



THE DEVELOPMENT OF A CONSENSUS-BASED FRAMEWORK FOR A SUSTAINABLE URBAN PLANNING OF THE CITY OF RIYADH

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degree of Doctor of Philosophy

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DECLARATION

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ABSTRACT

In the last few decades, there has been an increasing interest in the field of sustainable urban planning and it is in constant evolution across the world. Cities in developing countries, including the Kingdom of Saudi Arabia, are experiencing rapid and in many cases unsustainable growth. Since its establishment seventy years ago the Kingdom of Saudi Arabia has been transformed into a modern, developing country. This transformation has placed a great deal of pressure on many of the available resources, including oil and natural gas, and has introduced a number of serious issues, such as environmental degradation. Therefore, sustainable urban planning has emerged as a pressing concern that must be addressed by both governments and nongovernment authorities.

The overall aim of this thesis is to assess the urban planning of the city of Riyadh, in terms of sustainability, and to develop a comprehensive consensus-based framework for the sustainable urban planning of Riyadh. The research is carried out to answer the following main question: can the urban planning of the city of Riyadh be managed sustainably through an adapted sustainable urban planning framework? The research highlights the significance of sustainable urban planning for cities and gives an inclusive review of important issues in terms of underpinning concepts, principles and challenges. The research aims to critically evaluate the most common and established frameworks of sustainable cities.

The thesis provides a review of the existing urban fabric of the city of Riyadh and critically discusses its urban planning phases during the last few decades. This critical review is based on a proposed framework of sustainable urban planning. The proposed framework is evaluated based on the opinion of 35 experts, familiar with the local context of the city, through the use of the Delphi technique and the application of the Analytic Hierarchy Process (AHP). Through the testing process of the proposed framework in different parts of the City of Riyadh, the results have proven the hypothesis of the research, which indicates that a comprehensive consensus-based framework for sustainable urban planning, supported by understanding the key issues of sustainability and supported by clear and comprehensive guidelines, can benefit and manage the urban planning for the City of Riyadh sustainably.

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LIST OF ABBREVIATIONS

AHP	Analytic Hierarchy Process
BEQUEST	Building Environmental Quality Evaluation for Sustainability through Time
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
CASBEE	Comprehensive Assessment System for Building Environmental Efficiency
CNU	Congress for New Urbanism
CR	Consistency Ratio
CSBE	Centre for the Study of the Built Environment
DEFRA	Department of Environment Food and Rural Affairs
EEA	European Economic Area
EPR	Enterprise Planning and Research
GPN	Global Planners Network
ICLEI	International Council for Local Environmental Initiatives
ICT	Information and Communication Technology
KAUST	King Abdullah University of Science and Technology
KRNW	Knowledge Resource Nomination Worksheet
LEED	Leadership in Energy and Environmental Design
LRUD	Load Reduction in Urban Development
MDSTAR	Metropolitan Development Strategy for Al Riyadh
NRDC	Natural Resources Defence Council
ODPM	Office of the Deputy Prime Minister
OECD	Organisation for Economic Cooperation and Development
OGC	Office of Government Commerce
QUD	Quality Urban Development
SUP	Sustainable Urban Planning
SUPF	Sustainable Urban Planning Framework
UN	United Nations
USGBC	United State Green Building Council
WCED	World Commission on Environment and Development

CHAPTER ONE: INTRODUCTION

1.1. Introduction to Sustainable Urban Planning Approach

The phrase ‘sustainable development’ was popularised in the “Our Common Future” report, also known as the Brundtland report, which was published by the World Commission on Environment and Development (WCED) in 1987. The classic definition of the concept of sustainable development was introduced in this report as “development which meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

As result of the acceptance of the Brundtland report by the United Nations General Assembly, the term sustainable development had been given a political salience. In 1992, leaders set out the philosophies of the sustainable development concept at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in Brazil, which is also known as the Earth Summit or the Rio Summit (Drexhage and Murphy, 2010). Since the Earth Summit in 1992, there is a common agreement towards the fact that the concept of sustainable development needs the adoption of an integrated and comprehensive method to environmental, social, and economic processes (Munasinghe, 1992, Banuri et al., 1994, Najam et al., 2003).

During the last few decades, the term sustainable development has emerged widely and has been given many different definitions, which depend on the theme of the research. A number of studies (e.g. Pearce et al, 1989, Holmberg and Sandbrook, 1992, Addis and Talbot, 2001, Uqwu and Haupt, 2007) indicate that at the current time there are more than 70 different definitions for sustainable development due to the different academic fields. One recognised definition of sustainable development is “the achievement of a better quality of life through the efficient use of resources, which realises continued social progress while maintaining stable economic growth and caring for the environment” (OGC, 2007).

Recently, there has been a wide-ranging discussion regarding the relationship between urban planning and sustainable development (Vanessa, 2009). For example, “the idea of sustainable development has emerged over the past decades as a new requirement for urban and metropolitan level public action, which involves conceptual principles and practices as applied to land-use and urban planning” (EUE, 2009). Furthermore, the 1987 Brundtland Commission and its report “Our Common Future” located the subject of sustainable

development at the core of planning concerns and urban policy (Vanessa, 2009). The Sustainable City Conference, held in Rio de Janeiro in 2000, pointed out that the idea of sustainable development, as applied to a city, can be defined as the ability of the urban area to achieve the level of life quality required by the society without affecting the needs of the current and future generations or producing negative impacts inside as well as outside the boundary of this urban area and its region (Wallbaum et al., 2011).

Hald (2009), points out that the urban process in general and urban planning in particular vary universally and there are several urban indicators that are internationally followed to differentiate between non-urban and urban areas. Such indicators are population density, population size, employment profiles and range and number of services available. Currently, there has been emphasis on sustainable development as a fundamental principle in urban master planning in an attempt to enhance the quality of the life of citizens, control urbanization, overexploitation of natural resources, ecosystem destruction and environmental pollution (He et al., 2011, Mahmoud and El-Sayed, 2011). Diamantini and Zanon (2000) state that the knowledge of the significance of an urban development that can link the economic and social needs with the long-term environmental capacity is proved by a number of public initiatives and authorised documents on local, national, and international levels.

At this point, a sustainable approach to urban planning has come to be viewed as a necessity. Sustainable development in general, and particularly sustainable urban planning, has transferred from being an attractive topic to being the acknowledged aim of international strategies, including urban planning strategy (Diamantini and Zanon, 2000, Li et al., 2009, He et al., 2011). Clearly, it is no longer a question of whether urban planning must be understood within the context of sustainable development purposes, but it is a question of how. Thus, a sustainable approach to urban planning will constitute the theoretical basis of this study.

1.2. Overview of the Local Context of Saudi Arabia “The City of Riyadh”

The Kingdom of Saudi Arabia is one of the largest Arabian countries in the Middle East. It is located in the southwest of the continent of Asia and occupies most of the Arabian Peninsula. The Kingdom occupies an area of approximately 2,250,000 square kilometres with an estimated population of 27,173,977 as it is indicated by Ministry of Foreign Affairs (2011). Saudi Arabia extends from the Red Sea in the west to the Arabian Gulf in the east, and bounded on the east by Qatar, Bahrain, and the United Arab Emirates; on the south, by Yemen and Oman; and on the north by Jordan, Iraq, and Kuwait as illustrated in Figure 1.1.



Figