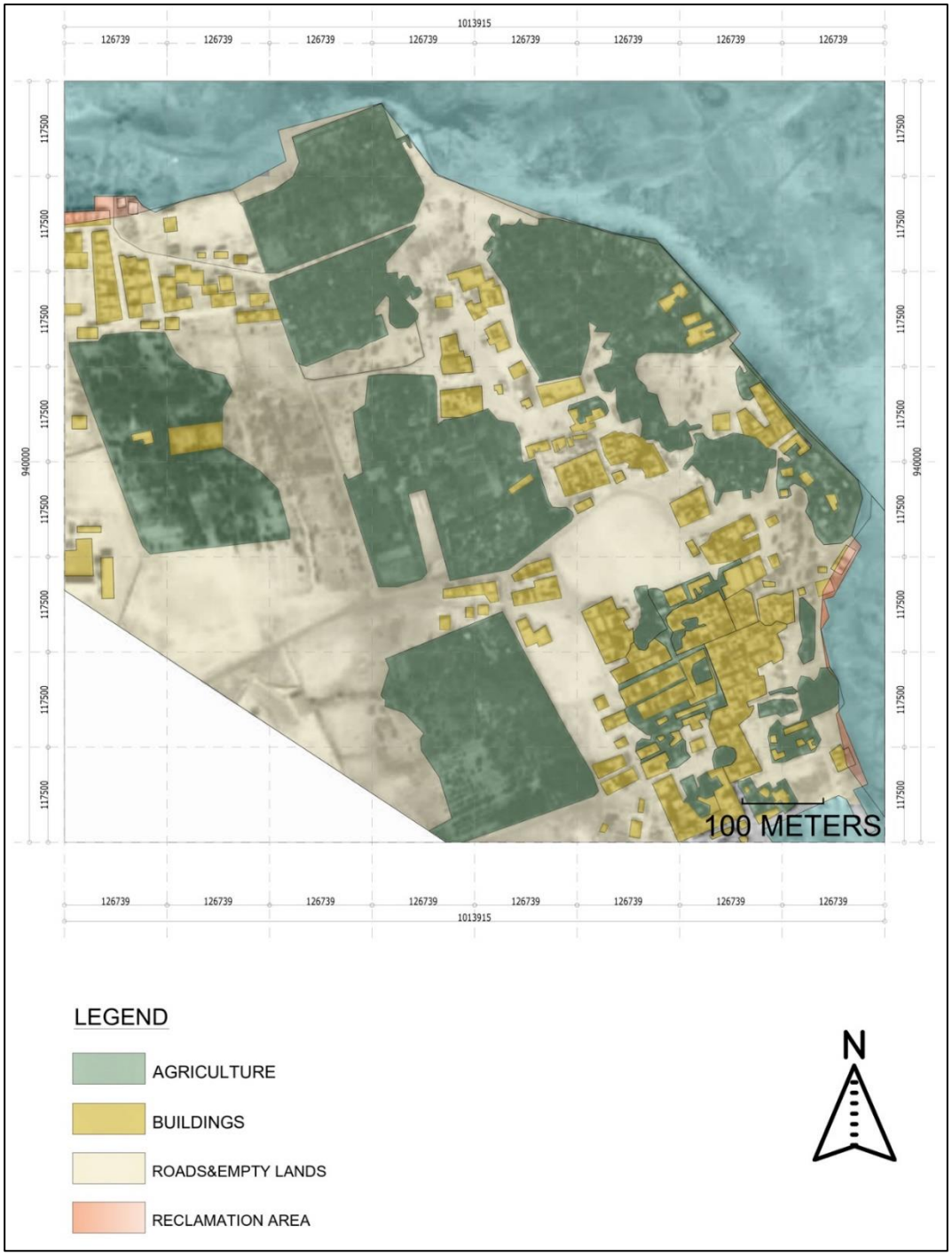


Figure 57: Zoning of Samaheej in 1983. Edited by the student.

The satellite image of Samaheej in 1983 shows that agricultural areas decreased significantly to 38%. Built-up areas doubled to 13%, while empty lands and roads also increased to 48% [Table.21].

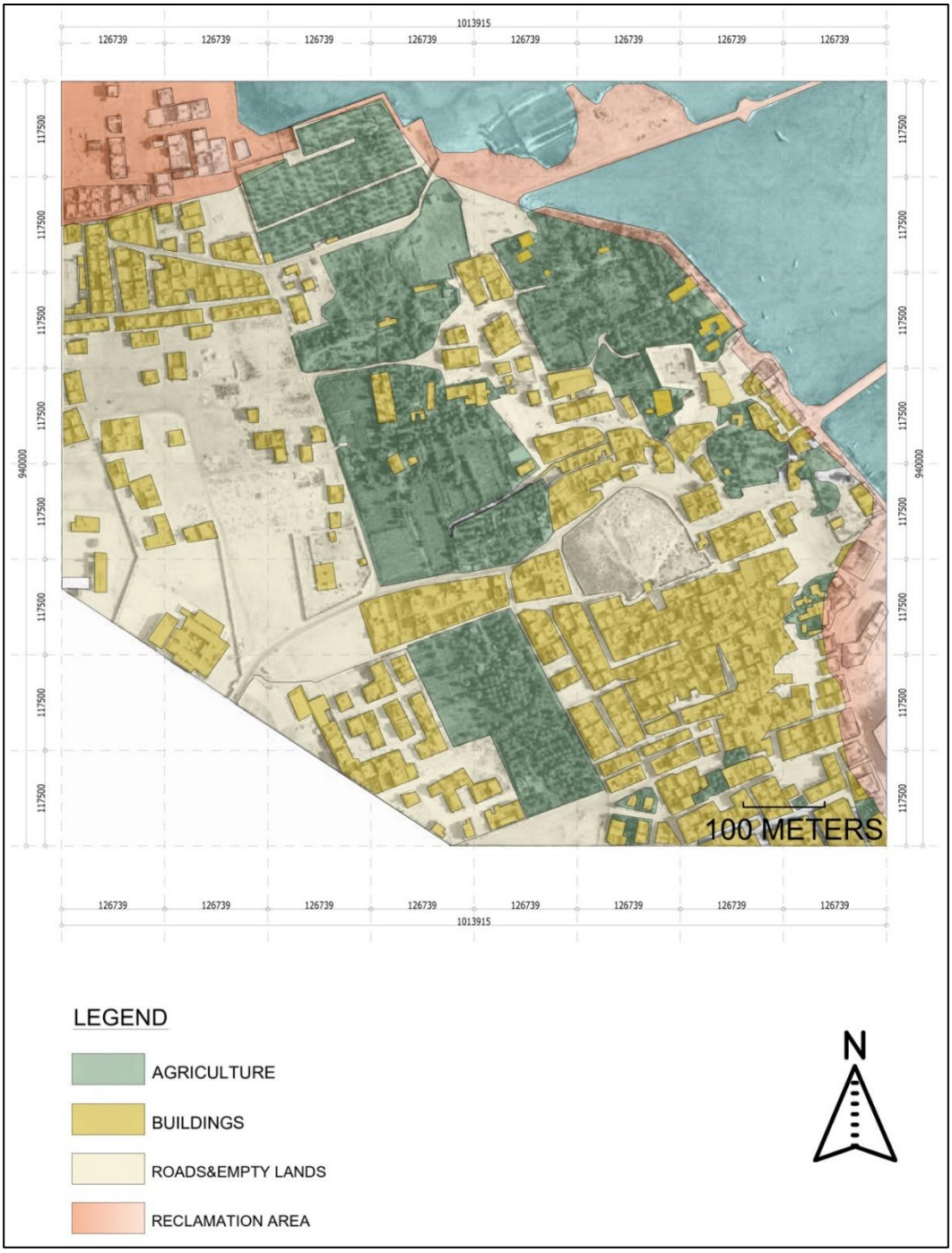


Figure 58: Zoning of Samaheej in 1998. Edited by the student.

The satellite image of Samaheej in 1998 shows that agricultural areas continued to decline, reaching 28%. Built-up areas continued to increase, reaching 28%. It is worth noting that land reclamation work had begun [Table.22].

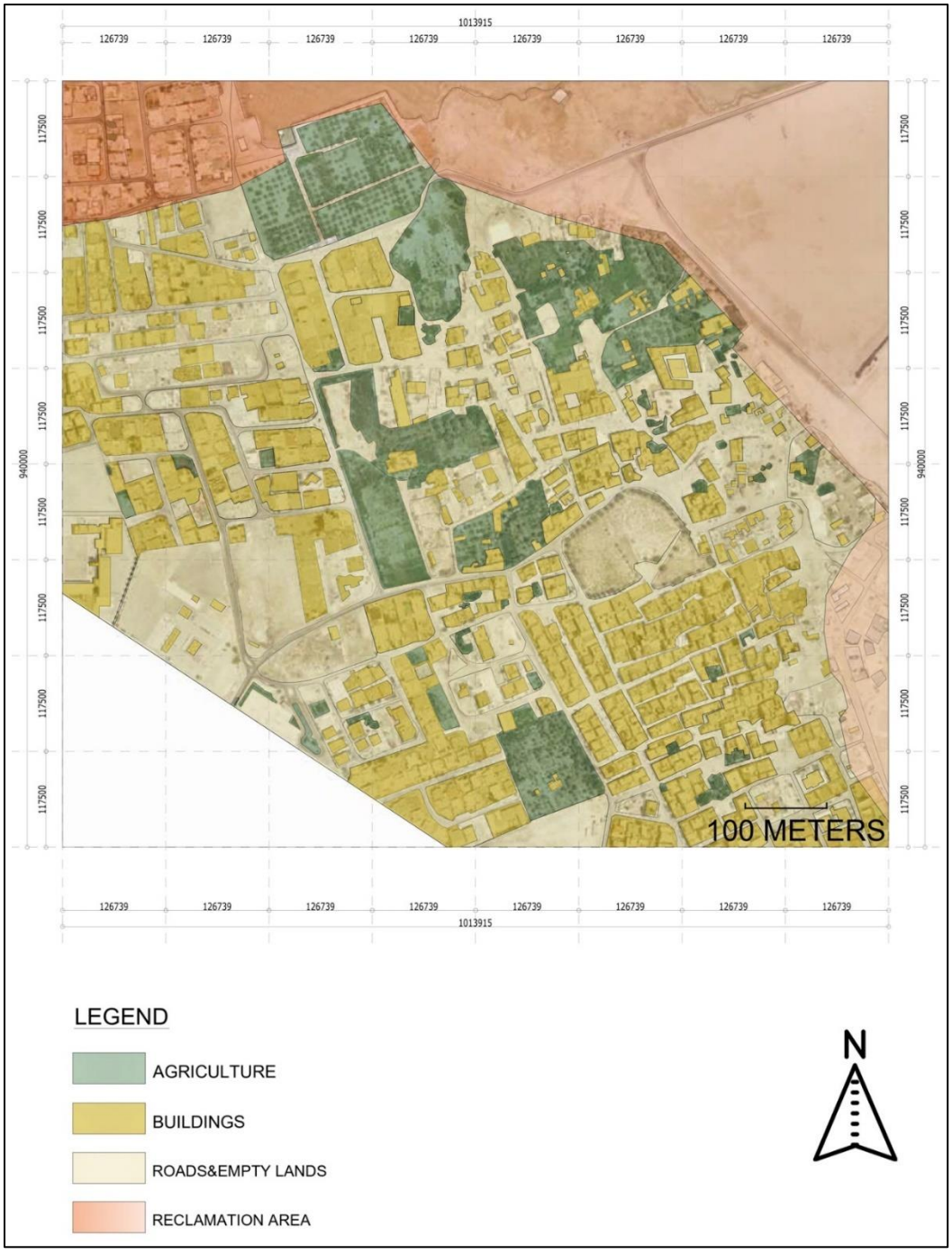


Figure 59: Zoning of Samaheej in 2007. Edited by the student.

The satellite image of Samaheej in 2007 shows that agricultural areas continued to decline, reaching 17%, while built-up areas continued to increase, reaching 35%. Sea reclamation activities were significantly increased [Table.23].

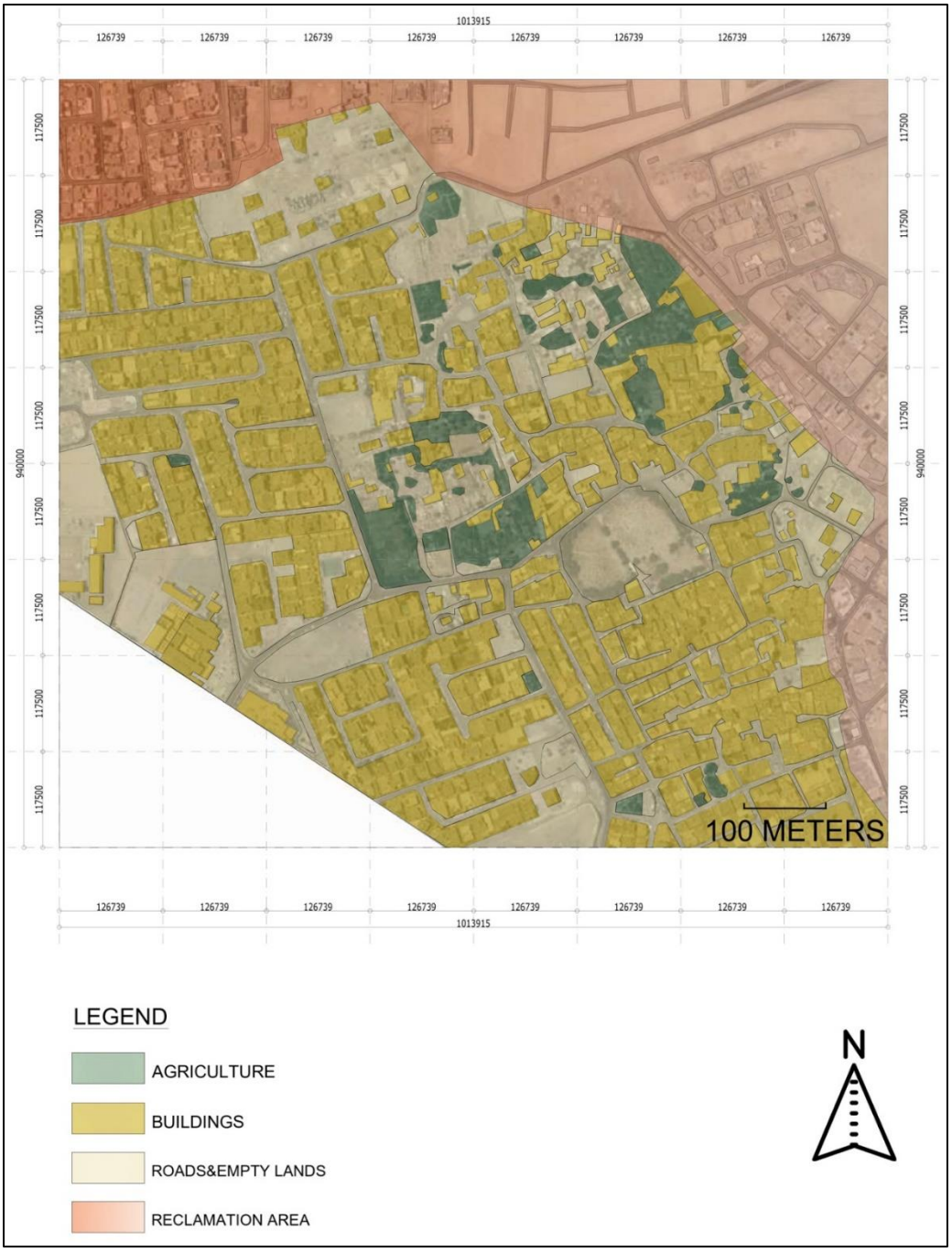


Figure 60: Zoning of Samaheej in 2017. Edited by the student.

The satellite image of Samaheej in 2017 shows that agricultural areas continued to decline, reaching 6%. Built-up areas increased significantly, reaching 52%. empty lands and roads accounted for approximately 40% [Table.24].

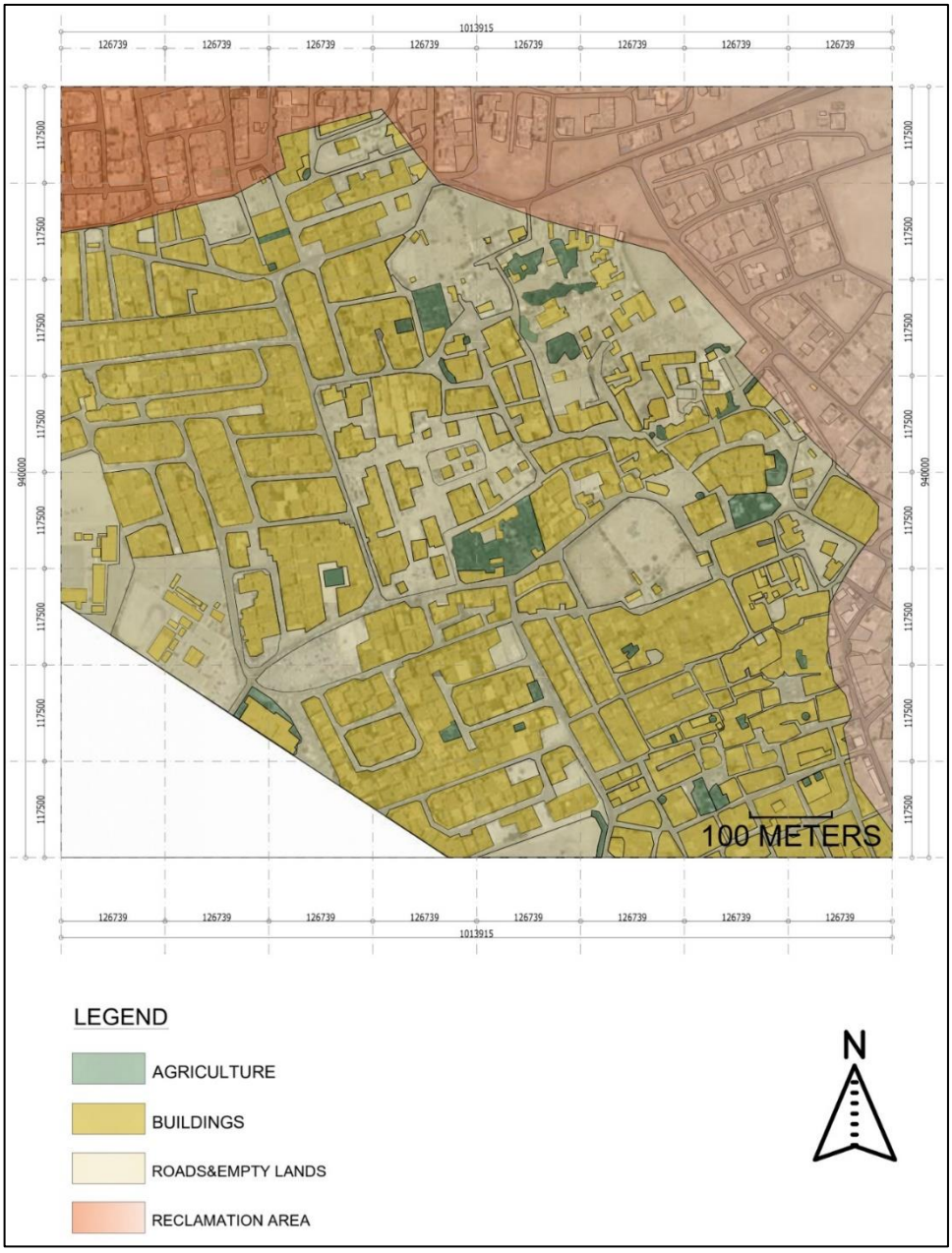


Figure 61: Zoning of Samaheej in 2023. Edited by the student.

The satellite image of Samaheej in 2023 shows that agricultural areas reached their lowest point, at 3%. Built-up areas, empty lands, and roads increased slightly [Table.25].

Table 19: areas & percentages of Samaheej in 1968

Location: Samaheej 1968		Study area in Hectare: - 66.08
Usage	Area in Ha	Percentage from the selected area
Agricultural area	36.72 Ha	55.57%
Built-up area	2.71 Ha	4.11%
Roads and empty lands	26.64 Ha	40.32%
Total	66.08 Ha	-

Table 20: areas & percentages of Samaheej in 1977

Location: Samaheej 1977		Study area in Hectare: 66.08
Usage	Area	Percentage from the selected area
Agricultural area	38.62 Ha	58.44%
Built-up area	4.35 Ha	6.59%
Roads and empty lands	23.10 Ha	34.97%
Total	66.08 Ha	-

Table 21: Areas & percentages of Samaheej in 1983.

Location: Samaheej 1983		Study area in Hectare: 66.08
Usage	Area	Percentage from the selected area
Agricultural area	25.34 Ha	38.36%
Built-up area	8.76 Ha	13.25%
Roads and empty lands	39.85 Ha	48.39%
Total	66.08 Ha	-

Table 22: Areas & percentages of Samaheej in 1998.

Location: Samaheej 1998		Study area in Hectare: 66.08
Usage	Area	Percentage from the selected area
Agricultural area	18.71 Ha	28.32%
Built-up area	19.09 Ha	28.90%
Roads and empty lands	28.27 Ha	42.78%
Total	66.08 Ha	-

Table 23: Areas & percentages of Samaheej in 2007.

Location: Samaheej 2007		Study area in Hectare: 66.08
Usage	Area	Percentage from the selected area
Agricultural area	11.42 Ha	17.29%
Built-up area	23.45 Ha	35.50%
Roads and empty lands	31.19 Ha	47.21%
Total	66.08 Ha	-

Table 24: Areas & percentages of Samaheej in 2017

Location: Samaheej 2017		Study area in Hectare: 66.08
Usage	Area	Percentage from the selected area
Agricultural area	4.61 Ha	6.99%
Built-up area	34.37 Ha	52.03%
Roads and empty lands	27.08 Ha	40.98%
Total	66.08 Ha	-

Table 25: Areas & percentages of Samaheej in 2023.

Location: Samaheej 2023		Study area in Hectare: 66.08
Usage	Area	Percentage from the selected area
Agricultural area	2.11 Ha	3.20%
Built-up area	35.11 Ha	53.14%
Roads and empty lands	28.85 Ha	43.66%
Total	66.08 Ha	-

After analyzing satellite images of Samaheej, it revealed that urban expansion had a significant impact on agricultural areas. Agricultural areas would constitute 58% in 1977, while built-up areas are 6% in the same year. However, there was significant urban expansion that not only came at the expense of agricultural areas, but also the sea was reclaimed (reclaimed areas were not included in the analysis). The percentage of built-up areas reached 53% in 2023, while agricultural areas decreased to 3% in the same year. It's worth noting that UPDA were entirely classified Samaheej as a residential area.

4.5 Thematic analysis of the interviews

The thematic analysis in this chapter was conducted through analyzing the interviews [Appendix. 8], [Appendix. 9] and [Appendix. 10] and comparing them with the results of the quantitative analysis and literature to arrive at a broad understanding of the effects of urban sprawl on agricultural areas in Bahrain and to derive comprehensive recommendations. It was divided into three sections in the form of articles with different titles,

following the same research method used by Salman (2016). It will cover a general background on the agricultural sector in Bahrain, a background on urban expansion and the decline of agricultural areas in Bahrain, with a discussion of the causes and consequences. Finally, recommendations are presented to preserve and develop agricultural areas.

4.5.1 The agricultural sector in Bahrain: History, types and profession

In this section of this thesis analysis, the general picture of the agricultural sector in Bahrain is given in terms of history from the 20th century till now, types of agricultural crops and lands, and as a profession and society interaction with it after an extensive analysis and study that has been done.

a) Historical background of agriculture in Bahrain in the last 120 years:

The conducted interviews in this thesis revealed that agriculture in Bahrain began to be slightly affected in 1920s and 1930s, but the urban expansion and agricultural decline problem grew significantly after Bahrain's independence from British colonization in 1971. Moreover, the interviews participants confirmed that Bahrain was an agricultural country, and agriculture is one of the main historical sources of income, along with pearl diving and fishing. The interviews revealed that Bahrainis have relied on the agricultural sector as a source of income despite the major challenges that this sector faced in the past and present like urban expansion. Satellite images of three areas in Bahrain (in different governorates) were analyzed in this chapter and it was found that there was indeed a large agricultural presence in the 1960s and even some of the

current residential areas were completely farms. For example, agriculture constituted 77% of Al-Segaya area in 1968. But the percentage of agricultural areas decreased dramatically over the years which matches the statements of the interviewees that major changes in the agricultural situation became more evident in the 1970s and has continued until nowadays.

The interviews and satellite images analysis results match the literature. In his description of Bahrain and the rural areas in particular, Lorimer (1915) indicated that Bahrain has historically been an agricultural country. For example, He described Al-Segaya area as: an area located in the southeast of Manama fort (Diwan Fort) [Fig.62] whose inhabitants work in palm trees, and it has many alfalfa farms and about 700 palm trees. Many areas in Bahrain described by Lorimer (1915) were similar to Al-Segaya area in terms of agricultural presence, which confirms that the agricultural sector in Bahrain was a primary sector in the past and Bahrain is an agricultural country. At the beginning of the urban expansion and



Figure 62: Manama fort or Al-Diwan fort in 1950s. Source: Al-Wattan News Paper

agriculture decline problem inflation, Shqlyh (1972) warned the responsible authorities about the issues that faces the agricultural sector in Bahrain which showed that what was warned against at that time has actually happened now based on the interviews and satellite images analysis.

b) Types of agriculture in Bahrain based on crops and land sizes:

The types of agricultural areas and lands differed based on land area (size) and use (crops). Based on the interviews, there are many types of crops such as palm trees (most density) which were 70% of the total agricultural areas in Bahrain, almond, mango, seder, mashmoom, lemon and alfalfa [Fig.63] & [Fig.64]. Given the importance of palms in Bahrain, the third participant mentioned that the Government of Bahrain issued a decree called (The Palm Tree Act), which forbids the cutting down of any palm tree for whatever reason. After reviewing Bahrain's regulations through the Legislation and Legal Opinion Commission, it was found that this code was issued in 1983 [appendix. 11]. On the other hand, the 3rd participant confirmed that there are some citrus oriented farms in the north and west areas of the main island. As for the 1st participant, he mentioned that there are some farms that are not for specific crops, but they have a variety of crops. At the moment and based on the literature, there is a lack of information on used crop types in the agricultural lands in Bahrain.



Figure 63: Palms in local Bahraini farm in 2025/ Source: The student



Figure 64: Local Bahraini farm shows palm trees and traditional farming system/ Source: The student

Furthermore, the interviewees did not discuss the types of agricultural areas and lands based on size. According to Hamza (2001) the real-estate terms in Bahrain include different types of agricultural lands. The following table identifies the types:

Table 26: Types of agricultural lands in Bahrain

Types of agricultural lands in Bahrain		
No.	Type	Description
1	Al Jobar (الجوبار)	It's agricultural land which is mostly in a rectangular shape. Its size is between Al Dolab and Al Daliya and irrigation water accumulates in it (Hamza, 2001) [Fig.65].
2	Al Kheyes (الخِيَس)	The abandoned palms regardless of their size (Hamza, 2001) [Fig.66].
3	Al Daliya (الدالية)	A comparatively small agricultural land. Smaller than Al Dolab and bigger than Al surma. It is mostly attached with the house of the owner (Hamza, 2001) [Fig.67] & [Fig.68]
4	Al Dolab (الدُولاب)	Big agricultural land but it is smaller than Al Sayyha. Mostly planted with palms. Sometimes called Al Nakhal (النَخَل) (Hamza, 2001) [Fig.65].
5	Al Rafadh (الرَفَض)	Small agricultural land and it is unirrigated because it is higher than the surrounding water level (Hamza, 2001) [Fig.69].
6	Al Sayyha (السيَّحة)	The big agricultural land or area and it is located on the sides of the villages (Hamza, 2001) [Fig.70].
7	Al Surma (الصُرمة)	The agricultural land with a simple size and it is smaller than Al Daliya (Hamza, 2001) [Fig.65].

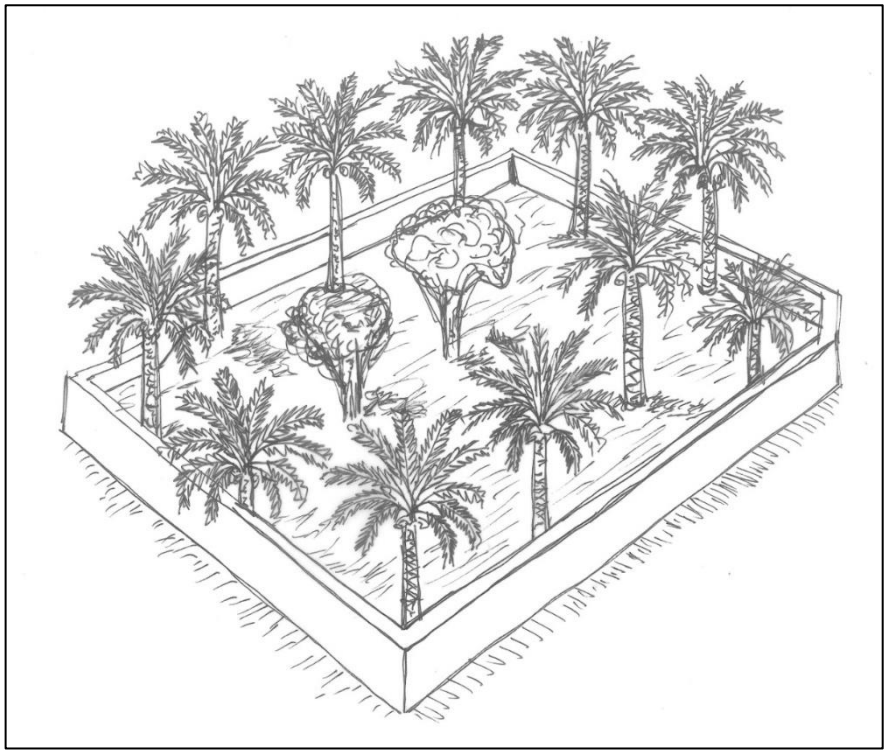


Figure 65: Sketch of an agricultural land which called Al-Jobar, Al-dolab & Al-Surma based on its size. Source: The student

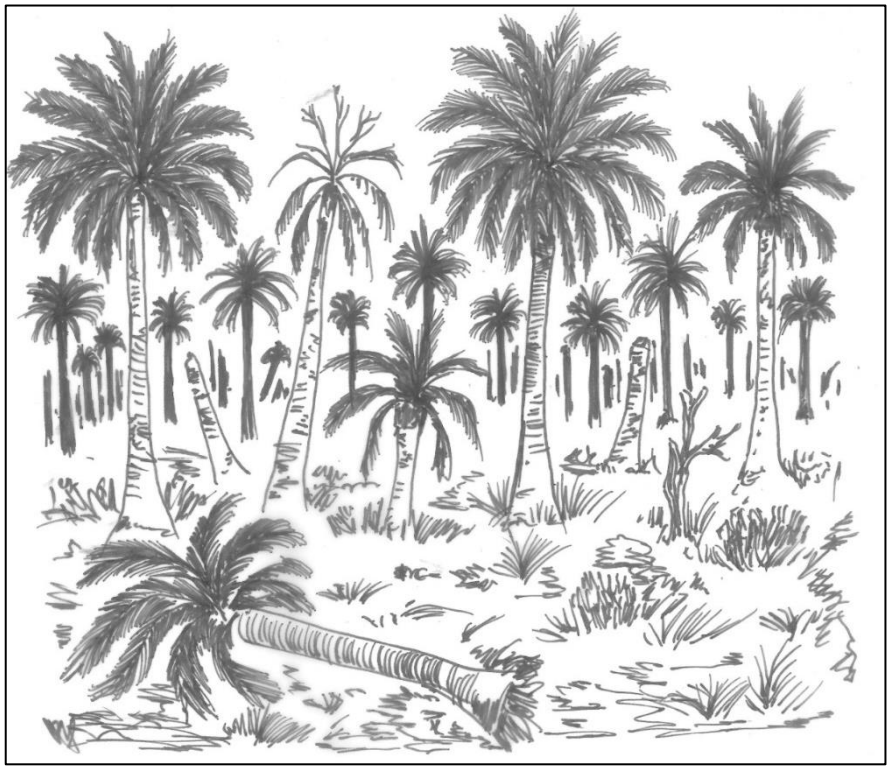


Figure 66: Sketch of abandoned agricultural land called Al-Kheyes. Source: The student

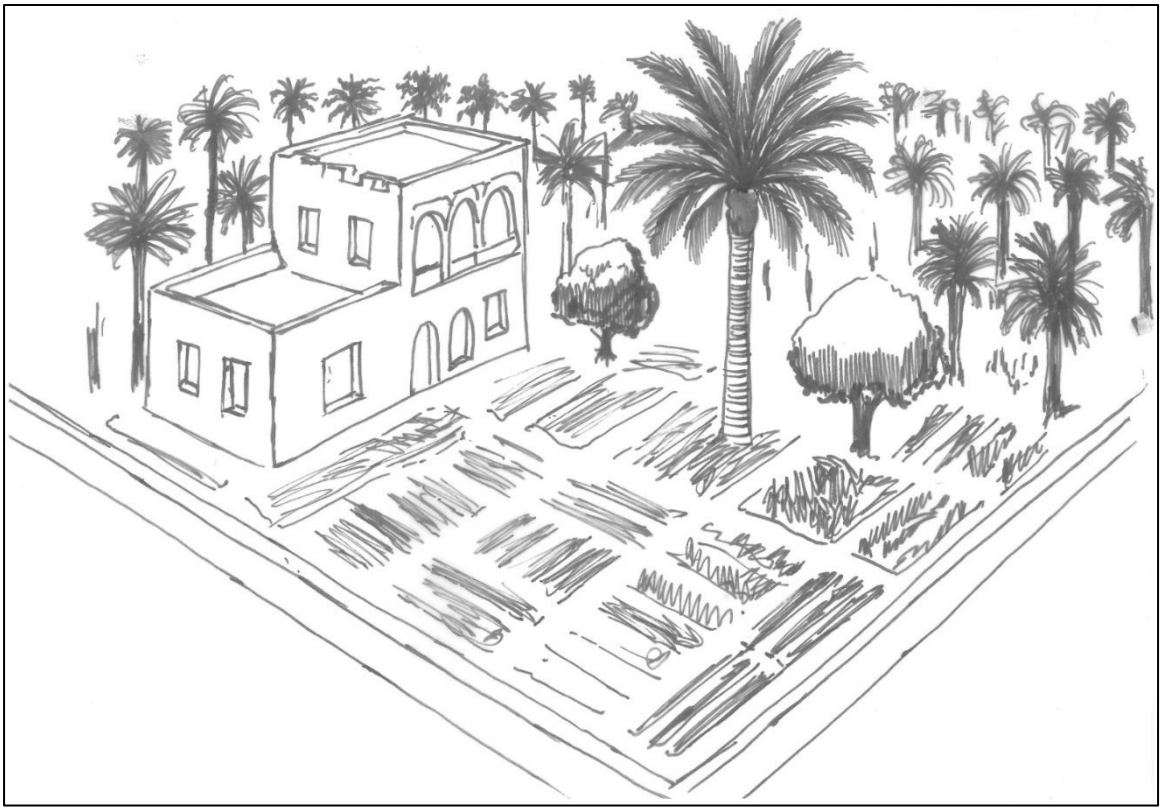


Figure 67: Sketch of an agricultural land called Al-Daliya which beside the house of the landowner. Source: The student

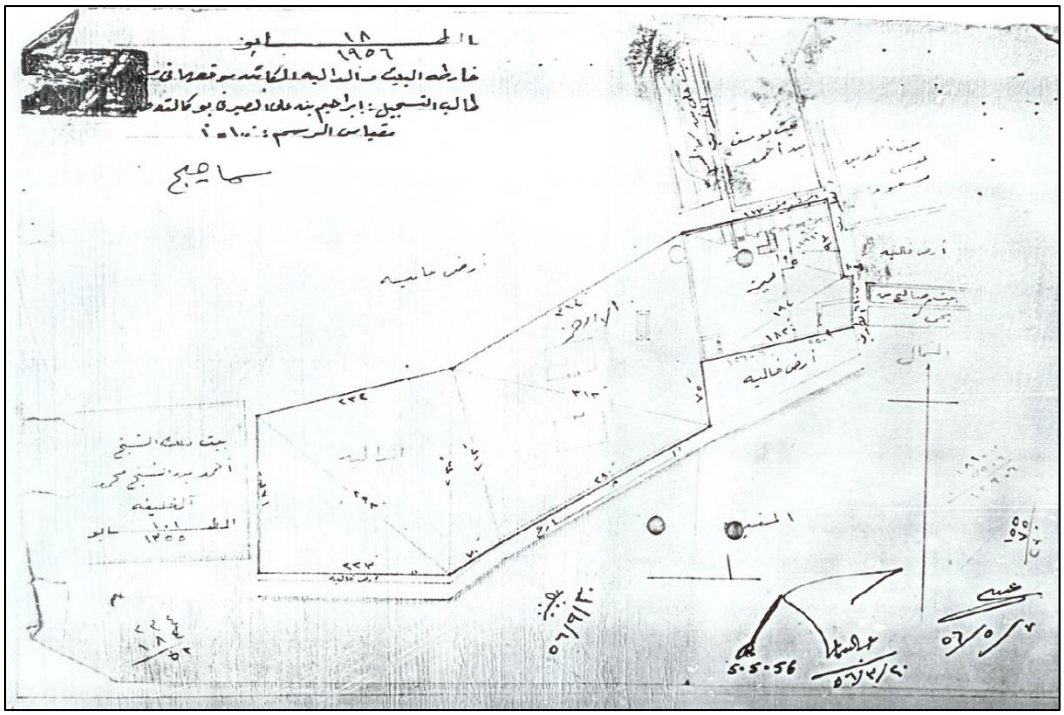


Figure 68: A map of an agricultural land (Daliya) issued in 1956 shows that the Daliya is attached to the landowner house which is matching the description in the previous table. Source: the student.



Figure 69: Sketch of an elevated agricultural land called Al-rafadh. Source: the student

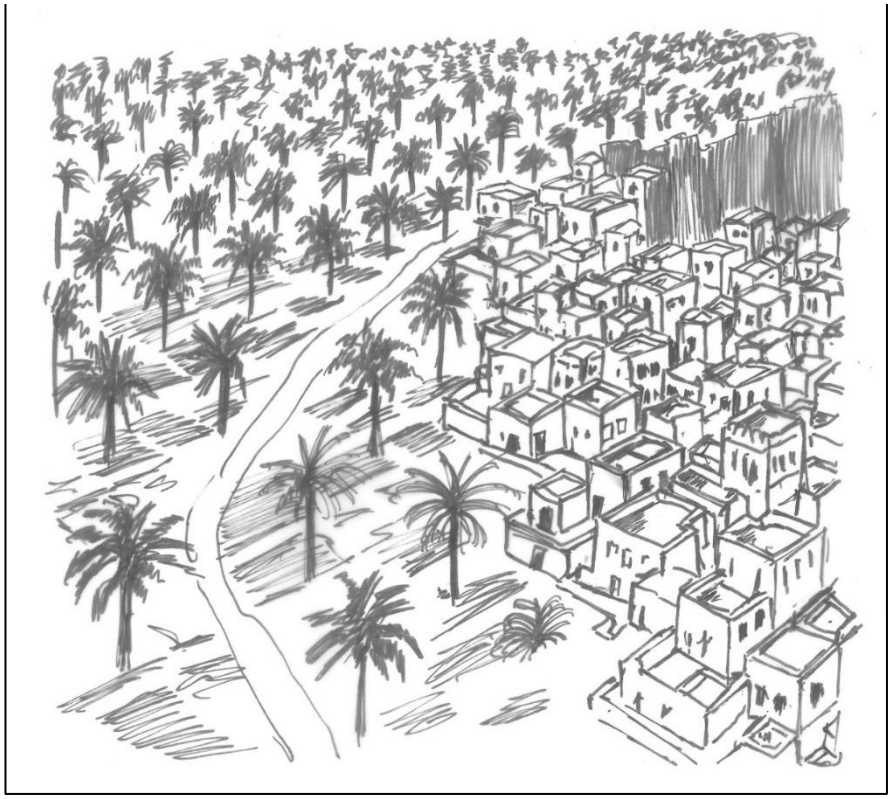


Figure 70: Sketch of an agricultural big area called Sayyha and it's located in the side of a village. Source: the student

The agricultural land terms in the previous table are not used nowadays due to the decrease in agricultural lands in this era, and it was limited to Al Mazraah (المزرعة) which is considered a general definition of the agricultural land (Farm). This is evident by the fact that the participants did not address these terms in the interviews.

c) Agriculture as a profession in Bahrain:

The interviews participants indicated that the social, cultural and economic situation in Bahrain changed dramatically after the independence. As people turned to jobs in sectors with higher income such as banking, services and tourism. On the other hand, the 3rd participant indicated that maintaining the farming industry is extremely costly nowadays which is considered as one of the reasons for the reluctance to work in this sector, although the agricultural sector used to be very essential due to its importance in the food security of the country.

In the past, the uses of agriculture in Bahrain were diverse. Shqlyh (1972) confirmed that a large number of Bahrainis were working in the agricultural sector before the 1960s. Therefore, it was a main source of income for Bahrainis. On this basis, there were great diversity in agricultural uses, professions and specializations. Starting from farmers specializing in palm trees, to farmers specializing in other crops. However, the uses were not limited to farming only, such as the usage of agriculture materials in making the daily use products and the construction of houses [Fig.71], [Fig.72]. As the interviews participants pointed out, these professions and uses have disappeared due to the spread of modern industries and businesses with higher income.



Figure 71: Bahrani women's making daily use products by palms leaves / Source: Al-Wasat News Paper

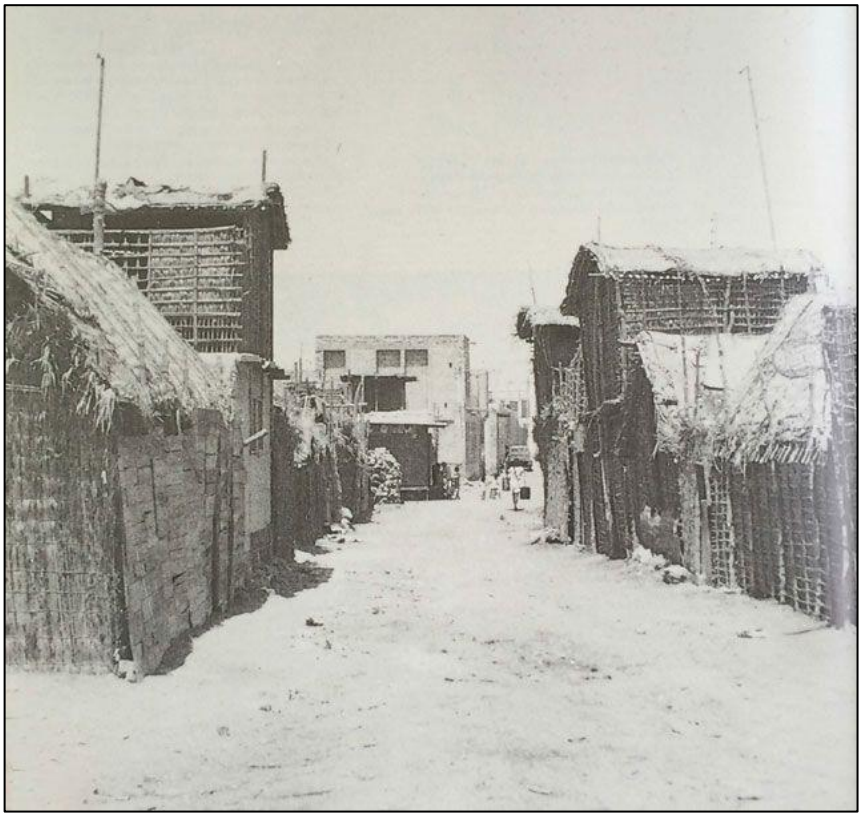


Figure 72: Photo in Bahrain 1940s shows the usage of palms as materials in the houses. / Source: Al-Wasat News Paper

4.5.2 Urban expansion and agriculture decline in Bahrain: background, reasons & results

After the discovery of oil and the oil boom in Bahrain in the last century, the country witnessed major economic and social transformations. This economic growth, coupled with a growth in population, led to massive urban expansion. Along with this urban expansion, agricultural areas declined significantly, greatly impacting the agricultural sector, which was once a primary sector that contributed to the economy of the country. In this theme of this thesis analysis, a background on urban expansion in Bahrain will be discussed and the reasons of urban expansion and agriculture decline will be presented along with the results of agriculture decline.

a) Background on urban expansion in Bahrain:

Based on the interviews, urban expansion begun in the main cities of Bahrain, specifically in the capital, Manama. According to the 3rd participant, this happened in 1950s, and the expansion was in two directions: east, specifically towards to Al-Qudaybiyah area, and west to the Al-Qufool area. These two areas were considered agricultural areas. Most of the agricultural lands located in these two areas were owned by well-known merchants in the country, such as Al-Qusaibi family and Mansour Al-Araydh. These merchants were the first merchants who dividid and sold lands in Bahrain. This urban expansion to the east and west of the capital, Manama, carried a new pattern of urbanization, which is the grid pattern which indeed differed from the traditional organic pattern of the city of Manama [Fig.73]. The roads of the new areas were 6

meters to 9 meters wide and Al-Qufool area was considered as a garden city of the capital. After the urban expansion to Al-Qufool and Al-Qudaybiya in the 1950s, the government of Bahrain implemented a plan to settle citizens, particularly the residents of densely populated cities like Manama, in a new vacant un-agricultural area, where it is not far from the capital. Therefore, Isa Town was established in the 1960s, but in the 1970s, urban expansion continued towards to south of Manama, specifically to Al-Segaya and Mahooz areas. This matched the satellite images analysis that were used previously in the chapter , which showed that urban expansion reached the Al-Segaya area in the 1970s, and the agricultural areas decreased from 77% to 51% only between 1968 and 1977.

b) Reasons for the urban expansion and the decline of agriculture:

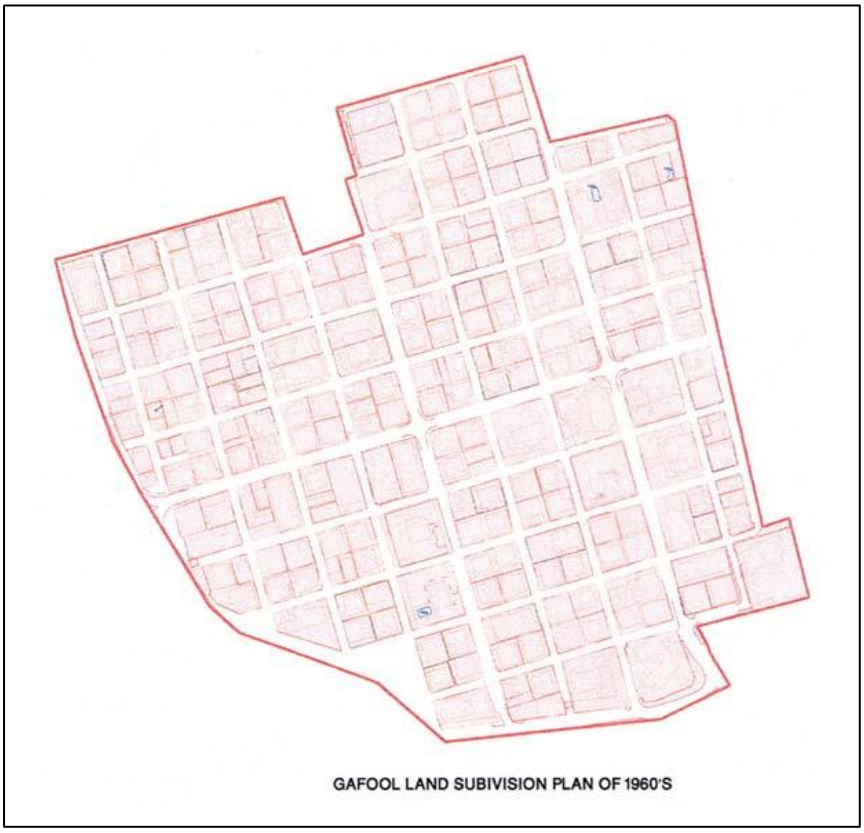


Figure 73: Al- Gufool land subdivision plan of 1960s. Source: Noor Al-Nabi, (2012)

The interviews revealed that the reasons for urban expansion and the decline in agricultural areas could be viewed from three perspectives: social, economic and environmental.

Based on the interviews, the social reasons for urban expansion and agricultural decline are multiple. Starting from the fast growth of the population, especially after the oil boom [Fig.74]. Population growth was a major factor in urban expansion, as the desire for urbanization increased, especially in major cities. This was in line with literature such as Shqlyh, (1972). Moreover, the behaviors and lifestyles of the people were changed. According to the 3rd participant, people used to live in extended family houses, but the demand has become for nuclear family houses which is matching with Salman (2016). This has led to an increase in the area used for housing. This was shown in the analysis of satellite images, as the rate of urban expansion has increased significantly since the 1970s until now, and this has had a fundamental impact on the area of agricultural zones. On the other hand, government housing policies encourage urban expansion. The third participant explained that the government still relies on the distribution of housing units and plots [Fig.75], and that there is no clear vision for vertical urbanization despite the country's limited geographic area. As for government policies to preserve agriculture, there are many decrees and laws to protect agricultural areas, such as the Palm Tree Protection Act “mentioned previously”, but the regulatory bodies have not been activated to implement these decrees, and the evidence for this is the significant decline in agricultural areas, as is evident in the

analysis of satellite images over the years.

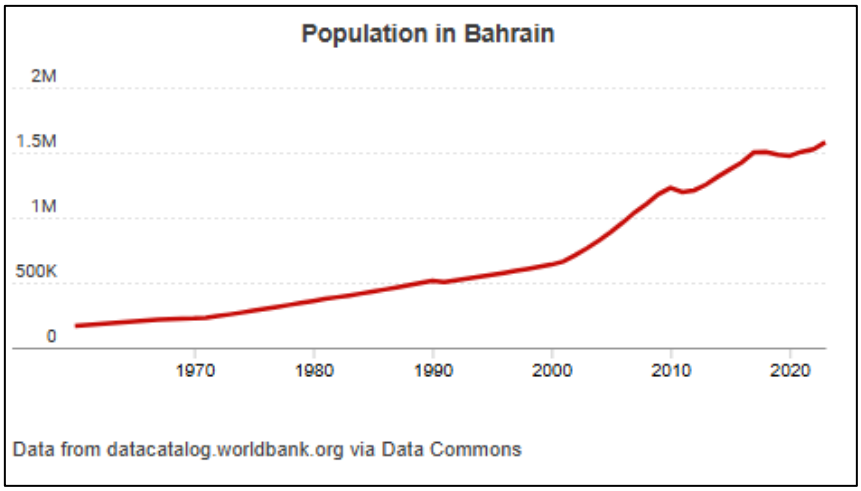


Figure 74: Bahrain population through the years. Source: Datacatalog.worldbank.org



Figure 75: Photo of Madinat Salman in 2022. Source: Al-Ayam News Paper

As for economic reasons, the interviews revealed that a group of economic reasons played a role in urban expansion and the decline of agriculture. For example, the first participant stated that the diversity and availability of professions in the country in the 1960s, resulting from the oil boom, were among the reasons that contributed to the lack of labor in the agricultural sector. These professions, such as those in the industrial, administrative, and banking sectors, attract more people due to their higher incomes compared to the agricultural sector [Fig.76].



Figure 76: Bapco workers extend oil pipelines to Ras Tanura, Saudi Arabia. Source: Bapco.

Therefore, these factors contributed to the neglect and decline of agriculture on the one hand, as well as the desire for urban expansion due to the rise in individual income. The first participant believed that this phenomenon in Bahrain did not have a negative impact on the economy; on the contrary, it had a positive impact. He explained that, just as in architecture, space must be utilized with a small footprint, and this is what is required in agriculture. Moreover, traditional agriculture methods are a waste of water and space. But what the 1st participant stated, that the transformation of agricultural areas into urban areas is a positive thing, contradicts what was confirmed by Al-Tarawneh (2014) and the other participants, as the decline of agricultural areas will negatively affect the national economy. As for the third participant, he explained that one of the main economic reasons is the high prices of lands in Manama, which has led to urban expansion into agricultural areas on the outskirts of cities and villages, where they are cheaper. This phenomenon has spread in the city

of Muharraq and villages, where agricultural landowners divide their lands and then sell them.

As for environmental reasons, the participants in the interviews did not address them primarily. Only the third participant mentioned the decline in groundwater levels and the increased salinity of water in some agricultural lands, which was also matching with Zubari, Al-Shaabani, Mohamed, (2023), were the results confirmed the increase in salinity in some areas in Bahrain such as the western area which is considered as an agricultural area [Fig.77]. Shqlyh (1972) mentioned that agriculture in Bahrain depends on groundwater by 95%. He also addressed the problem of high summer temperatures, which damage some crops, leading to higher prices for these crops in the markets due to their scarcity and increased demand. Reviewing the interviews and literature on the reasons for the decline in agriculture reveals that the main reasons are primarily social and economic, more than environmental. However, environmental reasons remain important.



Figure 77: Photo shows the decline of water level in a water well in Bahrain. Source: Al-Bilad News Paper

c) Results of agriculture decline and urban expansion:

Based on interviews, satellite images analysis, and literature, the results may be divided into the following:

- Environmental results: Participants of the interviews confirmed that agricultural areas in Bahrain have decreased along with the increase of urban expansion, which is matching with the analysis of the satellite images in this chapter. Accordingly, Narducci, Quintas-Soriano, Castro, Som-Castellano & S. Brandt (2019) confirmed that the decline in agricultural areas and urban expansion results in an increase in pollution, gas emissions, and deteriorating air quality. For this reason, the second participant confirmed that agricultural areas are the lungs of the city, giving the example of Central Park in New York City, which has the highest real estate prices due to its environmental quality [fig.78].



Figure 78: New York Central Park. Source: https://www.centralparknyc.org

- Economic results: Starting with the positive results, the 1st and 3rd participants confirmed that urban expansion results in an increase in investment and income, particularly for the owners of these lands that have been subdivided and sold. Moreover, the 3rd participant confirmed that urban expansion has contributed to raising the Ministry of Municipalities' revenue to 40 million dinars through the collection of municipal fees and the other investments projects. On the other hand, there are serious negative results on the national economy. This is because the decline in agriculture means a decline in the productivity of the agricultural sector, which has resulted in a greater reliance on food imports, posing a significant threat to the country's food security, as food prices are now linked to global markets which was confirmed by Al-Tarawneh (2014). Furthermore, the country's reliance is limited to a few, undiversified sectors, such as the oil sector, noting that the decline in agriculture has negative effects on livestock, as the second participant explained.

- Social results: The first participant emphasized that the positive social results of urban expansion were through providing housing spaces for people at the moment. However, the 3rd participant's opinion was that the method used in urban expansion will lead to a major problem in the future for next generations: land shortages due to the country's small geographic area and the increased demand for lands for private housing which may be inferred from the lack of good

alternatives to private low-rise housing projects. Ultimately, this resulted in a significant increase in land prices, making it difficult for individuals to purchase land. Indeed, what the 3rd participant mentioned matches Xu & Gao (2021) that the urban expansion methods of using low-rise housing in small geographic area in high population country results in high increase in land prices with land shortage which will lead to difficulties in obtaining housing.

As for the results and areas statistics (summarized in the table.27) through the analysis of satellite images for three agricultural areas in Bahrain (at different time periods from the 1960s to the present) in three different governorates: Al-Segaya in the Capital Governorate, West of Barbar in the Northern Governorate, and Samaheej in Muharraq Governorate. It was found that agricultural areas decreased significantly, particularly in Al-Segaya and Samaheej, both of which were populated in the 1960s. Between 1968 and 1977 and as one of the earliest areas affected by urban expansion and agricultural decline (due to its location beside Manama), agricultural areas in Al-Segaya decreased from 77% to 51%, while at the same time, built-up areas increased from 7% to 16%, and empty lands and roads increased from 15% to 32%. Similarly, in Samaheej, between 1977 and 1983, agricultural areas decreased from 58% to 38%, while the built-up areas increased from 6% to 13%, and empty lands and roads increased from 34% to 48%. This confirms the interviews findings that agricultural areas have decreased not only due to urban expansion (which is a main reason), but also due to the neglect of these agricultural areas due to the

lack of profitability and return on investment. As a result, urban expansion and the decline in agricultural areas in Al-Segaya and Samaheej continued, until the agricultural area in Al-Segaya reached only 10% of the total area in 2023. In Samaheej, the agricultural area in 2023 decreased to only 3% of the total area [Fig.79]. As for the West-Barbar area, which, according to Hamza (2001), was considered as Sayyha and it was uninhabited, satellite images analysis revealed that the agricultural areas in West-Barbar were only slightly affected, as the agricultural areas decreased between 1968 and 2023 from 59% to only 50%, despite the increase in built-up areas from 0.3% to 12% currently. This highlights the importance of what the interviews participants mentioned regarding the importance of allocating areas under the Green Belt zoning, which resulted in the preservation of some agricultural areas, West Barbar is one of them.

Table 27: Summary of satellite images analysis. E = empty lands % roads, AG= agricultural areas, B= built up areas, N= no data

Area/Year	Al-Segaya			Samaheej			West-Barbar		
	E	AG	B	E	AG	B	E	AG	B
1968	15.5%	77.1%	7.3%	40.3%	55.5%	4.1%	40.5%	59.1%	0.3%
1977	32.0%	51.3%	16.6%	34.9%	58.4%	6.5%	48.8%	49.9%	1.2%
1983	40.1%	33.7%	26.0%	48.3%	38.3%	13.2%	N	N	N
1998	55.4%	19.6%	24.9%	42.7%	28.3%	28.9%	36.2%	54.0%	9.7%
2007	60.7%	13.8%	25.3%	47.2%	17.2%	35.5%	32.3%	55.6%	11.9%
2017	54.3%	12.2%	33.4%	40.9%	6.9%	52.0%	32.7%	55.7%	11.5%
2023	60.0%	10.7%	29.1%	43.6%	3.2%	53.1%	36.6%	50.6%	12.6%



Figure 79: Removing the Rayya historical farm in Samaheej in 2015. Source: Al-Wasat News Paper

4.5.3 Recommendations and proposals: How to preserve and develop agricultural areas in Bahrain?

Agriculture is a key sector in the economies of many countries (Pawlak and Kołodziejczak, 2020). Many countries have relied on this sector to enhance food security and self-sufficiency (Gollin, 2023) (Chu, Peretto, Wang, 2022). Satellite images analysis and interviews in this chapter reveal that agriculture in Bahrain has faced significant challenges, resulting in a decline in its area and productivity. This has resulted in negative impacts on the economy, society, and the environment. According to the literature and interviews, other countries have adopted solutions to develop and improve the agricultural sector and its productivity such as Singapore. Based on the findings of the interviews and literature, recommendations and proposals are presented to preserve and develop agricultural areas in Bahrain.

a) Controlling urban expansion: Interviewees, specifically 2nd and 3rd participants, proposed solutions and proposals to control urban expansion and preserve agriculture in Bahrain. These proposals include reidentifying agricultural areas in Bahrain and placing them within classifications that protect them from urban expansion. The 3rd participants confirmed that some of these classifications already exist, but that there is no effective monitoring from governmental authorities to enforce these agricultural classifications. Moreover, he referred to Singapore as an example that adopted strict regulations to preserve and ensure the activation of agricultural areas, a practice that should be adopted in Bahrain [Fig. 82]. Furthermore, he called the Ministry of Housing to change its approach in providing housing services to adopt vertical architecture and other more dynamic methods in urban planning and abandon the current method of distributing housing units to preserve the current agricultural areas.

b) Water usage: The first participant emphasized that using traditional irrigation methods wastes water. While Shqlyh (1972) confirmed that 95% of agricultural areas in Bahrain depend on groundwater for irrigation, despite the increased salinity, according to the third participant. Bani (2020) explained that the irrigation methods used in Bahrain are: traditional surface irrigation, drip irrigation, sprinkler irrigation, and bubbles irrigation [Fig.80]. Bani (2020) recommended reducing groundwater use to 50% and implementing a water tariff of 15 fils per cubic meter. On the other hand, Alrowaili, Aldulaimi, Abdeldayem and Hasan (2024) recommended increasing the use of desalinated water, developing innovative solutions for using treated water for agricultural irrigation, supporting and encouraging the use of smart irrigation methods

and drip irrigation, and promoting modern and smart agricultural methods that rely on water efficiency.



Figure 80: Drip irrigation system. Source: www.snwa.com

c) Agriculture investment and farmers: The first participant advised individuals and developers to invest in agriculture by allocating spaces for agricultural investment projects, explaining that they can benefit from government support for these projects. Furthermore, the third participant suggested establishing companies specialized in agricultural investment, as these companies are stronger in facing local and global economic crises compared to individuals, provided that these companies receive support from banks specialized in the agricultural sector. The third participant also suggested that the government contribute more to agricultural investment through incentives, for example, by allocating 10% to 15% of agricultural land for investment and commercial use. Moreover, the 3rd participant suggested that the government expropriate agricultural lands and compensate the owners with other commercial lands if the owners do not wish to invest in these lands. The government would then make agricultural investments in these lands, thus contributing to providing jobs for the unemployed. Regarding farmers, the third participant explained that

Singapore has strengthened its human resources and exports them, and therefore emphasized that Bahrain (a country of farmers) needs to develop Bahraini farmers and create a new generation of them to develop the agricultural industry to compete with the engineering and medical sectors [Fig.81]. This matching Kan, Tosun, Kan, Dogan, Ucum & Solmaz (2019), as it was shown that government support for farmers has contributed to breathe new life into agriculture by encouraging youths.



Figure 81: Farmers training program. Source: www.canr.msu.edu

d) Smart agriculture: Participants proposed several ideas to promote smart agriculture. The 1st participant suggested a shift towards roof farming and sand-free farming, given that buildings constitute 70% of the area of populated areas, which could be used for productive cultivation of vegetables and fruits, not just for decorative purposes. He explained that this contributes to reducing heat transfer through roofs, cooling the atmosphere, rationalizing electricity consumption, and providing agricultural products. Quddus (2022) emphasized that roof farming is considered as an important method in providing agricultural products to

residents of populated cities, especially in countries with limited agricultural areas, which also contributes to reducing climate pollution [Fig.82]. The 2nd participant suggested focusing more on greenhouses (which have been adopted in some agricultural lands in Bahrain), as well as studying the feasibility of urban agriculture in Bahrain and the possibility of its implementation.

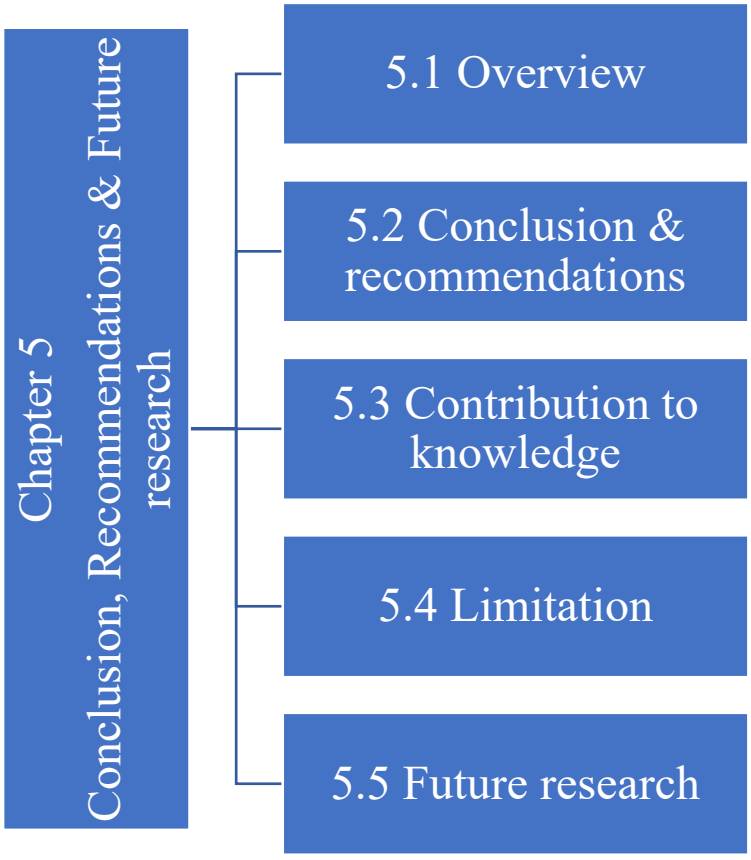


Figure 82: Car parking building roof turned to farm in Singapore. Source: https://qz.com/

e) Scientific research in sustainable urbanization, agriculture: The second participant emphasized the need for clear studies to preserve and develop agricultural areas in Bahrain. On the other hand, the first participant called for a fund to support innovation, creativity and find solutions to preserve agricultural areas which could also support scientific research in sustainable urbanization and agricultural preservation and development. This was confirmed by Evenson (1967) and Porceddu and Rabbige (1997), who emphasized that scientific research in the agricultural sector has significantly contributed to developing agricultural productivity, protecting the environment, and increasing the efficiency of land use.

f) Raising awareness: “As a society we need to have the awareness of the importance of green cities for societies and individuals” this was stated by the second participant. Therefore, it is particularly important to raise society awareness, whether at the individual or governmental level, to preserve the agricultural sector and contribute to urbanization in sustainable way without affecting other sectors. On this basis, Quddus (2022) stated the necessity of raising awareness and knowledge, which may be done, for example, through training and awareness programs.

CHAPTER FIVE: CONCLUSION, RECOMMENDATIONS & FUTURE RESEARCH



Chapter 5: Conclusion, Recommendations & Future Research

5.1 Overview

In the final chapter, the conclusion and recommendations of this thesis are presented in 5.2. The contribution to knowledge are presented in 5.3. The limitations of this thesis are presented in 5.4. The future research are presented in 5.5.

5.2 Conclusion & Recommendations

In conclusion, in conjunction with the changes occurring in the world generally and especially in our region economically, environmentally socially and politically. It is evident in Bahrain that urban expansion is one of the more significant challenges presented to the country. It is truly a hurdle in the face of Bahrain' sustainable development vision. It was confirmed that urban expansion in Bahrain has led to a significant decline in agricultural areas, which poses a major and direct threat to society, economy, and the environment. Therefore, there must be a serious stance to establish a new order of priorities in the process of sustainable development and the country's urban planning.

It is shown through the analysis of this thesis that there are social, economic and environmental dimensions behind the rapid increase of urban expansion and the decline of agricultural areas. Which are split into three sustainability dimensions.

From a social and legislative standpoint:

- The fast growth of the population, especially after the oil boom.
- The behaviors and lifestyles of the people were changed. where the demand has become for nuclear family houses.
- The government relies on the distribution of housing units and plots with no clear vision for vertical urbanization despite the country's limited geographic area.
- The weakness of governmental oversight regarding agricultural areas and their uses. Palm Tree Act as a prime example.

From an economic standpoint:

- Reliance on the oil industry, tourism, banking and other sectors.
- The diversity, availability and higher income of different professions in the country resulted in the absence of farmers.
- The unreasonable prices of lands in urban areas such as Manama & Muharraq.

From an environmental standpoint:

- The decline in groundwater levels in some agricultural lands while agriculture in Bahrain depends on groundwater by 95%.
- The increase in salinity in some areas in Bahrain such as the western area which is considered as an agricultural area.
- High summer temperatures, which damage some crops, leading to higher prices for these crops in the markets due to their scarcity and increased demand.

Urban expansion and the decline of agricultural areas has had numerous and notable results on society, economic and environmental security. The results have been divided accordingly:

Environmental results

- Significant decrease in agricultural areas. For example, agricultural areas in Samaheej used to be 58.4% of the total land in 1977. In 2023, it reached 3.2% of the total land only.
- Increase in pollution, gas emissions, and deteriorating air quality.
- Increase in groundwater salinity due to the irresponsible usage in housing projects and traditional irrigation methods.

Economic results

- A decline in the productivity of the agricultural sector, which has resulted in a greater reliance on food imports, posing a significant threat to the country's food security, as food prices are now linked to global markets.
- The country's reliance is limited to a few, undiversified sectors, such as the oil sector.
- Livestock is affected by the shortage of agricultural products and crops.

Social results

- Land shortages due to the country's small geographic area which is considered as a major problem in the future for next generations.

- A significant increase in land prices, which is difficult for individuals in order to purchase lands.
- The decline in the agricultural workforce is a looming threat to farming as a traditional Bahraini profession.

To counter these negative trends, this thesis is presenting important proposals and recommendations that could be a major step toward sustainability in the country if implemented.

- Restructuring the plans of urban planning of governmental authorities, especially the legislations of UPDA and the Ministry of Municipalities and Agriculture.
- Impose strict oversight from the governmental authorities to preserve agricultural areas and to pursue vertical architecture.
- Encouraging investment in agriculture and providing the necessary government support.
- Supporting local farmers and working to develop them and create a new generation of them to enhance the economy, decrease unemployment rate and to preserve farming as a traditional profession and identity of Bahrainis'.
- Inventing modern smart methods for agriculture and water consumption, such as vertical-farming, roof-farming, urban agriculture, and the use of smart economical irrigation technologies were many research were conducted for this manner such as (Elghonaimy and Albadal, 2021) & (Alrowaili, Aldulaimi, Abdeldayem & Hasan, 2024).
- Supporting scientific research regarding sustainable methods of urban planning and agriculture through moral and financial support

to researchers. As well as providing incentives and awards for researchers.

- Raise awareness of individuals and the government to preserve and enhance the agricultural sector by comprehensive long-term strategies.

As per Amato and Simonetti (2021) and (Unay-Gailhard, Chaskin and Brennan (2025), these strategies and recommendations may be applied as follows:

- In rooftop farming, which contributes to utilizing urban rooftops to produce food, enhance green cover, and reduce urban heat island effect. The implementation may be through the following steps:
    - Feasibility assessment by assessing the suitability of the roof for farming (load bearing capacity, location and drainage suitability).
    - Incorporate rooftop farming into architectural design, including waterproofing, drainage, and access pathways. Moreover, including seating, shading, and green spaces for community use where appropriate.
    - Integration with urban environment by providing design for aesthetic value and biodiversity, creating habitats that attract pollinators and enhance the microclimate. Furthermore, link rooftop farms to community centers, markets, or green corridors where possible.
- In smart irrigation systems, which contribute to enhance water efficiency in urban green spaces and agricultural projects. The implementation may be through the following steps:

    - Design integration by incorporating smart irrigation infrastructure into landscape design.
    - Technological compatibility by choosing technologies that integrate seamlessly with existing infrastructure along with planning for easy maintenance access.
    - Sustainable and monitoring to minimize water waste and promote sustainable water management system.
- As for rising societal awareness, to effectively raise awareness among both the community and the government about the significance of preserving agriculture lands—and to encourage urban agriculture and greenification—it is crucial to align these efforts with Bahrain's Vision 2030. Through a combination of public awareness campaigns, including social media initiatives, workshops, and educational programs, communities can learn about the environmental, social, and economic advantages of sustainable agriculture and green spaces. Additionally, emphasizing the contribution of these initiatives to economic diversification, environmental sustainability, and quality of life—key pillars of Vision 2030—can strengthen their impact. Engaging policymakers through forums and workshops can also support the development of regulations and incentives that facilitate the integration of agriculture and green projects into urban planning. Ultimately, fostering a culture that values agriculture and green spaces, and involving citizens in local projects, can enable both the community and the government to collaboratively achieve Bahrain's sustainable development goals.

In the end, this thesis emphasizes the critical role of preserving agricultural areas is of the utmost importance, especially in facing global economic and environmental changes. Agriculture is important for food security and providing a secure environment for people. Therefore, there must be cooperation between the public, private, and society sectors to preserve and develop agriculture, prioritizing scientific research and innovation. The challenge is significant for society and the government, but the opportunity still exists. With hard work, it is possible to preserve and develop the remaining parts of agricultural areas and achieve sustainable solutions.

5.3 Contribution to knowledge

This thesis contributes to knowledge through using mixed research methods, including satellite imagery mapping and thematic analysis, which resulted in comprehensive recommendations and proposals for urban planning in Bahrain. The research also presents, for the first time, a historical narrative of urban expansion in Bahrain, its patterns, and causes, particularly for the city of Manama. Furthermore, historical satellite images were presented for the first time, some of which were taken in 1968. In addition, sketches were drawn, presented for the first time to describe the types of agricultural areas and lands of Bahrain.

5.4 Limitations

The thesis faced some limitations such as:

- The limitations in the number of data (studied areas) given by SLRB (only three areas).

- The CRPEP registered urban planning private offices were limited to three only.
- GIS could not be used in this thesis due to the images format and the need of layering for the images which takes long time for analysis.
- The analysis of the satellite imagery may be affected due to the resolution and quality of the given satellite imagery (especially the old ones). Moreover, seasonal variations might affect the analysis. On the other hand, human error may occur in using AutoCAD for analyzing the data.

5.5 Future research

Based on this thesis, future research could be conducted for:

- Exploring other dimensions of urban expansion and its impact on marine resources in Bahrain.
- Urban and smart agriculture and their potential application in Bahrain.
- The zoning of Bahrain and its alignment with sustainability.
- The adoption of vertical urbanization in Bahrain.

The future researches could use different types of instruments in analyzing data such as GIS to improve data reliability and minimizing human error.

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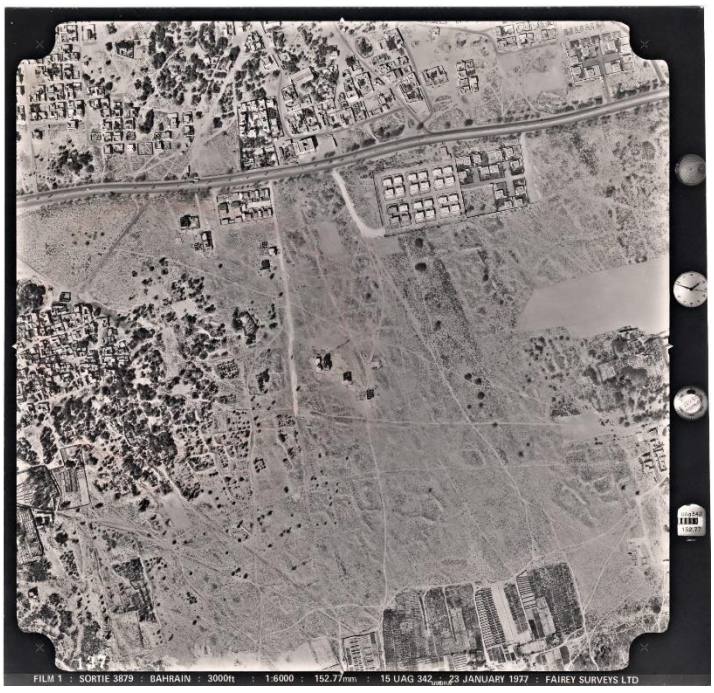
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7.0 Appendices

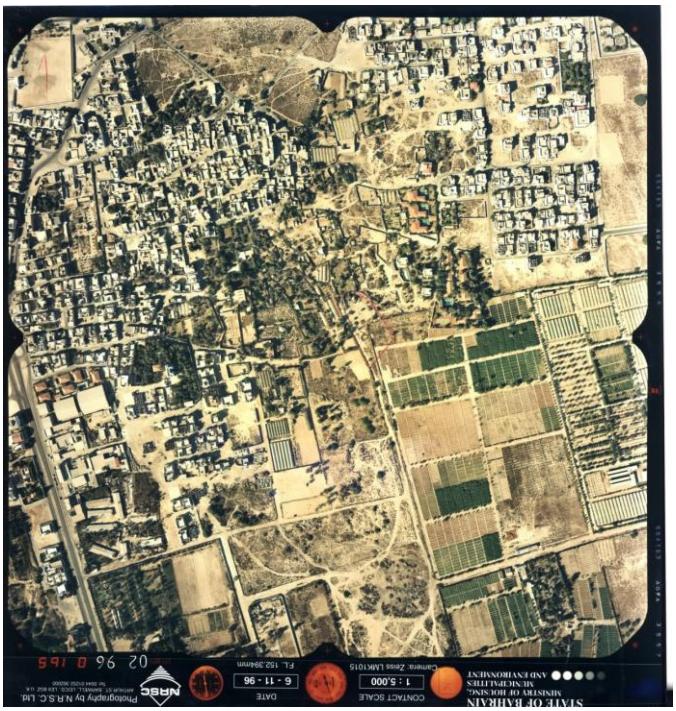
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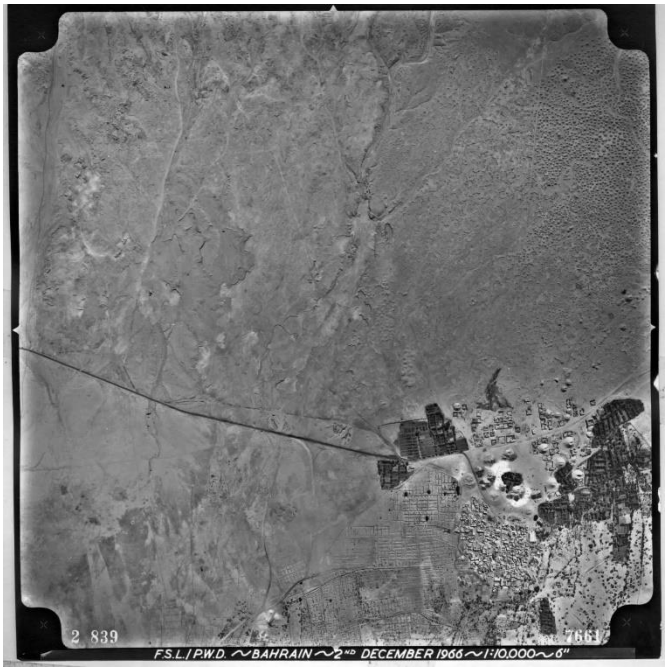


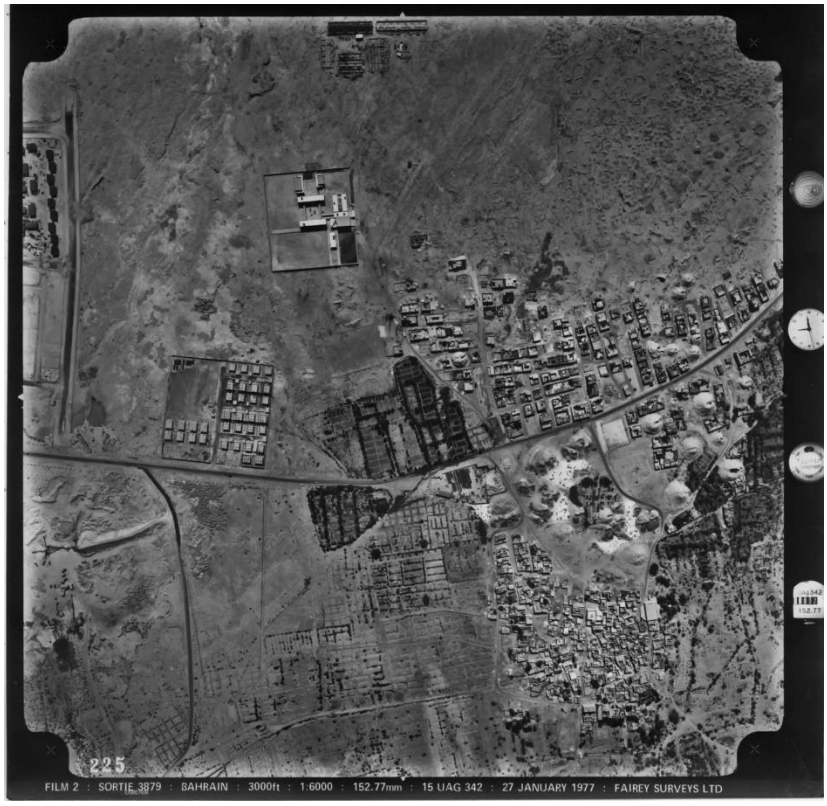

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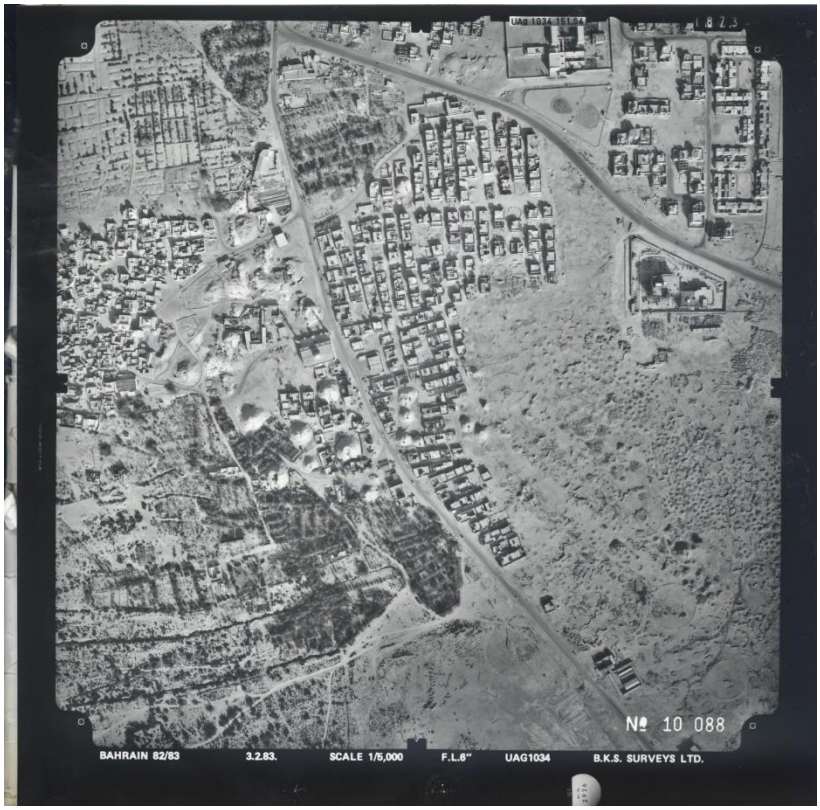

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MINISTRY OF HOUSING
BAHRAIN - BLOCK 3/4
DEVELOPED AREA



Appendix 2: Satellite images of Aali




225
FILM 2 : SORTIE 3879 : BAHRAIN : 3000ft : 1:6000 : 152.77mm : 15 UAG 342 : 27 JANUARY 1977 : FAIREY SURVEYS LTD


№ 10 088
BAHRAIN 82/83 3.2.83. SCALE 1/5,000 F.L.6" UAG1034 B.K.S. SURVEYS LTD.


No 03 041
BAHRAIN 82/83
14.01.83.
SCALE 1/5,000
F.L.6"
UAG1034
B.K.S. SURVEYS LTD.


005 91 158
GEONEX
92-94 CHURCH ROAD,
MITCHAM, SURREY
CONTACT SCALE
1:5,000
DATE
18/4/91
MINISTRY OF HOUSING
BAHRAIN - BLOCK 3/4
DEVELOPED AREA

Appendix 3: Area usages analysis table.

Example: Segaya 1968	Study area in Hectare: -	
Usage	Area in Ha	Percentage from the selected area
Agricultural area	-	-
Built-up area	-	-
Roads and empty lands	-	-
Total	-	-

Appendix 4: Interview form

URBAN EXPANSION AND ITS IMPLICATIONS UPON AGRICULTURAL LANDS IN BAHRAIN: A PLANNING PERSPECTIVE

INTERVIEW FORM

Interviewee:
Specialization:

Qualifications:

Experience:

Researches:

Questions & answers:

1. **Question:** According to Shebeb (2006), agriculture in Bahrain considered as a primary sector but, starting from 1970s it declined dramatically. Is agriculture in Bahrain remains as a primary sector? Why?

   Answer:

2. **Question:** According to Lorimer (1915), Bahrain Rural areas in 1910s are mostly composed of palm trees. were there other types of trees and crops? What are they?

Answer:

3. **Question:** Shebeb (2006), confirmed that cultivation was a primary source of Bahraini income. Is cultivation remains as main source of income? Why?

   Answer:

4. **Question:** According to Fuccaro (2000), rapid urban expansion led to decline in agricultural areas in Bahrain. When did the decline begin? What are the environmental, economic and social reasons?

   Answer:

5. **Question:** Many researchers in urbanization such as, Fazal (2000), Youssef, Sewilam, Khadar (2020), Catalán, Sauri, Serra(2008) confirmed that urban expansion in many countries led to extinct agriculture. In many cases, such as Youssef, Sewilam, Khadar (2020) case in Cairo, agricultural areas turned to houses projects. Did this phenomenon happen to agricultural areas in Bahrain?

   Answer:

6. **Question:** According to Al-Tarawneh (2014), the decline of agricultural will cause in negative impact on the economy. Has the decline of agricultural areas affected the Bahraini economy? If yes, What are the negative effects on the Bahraini economy?

Answer:

Question: Singapore contributed to enhance agriculture and food security by adopting several technologies such as vertical farming, urban farming and other alternative food sources (Mok, Tan, Chen, 2020). What is the role of Bahraini Government in contributing to enhance agriculture?

Answer:

7. **Question:** What is the role of traders, the real-estate companies, banks and investors in contributing to solve this issue?

   Answer:

8. **Question:** What proposals can be put forward to preserve and develop agricultural areas in Bahrain?

   Answer:

Appendix 5: The request of the data from the student to SLRB.

Gmail

Mohamed Ali <mohamedali.bh94@gmail.com>

طلب معلومات لرسالة ماجستير بجامعة البحرين
8 messages

Mohamed Ali <mohamedali.bh94@gmail.com> Fri, Apr 26, 2024 at 8:58 PM
To: "Mmurbati@slrb.gov.bh" <Mmurbati@slrb.gov.bh>

الأخ المهندس/ محمد عبدالغفار المرباطي المحترم ،
تحية طيبة وبعد،

لقد قمت بزيارتكم قبل عدة اشهر في مكتبكم بإدارة المسح الطبوغرافي بخصوص بحثي الخاص بالماجستير (تخصص العمارة - التصميم الحضري) بغرض طلب معلومات لرسالة الماجستير ، وقد لقيت ترحيباً وتعاوناً منكم بهذا الخصوص ، وهذا ما يدل على حرصكم واهتمامكم بتطوير البحث العلمي بمملكة البحرين والذي يصب في الوصول لرؤية البحرين 2030.

وعليه ، في المرفق رسالة تشرح المطلوب من البحث ورسالة اخرى من المشرف على الرسالة البروفيسور إسلام الغنيمي.
نتطلع للرد منكم بأقرب فرصة ،

للتواصل على النقال: 37473477

مع جزيل الشكر،
م. محمد حسين عبدالله

letter to SLRB.pdf
263K

Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh> Thu, Jun 6, 2024 at 3:08 PM
To: Mohamed Ali <mohamedali.bh94@gmail.com>
Cc: Ahmed Fathi Ebrahim Al Thawadi <AhmedAlThawadi@slrb.gov.bh>

السلام عليكم ورحمه الله وبركاته

المهندس محمد حسين عبدالله المحترم

شكراً لك على ثقتك بجهاز المساحة والتسجيل العقاري
في إطار التعاون مع الطلاب والباحثين وبعد مراجعة طلبكم المقدم
وعليه فإن الإدارة سوف تقوم بتوفير صور جوية لثلاث مناطق بحسب اختياركم على ان لا تتجاوز المنطقة الواحدة 1كم مربع (لأكثر من سنة بحسب توافرها)
برجاء ارسال المناطق المطلوبة او طلب تحديد موعد لزيارتنا ليتم تحديد المناطق معنا
ولكم جزيل الشكر

م. محمد عبدالغفار
المرباطي

Eng. Mohamed
AL Murbati

رئيس عمليات مسح
البيانات الجيومكانية

Chief of Geospatial
Data Survey

إدارة المسح الطبوغرافي

جهاز المساحة والتسجيل
العقاري

Topographic Survey
Directorate

Survey & Land
Registration Bureau

Tel: 17515321
Mob: 36333629
PO Box. 332, Manama,
Kingdom of Bahrain

25 أعوام وعطاء

جهاز المساحة والتسجيل العقاري
Survey & Land Registration Bureau

[Quoted text hidden]

Mohamed Ali <mohamedali.bh94@gmail.com> Sat, Jun 15, 2024 at 12:42 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>

الأخ الفاضل المهندس/ محمد عبدالغفار المرباطي المحترم،
رئيس عمليات مسح البيانات الجيومكانية،
إدارة المسح الطبوغرافي بجهاز المساحة والتسجيل العقاري،

تحية طيبة وبعد،

بداية أود شكركم على قبولكم التعاون معي في بحثي الخاص بالماجستير ، وهذا ما يدل على حرصكم على تطوير البحث العلمي بمملكة البحرين. عطفاً على ردكم الأخير ، أود تحديد موعد معكم لتحديد المناطق المطلوبة للبحث.

مع جزيل الشكر والتقدير
م. محمد حسين عبدالله

[Quoted text hidden]

Mohamed Ali <mohamedali.bh94@gmail.com> Thu, Jun 20, 2024 at 12:10 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>

تذكير
وكل عام وانتم بخير

[Quoted text hidden]

Mohamed Ali <mohamedali.bh94@gmail.com> Tue, Jul 2, 2024 at 9:16 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>

السلام عليكم ورحمة الله وبركاته،
الأخ الفاضل المهندس/ محمد عبدالغفار المرباطي المحترم،
تحية طيبة وبعد،

تواصل معي الأخ العزيز المهندس خالد قمبر الأسبوع الماضي لترتيب موعد بخصوص المعلومات المطلوبة ، وبالفعل قمت بالإجتماع مع المهندس خالد وقمنا بتحديد ثلاث مناطق (لا تزيد عن 1 كم مربع لكل منطقة) حسب المطلوب. وطلب مني المهندس خالد اعلامكم بذلك وتحديد السنوات المطلوبة للصور. وعليه ، فإن السنوات المطلوبة للبحث هي:

1- صورة في الستينات 1960s
2- صورة في السبعينات 1970s
3- صورة في الثمانينات 1980s
صورة في التسعينات 1990s

اي ، 4 صور لكل منطقة (بمجموع 12 صورة لكل المناطق) ، و إن تمكنتم بتوفير المزيد فذلك يدعم البحث العلمي.

لأي تفاصيل إضافية ، ارجوا التواصل معي.

ولكم جزيل الشكر والإمتنان،
م. محمد حسين

[Quoted text hidden]

Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh> Thu, Jul 4, 2024 at 10:04 AM
To: Mohamed Ali <mohamedali.bh94@gmail.com>

السلام عليكم

الأخ العزيز المهندس محمد حسين المحترم

بعد مراجعة المناطق المطلوبة من قبلكم وبحث مدى توافر المعلومات

نرفق لكم المناطق التالية:

سماهيج

العدلية

المالكية (لا يمكن توفيرها)

وفي حال الحاجة الى منطقة إضافية يرجى تزويدنا بالموقع المطلوب من خلال خرائط قوقل وارسالها لنا بحسب الاشتراطات السابقة

لا تتردد في التواصل معنا





م. محمد عبدالغفار المرباطي

Eng. Mohamed AL Murbati

رئيس عمليات مسح البيانات الجيومكانية

Chief of Geospatial Data Survey

إدارة المسح الطبوغرافي

جهاز المساحة والتسجيل العقاري

Topographic Survey Directorate

Survey & Land Registration Bureau

Tel: 17515321
Mob: 36333629
PO Box. 332, Manama,
Kingdom of Bahrain

From: Mohamed Ali <mohamedali.bh94@gmail.com>
Sent: Tuesday, 2 July, 2024 9:17 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>
Subject: Re: طلب معلومات لرسالة ماجستير بجامعة البحرين

السلام عليكم ورحمة الله وبركاته،

الأخ الفاضل المهندس/ محمد عبدالغفار المرباطي المحترم،

تحية طيبة وبعد،

تواصل معي الأخ العزيز المهندس خالد قمبر الأسبوع الماضي لترتيب موعد بخصوص المعلومات المطلوبة ، وبالفعل قمت بالإجتماع مع المهندس خالد وقمنا بتحديد ثلاث مناطق (لا تزيد عن 1 كم مربع لكل منطقة) حسب المطلوب. وطلب مني المهندس خالد اعلامكم بذلك وتحديد السنوات المطلوبة للصور. وعليه ، فإن السنوات المطلوبة للبحث هي:

1- صورة في الستينات s1960

2- صورة في السبعينات s1970

3- صورة في الثمانينات s1980

صورة في التسعينات s1990

اي ، 4 صور لكل منطقة (بمجموع 12 صورة لكل المناطق) ، و إن تمكنتم بتوفير المزيد فذلك يدعم البحث العلمي.

لأي تفاصيل إضافية ، ارجوا التواصل معي.

ولكم جزيل الشكر والإمتنان،

م. محمد حسين

On Thu, Jun 20, 2024 at 12:10 PM Mohamed Ali <mohamedali.bh94@gmail.com> wrote:

> تذكير
>
> وكل عام وانتم بخير

On Sat, 15 Jun 2024, 12:42 pm Mohamed Ali, <mohamedali.bh94@gmail.com> wrote:

> الأخ الفاضل المهندس/ محمد عبدالغفار المرباطي المحترم،
>
> رئيس عمليات مسح البيانات الجيومكانية،
>
> إدارة المسح الطبوغرافي بجهاز المساحة والتسجيل العقاري،
>
> تحية طيبة وبعد،
>
> بداية أود شكركم على قبولكم التعاون معي في بحثي الخاص بالماجستير ، وهذا ما يدل على حرصكم على تطوير البحث العلمي بمملكة البحرين. عطفاً على ردكم الأخير ، أود تحديد موعد معكم لتحديد المناطق المطلوبة للبحث.
>
> مع جزيل الشكر والتقدير
>
> م. محمد حسين عبدالله

On Thu, Jun 6, 2024 at 3:08 PM Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh> wrote:

> > السلام عليكم ورحمه الله وبركاته
> >
> > المهندس محمد حسين عبدالله المحترم
> >
> > شكراً لك على ثقتك بجهاز المساحة والتسجيل العقاري
> > في إطار التعاون مع الطلاب والباحثين وبعد مراجعة طلبكم المقدم
> > وعليه فإن الإدارة سوف تقوم بتوفير صور جوية لثلاث مناطق بحسب اختياركم على ان لا تتجاوز المنطقة الواحدة 1كم مربع
> > (لأكثر من سنة بحسب توافرها)

برجاء ارسال المناطق المطلوبة او طلب تحديد موعد لزيارتنا ليتم تحديد المناطق معنا

ولكم جزيل الشكر

م. محمد عبدالغفار المرباطي

Eng. Mohamed AL Murbati

رئيس عمليات مسح البيانات الجيومكانية

Chief of Geospatial Data Survey

إدارة المسح الطبوغرافي

جهاز المساحة والتسجيل العقاري

Topographic Survey Directorate

Survey & Land Registration Bureau

Tel: 17515321
Mob: 36333629
PO Box. 332, Manama,
Kingdom of Bahrain

25 أعوام وعطاء

جهاز المساحة والتسجيل العقاري
Survey & Land Registration Bureau

From: Mohamed Ali <mohamedali.bh94@gmail.com>
Sent: Friday, 26 April, 2024 8:59 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>
Subject: طلب معلومات لرسالة ماجستير بجامعة البحرين

الأخ المهندس/ محمد عبدالغفار المرباطي المحترم ،

تحية طيبة وبعد،

لقد قمت بزيارتكم قبل عدة اشهر في مكتبكم بإدارة المسح الطبوغرافي بخصوص بحثي الخاص بالماجستير (تخصص العمارة - التصميم الحضري) بغرض طلب معلومات لرسالة الماجستير ، وقد لقيت ترحيباً وتعاوناً منكم بهذا الخصوص ، وهذا ما يدل على حرصكم واهتمامكم بتطوير البحث العلمي بمملكة البحرين والذي يصب في الوصول لرؤية البحرين 2030.

وعليه ، في المرفق رسالة تشرح المطلوب من البحث ورسالة اخرى من المشرف على الرسالة البروفيسور إسلام الغنيمي.

نتطلع للرد منكم بأقرب فرصة ،

للتواصل على النقال: 37473477

مع جزيل الشكر،

م. محمد حسين عبدالله

2 attachments

Samaheej_over_years.pdf
11821K

Adliyah_Over_Years.pdf
13406K

Mohamed Ali <mohamedali.bh94@gmail.com> Sat, Jul 20, 2024 at 9:40 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>

الفاضل المهندس/ محمد عبدالغفار المرباطي المحترم،
تحية طيبة وبعد،

كل الإمتنان لكم على تعاونكم بتوفير الصور المطلوبة لمنطقتي العدلية وسماهيج وسوف يساهم ماقمتم بتوفيره في خدمة البحث. وهنا ارفق لكم المنطقة الثالثة المطلوبة (منطقة الجسرة بمساحة 1كم مربع) في المحافظة الشمالية والتي ارجوا منكم توفيرها وذلك لتغطية البحث من كل الجوانب.

مع جزيل الشكر والإمتنان،
م. محمد حسين عبدالله

[Quoted text hidden]



jasra.jpg
695K

Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh> Sun, Jul 28, 2024 at 3:30 PM
To: Mohamed Ali <mohamedali.bh94@gmail.com>

الأخ العزيز المهندس محمد حسين المحترم

بعد مراجعة المناطق المطلوبة من قبلكم وبحث مدى توافر المعلومات وبحسب المكالمة الهاتفية بيننا فإنه تعذر علينا توفير المعلومات المطلوبة للموقع المحدد من قبلكم

وعليه فقد تم توفير موقع مقارب للمواصفات المطلوبة في منطقة باربار للسنوات 1968 و1977 و1983 و1998 و2007 و2017 و2023 بحسب طلبكم

ولكم جزيل الشكر

م. محمد عبدالغفار
المرباطي

Eng. Mohamed
AL Murbati

رئيس عمليات مسح
البيانات الجيومكانية

جهاز المساحة والتسجيل العقاري
Survey & Land Registration Bureau

Chief of Geospatial Data Survey

إدارة المسح الطبوغرافي

جهاز المساحة والتسجل العقاري

Topographic Survey Directorate

Survey & Land Registration Bureau

Tel: 17515321
Mob: 36333629
PO Box. 332, Manama,
Kingdom of Bahrain

From: Mohamed Ali <mohamedali.bh94@gmail.com>
Sent: Saturday, 20 July, 2024 9:41 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>
Subject: Re: طلب معلومات لرسالة ماجستير بجامعة البحرين

الفاضل المهندس/ محمد عبدالغفار المرباطي المحترم،

تحية طيبة وبعد،

كل الإمتنان لكم على تعاونكم بتوفير الصور المطلوبة لمنطقتي العدلية وسماهيج وسوف يساهم ماقمتم بتوفيره في خدمة البحث.
وهنا ارفق لكم المنطقة الثالثة المطلوبة (منطقة الجسرة بمساحة 1كم مربع) في المحافظة الشمالية والتي ارجوا منكم توفيرها وذلك لتغطية البحث من كل الجوانب.

مع جزيل الشكر والإمتنان،

م. محمد حسين عبدالله

On Thu, Jul 4, 2024 at 10:04 AM Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh> wrote:

السلام عليكم

الأخ العزيز المهندس محمد حسين المحترم

بعد مراجعة المناطق المطلوبة من قبلكم وبحث مدى توافر المعلومات

نرفق لكم المناطق التالية:

سماهيج

العدلية

المالكية (لا يمكن توفيرها)

وفي حال الحاجة الى منطقة إضافية يرجى تزويدنا بالموقع المطلوب من خلال خرائط قوقل وارسالها لنا بحسب الاشتراطات السابقة

لا تتردد في التواصل معنا

جهاز المساحة والتسجيل العقاري
Survey & Land Registration Bureau

م. محمد عبدالغفار المرباطي

Eng. Mohamed AL Murbati

رئيس عمليات مسح البيانات الجيومكانية

Chief of Geospatial Data Survey

إدارة المسح الطبوغرافي

جهاز المساحة والتسجيل العقاري

Topographic Survey Directorate

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Tel: 17515321
Mob: 36333629
PO Box. 332, Manama,
Kingdom of Bahrain

From: Mohamed Ali <mohamedali.bh94@gmail.com>
Sent: Tuesday, 2 July, 2024 9:17 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>
Subject: Re: طلب معلومات لرسالة ماجستير بجامعة البحرين

السلام عليكم ورحمة الله وبركاته،

الأخ الفاضل المهندس/ محمد عبدالغفار المرباطي المحترم،

تحية طيبة وبعد،

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1- صورة في الستينات s1960

2- صورة في السبعينات s1970

3- صورة في الثمانينات s1980

صورة في التسعينات s1990

اي ، 4 صور لكل منطقة (بمجموع 12 صورة لكل المناطق) ، و إن تمكنتم بتوفير المزيد فذلك يدعم البحث العلمي.

لأي تفاصيل إضافية ، ارجوا التواصل معي.

ولكم جزيل الشكر والإمتنان،

م. محمد حسين

On Thu, Jun 20, 2024 at 12:10 PM Mohamed Ali <mohamedali.bh94@gmail.com> wrote:

تذكير

وكل عام وانتم بخير

On Sat, 15 Jun 2024, 12:42 pm Mohamed Ali, <mohamedali.bh94@gmail.com> wrote:

الأخ الفاضل المهندس/ محمد عبدالغفار المرباطي المحترم،

رئيس عمليات مسح البيانات الجيومكانية،

إدارة المسح الطبوغرافي بجهاز المساحة والتسجيل العقاري،

تحية طيبة وبعد،

بداية أود شكركم على قبولكم التعاون معي في بحثي الخاص بالماجستير ، وهذا ما يدل على حرصكم على تطوير البحث العلمي بمملكة البحرين. عطفاً على ردكم الأخير ، أود تحديد موعد معكم لتحديد المناطق المطلوبة للبحث.

مع جزيل الشكر والتقدير

م. محمد حسين عبدالله

On Thu, Jun 6, 2024 at 3:08 PM Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh> wrote:

السلام عليكم ورحمه الله وبركاته

المهندس محمد حسين عبدالله المحترم

شكراً لك على ثقتك بجهاز المساحة والتسجيل العقاري
في إطار التعاون مع الطلاب والباحثين وبعد مراجعة طلبكم المقدم
وعليه فإن الإدارة سوف تقوم بتوفير صور جوية لثلاث مناطق بحسب اختياركم على ان لا تتجاوز المنطقة الواحدة 1كم مربع (لأكثر من سنة بحسب توافرها)
برجاء ارسال المناطق المطلوبة او طلب تحديد موعد لزيارتنا ليتم تحديد المناطق معنا
ولكم جزيل الشكر





م. محمد عبدالغفار المرباطي

Eng. Mohamed AL Murbati

رئيس عمليات مسح البيانات الجيومكانية

Chief of Geospatial Data Survey

إدارة المسح الطبوغرافي

جهاز المساحة والتسجيل العقاري

Topographic Survey Directorate

Survey & Land Registration Bureau

Tel: 17515321
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PO Box. 332, Manama,
Kingdom of Bahrain

From: Mohamed Ali <mohamedali.bh94@gmail.com>
Sent: Friday, 26 April, 2024 8:59 PM
To: Mohamed A Ghaffar AL Murbati <mmurbati@slrb.gov.bh>
Subject: طلب معلومات لرسالة ماجستير بجامعة البحرين

الأخ المهندس/ محمد عبدالغفار المرباطي المحترم ،

تحية طيبة وبعد،

لقد قمت بزيارتكم قبل عدة اشهر في مكتبكم بإدارة المسح الطبوغرافي بخصوص بحثي الخاص بالماجستير (تخصص العمارة - التصميم الحضري) بغرض طلب معلومات لرسالة الماجستير ، وقد لقيت ترحيباً وتعاوناً منكم بهذا الخصوص ، وهذا ما يدل على حرصكم واهتمامكم بتطوير البحث العلمي بمملكة البحرين والذي يصب في الوصول لرؤية البحرين 2030.

وعليه ، في المرفق رسالة تشرح المطلوب من البحث ورسالة اخرى من المشرف على الرسالة البروفيسور إسلام الغنيمي.

نتطلع للرد منكم بأقرب فرصة ،

للتواصل على النقال: 37473477

مع جزيل الشكر،

م. محمد حسين عبدالله

Barbar_over_the_years.pdf
11768K

Appendix 6: The official letter from the thesis supervisor (Prof. Islam AL-Ghonaimy) to SLRB.



UNIVERSITY OF BAHRAIN
College of Engineering
Dept. of Architecture & Interior Design

جامعة البحرين
كلية الهندسة
قسم العمارة والتصميم الداخلي

التاريخ :2024/02/26

السادة/ إدارة المسح الطبوغرافي المحتـــــرم
جهاز المساحة والتسجيل العقاري ،
تحية طيبة وبعد ،

الموضوع : طلب معلومات لبحث ماجستير في تخصص العمارة – كلية الهندسة

الأخوة الكرام ، كل الشكر والتقدير لكم على جهودكم المبذولة في التعاون مع جامعة البحرين في بحوث الطلبة وذلك عبر المساعدة بتوفير المعلومات التي تساهم في عمل البحوث العلمية والتي تصب في تطوير الأعمال العلمية والأكاديمية في مملكة البحرين. ومن هنا نرجوا منكم التكرم بمساعدة الطالب: محمد حسين عبدالله حسين محمد علي (941003710) المسجل ببرنامج الماجستير بقسم العمارة والتصميم الداخلي بكلية الهندسة جامعة البحرين وذلك بتوفير المعلومات المتعلقة ببحث الماجستير الخاص به.
مع تعهد الطالب بسرية التعامل مع المعلومات وان تكون فقط لخدمة برنامج الماجستر الخاص به والتزامه باطلاعكم علي تعامله مع المعلومات التي ستزودونها له في المجال الاكاديمي فقط
ولكم منا جزيل الشكر والامتنان.

المشرف علي الطالب : أ. د. إسلام حمدي الغنيمي

المشرف علي برنامج عمارة البيئة - قسم العمارة والتصميم الداخلي
كلية الهندسة بجامعة البحرين

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صندوق بريد: ٣٢٠٣٨ - مملكة البحرين
هاتف: ١٧٨٧٦٦٤٨ / ١٧٨٧٦٦٤٧ / ١٧٨٧٦٦٤٦ (+٩٧٣)
فاكس: ١٧٦٨٣٨٠٥ (+٩٧٣)

Appendix 7: The official letter from the student to SLRB.

2024/04/26

السادة/إدارة المسح الطبوغرافي المحترميـــن

جهاز المساحة والتسجيل العقاري،

تحية طيبة وبعد،

الموضوع : طلب معلومات لبحث ماجستير في تخصص العمارة – كلية الهندسة

الأخوة الكرام ، لكم كل الشكر والتقدير على تعاونكم الكبير مع الباحثين والطلاب والذي يساهم في إثراء البحوث العلمية في مملكة البحرين.

عطفاً على الرسالة المرفقة من أ.د. إسلام حمدي الغنيمي (المشرف على بحثي في برنامج الماجستير في العمارة بجامعة البحرين) بخصوص طلب معلومات لبحث الماجستير في تخصص العمارة ، ارجوا منكم التكرم بمساعدتي بتوفير صور من الأقمار الصناعية أو صور جوية لبعض المناطق في مملكة البحرين على عدة فترات لكل منطقة (عشر سنوات تقريباً) وذلك بدءاً من الأقدم حتى الأحدث حتى عام 2000م. على سبيل المثال: منطقة المالكية ، الصور في سنة 1960 ، 1970 ، 1980 ، 1990.

المناطق المطلوبة في الجدول التالي:

المحافظة	المجمعات
العاصمة	توبلي ، سترة ، العدلية ، السقية
المحرق	عراد ، سماهيج ، الدير
الشمالية	جبلة حبشي ، المالكية ، كرانة ، كرزكان ، باربار
الجنوبية	دار كليب

في المرفق:

- رسالة من الدكتور المشرف على الرسالة.

للتواصل معي على:

نقال: 37473477 و 33123789

ايميل: Mohamedali.bh94@gmail.com

مع جزيل الشكر والإمتنان ،



م. محمد حسين عبدالله

202012479

طالب دراسات عليا بجامعة البحرين

Appendix 8: Interview script 1

URBAN EXPANSION AND ITS IMPLICATIONS UPON AGRICULTURAL LANDS IN BAHRAIN: A PLANNING PERSPECTIVE

INTERVIEW NUMBER 1

Interviewee: Mr. Oun Ali Al-Khunaizi.

Specialization: Urban Planning.

Qualifications:

- Bachelors in urban planning / Al-Azhar University (1984).
- Master of Planning Studies / New Castle University (1994).

Experience:

- Urban Planner in Ministry of Housing / Bahrain till 2004.
- Director of Jaafariya Waqf Directorate 2004 – 2007.
- Technical consultant of the minister of municipalities 2007 – 2009.
- Founder of Madaen – Urban Planning & Civil Engineering 2009 - yet.

Researches:

- Urban Growth rings in Muharraq

Questions & answers:

1. **Question:** According to Shebeb (2006), agriculture in Bahrain considered as a primary sector but, starting from 1970s it declined dramatically. Is agriculture in Bahrain remains as a primary sector? Why?

   Answer: Of course, in the past and until now in somehow the villages are all agricultural areas. The country is an agricultural country. Moreover, there are coasts so, there is a fishing profession along with the urban potential of Manama, Muharraq and the other towns.

2. **Question:** According to Lorimer (1915), Bahrain Rural areas in 1910s are mostly composed of palm trees. were there other types of trees and crops? What are they?

   Answer: I lived in rural areas and I remember between 1960s to 1970s I used to walk from Noaim to Jidhafs through farms. I remember there are different types of trees such as almond trees, mango trees, Seder trees (Ziziphus spina-christi) and the other local trees. Moreover, there are leafy plants, vegetables alongside with plam trees. But, I never seen a farm only for plam trees. For example, in Saudi Arabia and USA I saw some farms are only for a specific type of tree but, I never seen this in Bahrain. Therefore, there is a diversity in the types of trees. On the other hand, and there is a density of the plam trees in the Bahraini agricultural areas.

3. **Question:** Shebeb (2006), confirmed that cultivation was a primary source of Bahraini income. Is cultivation remains as main source of income? Why?

   Answer: The country consists of coasts and agriculture. In the past before 1960s, the main sources of income are farming, fishing and pearl diving and still the fishing is one of the main income sources for many Bahrainis fishermen even after urbanization and the oil boom.

4. **Question:** According to Fuccaro (2000), rapid urban expansion led to decline in agricultural areas in Bahrain. When did the decline begin? What are the environmental, economic and social reasons?

   Answer: I wouldn't call it a decline, there are professions with higher income that attracts more especially after the oil boom in 1960s. Such as the industrial and managerial professions because the country became a center of managerial businesses. Moreover, the education rate in the country is very high and the educational missions have been around since 1940s and 1950s. Therefore, there are engineers, doctors, bankers etc. Multiple segment of society went to these professions. It doesn't mean that they have left farming but, agriculture have its investors. In addition to that, the need of housing projects which were built in the boarders of the agricultural areas.

5. **Question:** Many researchers in urbanization such as, Fazal (2000), Youssef, Sewilam, Khadar (2020), Catalán, Sauri, Serra(2008) confirmed that urban expansion in many countries led to extinct

agriculture. In many cases, such as Youssef, Sewilam, Khadar (2020) case in Cairo, agricultural areas turned to houses projects. Did this phenomenon happen to agricultural areas in Bahrain? Why?

Answer: Whenever there is an increase in population obviously there is a need of housing projects, either it is houses or residential buildings. There is a tendency to transform some agricultural areas into housing projects depending on the density of its agriculture and the types of agricultural crops. I saw this transformation in many countries and Bahrain is one of them, except the large countries. In the large countries, the agricultural areas are separated and far away from the urban centers. In Bahrain, the urban areas are limited and surrounded by agricultural areas. It doesn't make sense to keep the agricultural areas and freeze were there is an important need for housing projects for people. Since long time ago, there is a regulation in Bahrain called "The Green Belt" and there are land classifications and zonings, some of these zonings are classified to protect the agricultural areas such as agricultural zonings and residential garden zonings. This is balancing the need for housing projects and protecting agriculture.

6. **Question:** According to Al-Tarawneh (2014), the decline of agricultural will cause in negative impact on the economy. Has the decline of agricultural areas affected the Bahraini economy? If yes, What are the negative effects on the Bahraini economy?

Answer: This question will be answered from the economists. But, the government provides support for investment and the new professions

with higher income. I believe it does not affect in a negative way, but in a positive way in the economy. The development is not only in urbanization, transportation and lifestyle but also in agricultural methods. For example in architecture, you can dwell hundred people in hundred houses or you can dwell hundred people in twenty buildings. Therefore, you have optimum use of space in small footprint. Same thing goes for agriculture, the old method of agriculture is a waste of water and space. Nowadays, there are different agricultural methods such as roof farming and farming without sand. Personally, I have roof farming in my private villa and it is not cosmetic plants but it is productive such as vegetables and fruits. From planning, architectural and practical standpoint, 70% of populated areas are covered by buildings. All these houses are with roofs that can be useful for roof farming. The advantages are:

- It will reduce the sun heat that will transfer through the roof.
- Cooling down the weather.
- Supporting the government in reducing the use of electricity.
- Providing products.

If there is a decline in agricultural areas, there are many other alternatives.

7. **Question:** Singapore contributed to enhance agriculture and food security by adopting several technologies such as vertical farming, urban farming and other alternative food sources (Mok, Tan, Chen, 2020). What is the role of Bahraini Government in contributing to enhance agriculture?

Answer: The role of the government is clear and effective. Nowadays, there is support provided by the government to farmers and individuals if they want to contribute to farming and agriculture. If you go to the engineers in Agriculture Department as an individual, they will provide help by giving technical consultation, ideas and even cultivation of your surface. I was working as a technical consultant to the minister of municipalities, the government provides support to individuals to contribute to agriculture production. If you don't know as a individual that government is providing these services, as a citizen you should contribute in agriculture and that is the role of the citizen.

8. **Question:** What is the role of traders, the real-estate companies, banks and investors in contributing to solve this issue?

   Answer: It is possible to invite them to create a support fund for creativity and to find alternative solutions for the green areas.

9. **Question:** What proposals can be put forward to preserve and develop agricultural areas in Bahrain?

   Answer: Individuals and developers must have the conviction to allocate some areas for agriculture and to take advantage of the governmental support for agriculture.

Appendix 9: Interview script 2

URBAN EXPANSION AND ITS IMPLICATIONS UPON AGRICULTURAL LANDS IN BAHRAIN: A PLANNING PERSPECTIVE

INTERVIEW FORM 2

Interviewee: Dr. Suhail Al-Masry

Specialization: Architecture / Urban planinng

Qualifications:

- PhD in urban planning, housing studies.
- Bachelor's in architecture.

Experience:

- An academic in University of Bahrain for 12 years.
- Head of Architecture & Design department in Gulf House Engineering.

Researches:

His research interests cover various topics such as:

- Sustainability in environment.
- Heritage conservation.
- Cities in the 21st century.

Questions & answers:

1. **Question:** According to Shebeb (2006), agriculture in Bahrain considered as a primary sector but, between 1950s to 1970s it declined dramatically. Is agriculture in Bahrain remains as a primary sector? Why?

Answer:

The reason is recently there are a lot of as we may call them agricultural projects like green houses and so on. Because of the security of food and this is something that the government of Bahrain is interested in. And in fact they have already tended to a few projects to encourage and grow agriculture in Bahrain. Because you cannot keep them pending and so on. This is one of the benefits, to produce food and not rely too much on the outside. The second thing is the environmental aspect of it, because any agriculture area or green area is the lung of the city. In New York city, the park which is one of the most expensive land properties in the world. And this large park cannot be touched. In London too, there lies a green line and this area cannot be touched by urbanization because they recognize that this green area is important for the health of the city. Bahrain is also encouraging and contributing to parts of the healthy city programs and the sustainability program. Green areas are important for the well being of the people. Imagine living in concrete. Most housing projects nowadays insist on a percentage of green areas. Recognizing its importance. We need to control the urbanization to not grow over it. Maybe, instead of going horizontally we go vertical. So, we can conserve our green areas.

2. **Question:** According Lorimer (1915), Bahrain Rural areas in 1904 are mostly composed of palm trees. were there other types of trees and crops? What are they?

Answer:

I cannot comment on this one, because I don't know the species. But I do know that palm trees are a symbol and are the most common symbol. However, do not forget that palm trees need water and the availability of water which will allow the tree to grow. So don't forget the aquifers which are used to purify water. There were several springs in Bahrain which were used to water these trees. So, all of them are interacted. Other species of trees, I believe there is a book about local species in Bahrain. This book is available, maybe you can refer to it and see other species. I know Al-mashmoom is one of them. However, this is something which you can find in the book.

3. **Question:** Shebeb (2006), confirmed that cultivation was a primary source of Bahraini income. Is cultivation remains as main source of income? Why?

Answer:

It does not remain as such. Because of the change of the whole social and cultural and economic situation of Bahrain. If you want to look and check, you can see the GDP and see. You will probably see that banking and services are more than cultivation. However, before it was different there were 2 sources of income. One of them was fishing and the other was agriculture. Life was much simpler and easier. Yet, nowadays, there is banking, services and tourism. We should not undermine agriculture. Agriculture is very important for the development of the country. And to secure food without relying on outside sources. Agriculture and green areas come with other aspects too. Raising animals and so on.

4. **Question:** According to Fuccaro (2000), rapid urban expansion led to decline in agricultural areas in Bahrain. When did the decline begin? What are the environmental, economic and social reasons?

Answer:

Fuccaro wrote a book about Bahrain by the way. In 2000. Because if you look into the pattern of growth in Bahrain. It was in a traditional type of society, where life was simple. Fishing and agriculture were prevalent with more focus on neighbor's and family. Around the 1920s and 1930s there was an introduction of new building materials. Concrete blocks and so on. You can observe this in Muharraq, in Manama. After this period until the independence. There was the establishment of the ministries. And at that time the population was around 500'000 or 600'000. This was during the 50s and 60s. You can look this up in the statistics. After the independence, it was the start of urban growth, the opening of more streets. Madinat Isa was opened in the 60s. In the late 60s. Madinat Hamad followed in 1982 as I can recall. There was a need to provide services and social housing. Providing various cities. So, this urbanization is associated with the growth of the population. Society changes, we do not live like our fathers and so on. Change is apparent because we are bombarded with new things all the time, and we are connected to the rest of the world. We are connected digitally. Life changes in all shapes and forms. Bahrain used to rely on fishing, pearls and agriculture but now that has changed. Tourism is a center of economy, real estate is a center of economy. This is a pattern in all the world, except that our population is always growing, yet the

rest of the world is declining in population. Because our system is based on family. So, the decline in agriculture starts with urbanization and modernization and where it began. The needs demand for urbanization and modernizations. You can clearly see this in Muharraq. Just go to google earth and see where is the old city and the regular city. Also check the reclamation of lands.

5. **Question:** Many researchers in urbanization such as, Fazal (2000), Youssef, Sewilam, Khadar (2020), Catalán, Sauri, Serra(2008) confirmed that urban expansion in many countries led to extinct agriculture. In many cases, such as Youssef, Sewilam, Khadar (2020) case in Cairo, agricultural areas turned to houses projects. Did this phenomenon happen to agricultural areas in Bahrain?

   Answer:

   It is part of urbanization, and I think that your case study should prove this or not. You cannot compare to Cairo because the rate there is much bigger because of the population. And the size of the country. In Bahrain you can come to this based on the analysis of your case study. Of course, urbanizing is part of it. It didn't become extinct, but it has dwindled. We have a dilemma here, because we know that green areas are good, but we also have to provide space for the population. How to find the balance between the two is what's important.

6. **Question:** According to Al-Tarawneh (2014), the decline of agricultural will cause in negative impact on the economy. Has the decline of

agricultural areas affected the Bahraini economy? If yes, What are the negative effects on the Bahraini economy?

Answer:

It's not true in anyway. You need to see the changes that happened. In order to answer this you need to know the exact percentage of agriculture in the economy of Bahrain so you can compare it to now. Perhaps it was providing food for families and the surroundings and so on. At the same time what are the alternatives emerging now in Bahrain. Green houses which are a big positive by the way. Because I am condensing agriculture with its benefits in smaller areas while producing. Nevertheless, we must look at the environmental aspect of it.

7. **Question:** Singapore contributed to enhance agriculture and food security by adopting several technologies such as vertical farming, urban farming and other alternative food sources (Mok, Tan, Chen, 2020). What is the role of Bahraini Government in contributing to enhance agriculture?

Answer:

I believe that Bahrain has already made projects for green houses and so on. Also let's look at the conditions of some areas. In some places which I know of. The urban farming is something visible on Google earth, roof farming as well. This is very limited for the individuals. We must provide a larger scale for agriculture protection. Let's focus on green houses and so on. Singapore is very limited, and we always compare them to Bahrain for obvious reasons such as they are both

islands. But let's not forget that you are building your questionnaire on something. And this is what should come in your literature review. This is my topic and I'm basing my talk on these things and people.

8. **Question:** What is the role of traders, the real-estate companies, banks and investors in contributing to solve this issue?

   Answer:

   I think it should start strategically. What city would we like? Is it a smart city? A sustainable city? I believe that we should look at all the activities going on. A few years back, no one in our region heard of sustainability, at least the Arab region. It started in the 1919 and 1920. It started in Istanbul. So, they signed for sustainability. Bahrain signed for it too. As a society we need to have the awareness of the importance of green cities for societies and individuals. Imagine if each house was made to have at least one tree in its backyard. This is important. I need to look at the outside. I believe real estate should provide a part of it as an obligation for future projects. Bahrain had already committed to a certain number of green areas provided for it. East Sitra, UOB, it must be a regulation. Recently, we are having a project and discussing the increase of green areas. But this is not simple. Provide all the necessary details to people.

9. **Question:** What proposals can be put forward to preserve and develop agricultural areas in Bahrain?

   Answer:

You need to have a very clear study overall. I believe that three is a strategy developed that shows the growth of Bahrain in the next 20 to 30 years. What is important is looking at we have and trying to protect it in the future. Classification of land in agriculture is very important to protect what we have and not lose it. We have a fear that we will lose most of these lands to housing and other factors. What we need to look at is the existing areas and find alternatives for expansion.

Appendix 10: Interview script 3

URBAN EXPANSION AND ITS IMPLICATIONS UPON AGRICULTURAL LANDS IN BAHRAIN: A PLANNING PERSPECTIVE

INTERVIEW FORM (3)

Interviewee: Mr. Faeq Juma Al-Mandeel (First Bahraini graduates as an urban planner)

Specialization: Urban planinng

Qualifications:

- Master's degree in philosophy: Policies of Urban Planning.
- Bachelor's in urban planning, Al-Azhar University (1981)

Experience:

- Founder and principal urban planner in Urban Vision Consultant starting from 2006 till now.
- Worked in the Ministry of Housing, Bahrain starting from 1981 till 2006. Positions in MOH includes research and studies, construction control and assistant undersecretary of urban planning.

Researches:

-

Questions & answers:

1. **Question:** According to Shebeb (2006), agriculture in Bahrain considered as a primary sector but, between 1950s to 1970s it declined

dramatically. Is agriculture in Bahrain remains as a primary sector? Why?

Answer: If we look at the base of the economy in Bahrain and look back to one century. It was pearl diving, fishing and agriculture, these were the cornerstones of the economy before the discovery of oil in1932. Diving was the first cornerstone to crumble based on the pearling crisis. Nevertheless, farming continued till recently (the end of 20th century). Agriculture was working on all bases and fronts, there was productive farming and revenues. But as a result of the demands of urbanization and the limited geographical size of the country. Urbanization was limited yet the density of living areas was large. There were a lot of variables in place. Even behaviors of people, independent houses from the family. It was a change in the lifestyle of the population. From compound families to core families. Compound families are when the whole family lives together, even if the children were to get married, they would still be living in the same house. So, housing requirements in the country were limited. Yet, nowadays since the economic boom (due to higher oil revenue) after the independence of Bahrain in 1971, lifestyles changed and there was a demand for more independent housing which was apperant firstly in the city of Manama and reached the agricultural suburbs of Manama such as Al-Gudaibiya and Al-Qufool. We can observe the visible change of urbanization pattern in these two areas to grid pattern and Al-Qufool was considered as a garden city for Manama. The old Manama urban pattern was traditional organic pattern. The new extensions of Manama was with wider roads (6 meters & 9 meters). Urbanization was following two

ways, one of which was eastwards to Al-Gudaibiya and the other was towards Al-Qufool and Al-Burhama. These were the first expansions that occurred. After that, in the mid-70s, urbanization was reaching the southern part (Al-Suqaya and Al-Mahooz). Developers who owned agricultural lands started dividing them up and selling them which encouraged buyers to move into these areas. The ministry of Housing was not distributing houses or lands at this time. Gifts were directly given by his royal highness Sheikh Isa Bin Salman. There were no actual housing projects like the ones we see today. Therefore, people started buying in payments from notable landowners such as Mansoor Al-Oraidh, The Matar family, The Qusaibi family. Al-Qufool was mostly owned by The Qusaibi family and they divided it and started selling in 1959. The first expansion was between 1955 to 1959. In the 1950s it was Al-Gudaibiya and Al-Qufool. In the 1970s it was Al-Mahooz and Al-Suqaya. With the increasing pace of urbanization development and the introduction of cars in massive ways and the people being able to live in a somewhat remote location from the capital, people started moving to other areas. In addition, The Ministry of Housing's contributed to finding new areas, the first one was Madinat Isa in 1965 and it being available for living in 1968. It was ouside from the capital. It helped people exit the capital and encouraged them to leave Manama, Muharraq and their villages. Government housing was the main encouraging factor in helping people move. So, agriculture is still a main sector in our economy, but it needs new agricultural policies economically linked to the country's resources. We still have agriculture zones, but they are not well managed specially from the economic point of view. It needs economic planning. That

way, these remaining lands and areas can be of use to the country. Bahrain is one of the leading countries in trying to keep an agricultural green belt around the urban areas. A decree was issued in 1973 by his highness the prime minister Sheikh Khalifa bin Salman that determines the location of Green Belt areas to be protected and it was not allowed to build in these areas. Yet, as a result of the increase in the saltness of the water, the increasing desire to leave certain areas and due to the need for new roads and new service-oriented facilities. Therefore, they were forced to reduce the Green Belt zones to complete the urban structure of the country From here, the green belt areas start to lose the areas.

2. **Question:** According Lorimer (1915), Bahrain Rural areas in 1904 are mostly composed of palm trees. were there other types of trees and crops? What are they?

   Answer: As far as I can tell, yes. Bahrain was rich in many different types of trees. Yet, the main tree was always the palm tree. Lemon trees were also prevalent, farms were actually named after the trees that were planted in them. For example, lemon gardens, almond gardens, cordia myxa gardens, and some citrus oriented gardens such as orange. These gardens were prevalent in the northern and western parts of the country. Nevertheless, 70% of the farming in Bahrain was palm trees. Therefore, the government of Bahrain issued a decree called (The Palm Tree Act), which forbids the cutting down of any palm tree for whatever reason. So, the palm tree remains in the agricultural areas. Yet, with the

increased saltness in the water, the demands of urbanization and the uselessness of agricultural areas. People had to ignore taking care of palm trees and all kinds of trees in general. Therefore, the previously fertile lands for agriculture turned into an appropriate land for urbanization after it become dry.

3. **Question:** Shebeb (2006), confirmed that cultivation was a primary source of Bahraini income. Is cultivation remains as main source of income? Why?

   Answer: No, I do not think so. Because maintaining the farming industry is extremely costly, even though there have been some new innovations that assist the profession. Honestly, it cannot be categorized as being a main and dependable source of income. There may still be some negative aspects that hold it from becoming a main source of income. Land owners' refusal to enhance and maintain their lands is a main reason as well. For example, a land owner holds a land worth 10 million dinars and expected outcome from this land is 6% as a minimum revenue to keep the land, but with the agricultural investment, the 6% revenue cannot be obtained. Therefore, its more profitable to sell it or divide it up and sell it afterwards. Otherwise, it remains as a neglected agricultural land if he cannot sell it or divide it and sell it afterwards.

4. **Question:** According to Fuccaro (2000), rapid urban expansion led to decline in agricultural areas in Bahrain. When did the decline begin? What are the environmental, economic and social reasons?

Answer: We mentioned the social reasons for this. The main economic reason is the increase in land prices in the capital. Considering the marketing value of downtown Manama in relation to the outer parts nearby it. The prices of agricultural lands were lower. Mustafa Abdullatif divided some lands, Mansoor Aloraidh as well and Al-qusaibi, and they sold them. These were the main people that started dividing their lands and selling them. This was the situation in Muharraq as well, also in villages too. Due to the population as well, Manama was far higher in population than the other areas, the population of Manama was around 100 thousand. So, the expansion was faster in Manama, which prompted people to move into cheaper areas. Investing in lands that near to the urban areas because the lands in urban areas are with more higher prices than the lands in agricultural areas. The environmental reason is perhaps the lowered level of drinkable water in these areas led to the dryness and unproductivity of these lands. This also led owners to turn to other sources of income. Which is basically another economic reason.

5. **Question:** Many researchers in urbanization such as, Fazal (2000), Youssef, Sewilam, Khadar (2020), Catalán, Sauri, Serra(2008) confirmed that urban expansion in many countries led to extinct agriculture. In many cases, such as Youssef, Sewilam, Khadar (2020) case in Cairo, agricultural areas turned to houses projects. Did this phenomenon happen to agricultural areas in Bahrain?

   Answer: If we compare Cairo or metropolitan cities to Manama which is a relatively small scale city. For a period of time, we were similar to

them. Because of the immigration from villages to cities. Cairo is still experiencing immigration into it. Damascus and Baghdad have many luring and attractive factors for rural people such as job opportunities. That is because these cities are massive in scale and capitals are always a major attraction to rural people. In Bahrain, the capital was an attraction for limited period, till recently. Precisely, towards the late 1960s or at the most till the mid-1970s. After that, the capital has become repellent to the people. Therefore, people went to the rural areas and villages for cheaper land prices. Living conditions were also better, even the time from home to work was exceedingly low so it was not a problem to move away from the capital to the rural areas in nearby. So, Bahrain is basically a city state. For a period of time, we thought of creating urban cordons which defines villages and their borders. Yet, this was a difficult task since Bahrain is a small state and it is hard to apply models in larger countries.

6. **Question:** According to Al-Tarawneh (2014), the decline of agricultural will cause in negative impact on the economy. Has the decline of agricultural areas affected the Bahraini economy? If yes, What are the negative effects on the Bahraini economy?

   Answer: Let's start positively, agricultural areas transformed into large urban areas, and created revenues for landowners. It also increased government income through municipal charges. For a period of time, the revenue of the municipality did not exceed 6 million dinars, today it exceeds 40 million dinars. This is because of urbanization and collecting income through municipal charges, new urban projects, investment projects from municipalities and other sectors which economically developed these areas. Now for the negatives, we are in

danger of losing our food security. If in the future we lose our oil resources, we only have agriculture. Therefore, by losing our safety net we lose our always renewing source of food.

7. **Question:** Singapore contributed to enhance agriculture and food security by adopting several technologies such as vertical farming, urban farming and other alternative food sources (Mok, Tan, Chen, 2020). What is the role of Bahraini Government in contributing to enhance agriculture?

   Answer: We always compare ourselves to Singapore, from the 1970s till this day. We always say Bahrain is the Singapore of the gulf. And we really dreamt that we could be Singapore, since Bahrain has even bigger potential than Singapore. The point of comparison is that both are tiny islands. We are even better than Singapore in that we have oil resources. Singapore does not have any oil resources, however they enhanced their human resources. They export human resources. When Singapore launched it's master plan. It located the agricultural zones and enforced their regulations harshly to do it. At the same time, they allowed urbanization systems in its designated zone. Therefore, this type of urbanization becomes dynamic as per the requirements of urbanization and its needs. For example, there are availability of units starting from 1-bedroom unit till 3-bedroom unit depending on the number of family members. They incorporated a system of residential lease instead of ownership which helped the government in controlling the development of urbanization, they did this by locating a specific area for urbanization with developing the services that serve this urban area and protect and develop the agricultural zones. We still have the opportunity to do this but we need firmness in actions and we also need

positive input from the government. We cannot leave these agricultural lands in the hands of owners who cannot use them properly and invest in them. Either the government will take these lands and give the owners other lands in another zoning with different specifications which will allow the owners to invest in projects that will not have a negative impact on agriculture. Then, the government should develop these agricultural areas. Therefore, these agricultural zones will remain intact. This will create job opportunities as well. Bahrain is the country of farmers and it's filled with farmers. We must have a new generation of farmers. We must evolve the farming industry to compete with doctors and engineers. That way, people will be encouraged to work as farmers if they see that their income rivals that of other professions.

8. **Question:** What is the role of traders, the real-estate companies, banks and investors in contributing to solve this issue?

   Answer: I believe that they have a huge role in this. If there is some cooperation to create and establish agricultural companies and investments and establishes what cannot be done as individuals. With the support of banks, which could be specialized in farming matters. Tamkeen helped immensely in this aspect but it only helped individuals rather than corporations. Corporations can wither economic crisis, yet an individual cannot. For example, traders can establish companies and buy agricultural lands and they bring agricultural productive systems and agricultural development systems it may help in having agriculture revenue. I prefer to have companies that invest in agriculture rather than individuals due to the strength of companies in facing the economic and environmental crisis.

9. **Question:** What proposals can be put forward to preserve and develop agricultural areas in Bahrain?

   Answer: When I worked in the ministry, we conducted many studies on this topic. I believe that what we are supposed to do is create a strategy within the master strategic plan Bahrain. This must include the conservation of agricultural zones, and this already exists. However, the implementation of this strategy was lackluster. It did not contribute in creating opportunities for investing in agriculture. That is why we need the government to encourage people to invest in agriculture with incentives. For example, the expansion of the areas could be with limitations such as 10% or 15%. As I told you, we thought of cordones in villages to conserve agricultural zones. but if owner does not see revenue or income from his land then it is only natural that he will not be as motivated to work it and develop it. Agriculture from the environmental stand point is the beathing space for urban areas. Unfortunately, there no development control in Bahrain, the hall country became a commercial market. It must be a system for urbanization in the country. We cannot open the country for urbanization similar to what is happening at this moment. For example, we should change the system in the ministry of Housing such is increasing the building and reducing the housing units (the houses) where the people should get used to the flats units. In the future, the place will be not enough even after reclaiming the sea. We need to keep space for the future generations. Therefore, the urbanization in Bahrain should used in different ways such vertical urbanization and also vertical agriculture.

Appendix 11: Bahraini palm protection act

مرسوم بقانون رقم (٢١) لسنة ١٩٨٣
في شأن حماية النخيل

نحن عيسى بن سلمان ال خليفة امير دولة البحرين ،
بعد الاطلاع على الدستور ،
وعلى الامر الاميري رقم ٤ لسنة ١٩٧٥ ،
وبناء على عرض وزير التجارة والزراعة ،
وبعد موافقة مجلس الوزراء ،

رسمنا بالقانون الاتي :

مادة ـ ١ ـ

يحظر قطع النخيل او التسبب بأية صورة في وقف نموه ،
ويحدد وزير التجارة والزراعة بقرار منه حالات الترخيص بقطع النخيل ،

مادة ـ ٢ ـ

على ملاك النخيل العناية بخدمة النخيل المملوك لهم ومراعاة ريه على نحو يكفل استمرار بقائه والمحافظة على بهائه ،

مادة ـ ٣ ـ

يصدر وزير التجارة والزراعة قرارات تنظيم ما يلي :
١ ـ تحديد العدد الانسب من النخيل الممكن زراعته في الدونم الواحد للارض الزراعية الجديدة ،
٢ ـ وضع نظام للحوافز للمزارعين بقرض تشجيعهم على الاكثار من زراعة الاصناف الجديدة من النخيل ،
٣ ـ تنظيم استيراد وتصدير فسائل النخيل واجزائها ومنتجات النخيل ،
٤ ـ تنظيم عمليات تسويق النخيل واجزائه ومنتجاته وعلى الاخص تنظيم العلاقة بين المنتجين والجهات المهتمة بشئون تصنيع وتسويق التمور ،
٥ ـ وضع نظام لتشجيع زراعة النخيل في الحدائق المنزلية والعامة ،

مادة ـ ٤ ـ

يعاقب كل من يخالف احكام المادتين الاولى او الثانية من هذا القانون بالحبس مدة لا تزيد على ثلاثة اشهر وبغرامة لا تتجاوز خمسمائة دينار او باحدى هاتين العقوبتين ،

مادة ـ ٥ ـ

يكون لموظفي ادارة الزراعة الذين ينتسبهم وزير التجارة والزراعة لهذا الغرض سلطة دخول الزارع للتحقق من تطبيق القانون كما يكون لهم سلطة ضبط ما يقع مخالفا لاحكامه وتحرير المحاضر اللازمة واحالتها الى الادعاء العام ،

مادة ـ ٦ ـ

لوزير التجارة والزراعة اصدار القرارات اللازمة لتنفيذ هذا القانون .

مادة ـ ٧ ـ

على وزير التجارة والزراعة تنفيذ هذا القانون ، ويعمل به بعد ثلاثة شهور من تاريخ نشره في الجريدة الرسمية .

أمير دولـــة البحرين

عيسى بن سلمان آل خليفة

صدر في قصر الرفاع :

بتاريخ : ٦ ربيع الاول ١٤٠٤هـ

الموافق : ١٠ ديسمبر ١٩٨٣ م

الخُلاصة

التوسع العمراني ظاهرة عالمية لا تقتصر على بلد معين. يُعدّ النمو السكاني والهجرة من الريف إلى المدن من الأسباب الرئيسية لزيادة ظاهرة التوسع العمراني. وقد أظهرت الدراسات أن ذلك يؤثر سلبًا على المجتمعات والاقتصادات والبيئة. وهذا ما حذّر منه باحثون في البحرين، حيث أوضحوا أن إهمال سياسة استخدام الأراضي و البيئة سيتسبب بالعديد من المشكلات الاقتصادية والبيئية والاجتماعية. بناءً على ذلك، أُجريت هذه الرسالة لتحليل آثار التوسع العمراني في البحرين، والتوصل إلى توصيات ومقترحات لتطوير وتحسين سياسة إستخدام الأراضي و التخطيط العمراني.

استُخدمت أساليب مُختلطة لتحليل البحث. حيث حُللت صور الأقمار الصناعية لمناطق مُتعددة في البحرين لتحديد التغيرات الجغرافية على مر السنين ورسم خرائط لها. علاوة على ذلك، أُجريت مُقابلات مع مُختصين في التخطيط العمراني لفهم أسباب ونتائج التوسع العمراني والتوصل إلى توصيات ومقترحات شمولية. وقد حُللت المُقابلات باستخدام التحليل الموضوعي نظرًا لقدرته على بناء النظريات ووضع توصيات أكثر شمولية.

بعد تحليل صور الأقمار الصناعية، وُجد انخفاض كبير في المساحات الزراعية. على سبيل المثال، انخفضت المساحات الزراعية في السقية من 77% إلى 10% من المساحة الإجمالية بين عامي 1968 و2023. وقد توافق تحليل صور الأقمار الصناعية مع نتائج التحليل الموضوعي. وقد تبين أن انخفاض المساحات الزراعية يعود إلى عدة أسباب، منها رغبة المجتمع في التوسع العمراني الأفقي، ونقص الرقابة على المناطق الزراعية من الجهات المسؤولة. وبالتالي، يؤدي انخفاض المساحات الزراعية إلى تدهور جودة الهواء وزيادة التلوث مما يؤثر سلبًا على البيئة. وأكد المشارك الثالث أن النهج المتبع في البحرين للتوسع العمراني سيؤدي إلى عواقب وخيمة على الأجيال القادمة، بما في ذلك عدم توفر الأراضي وندرتها. ومع ذلك، تم استخلاص العديد من المقترحات، بما في ذلك التحكم في التوسع العمراني، واعتماد التقنيات الزراعية الذكية، وزيادة الوعي العام. وفي النهاية، تؤكد هذه الأطروحة على أن الحفاظ على المناطق الزراعية المتبقية في البحرين وتطويرها له أهمية قصوى وأن الفرصة لا تزال قائمة.

التمدد العمراني و آثاره على الأراضي الزراعية في البحرين: منظور تخطيطي

اطروحة مقدمة لإنجاز جزء من برنامج ماجستير العمارة

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قسم العمارة والتصميم الداخلي

كلية الهندسة

جامعة البحرين

2025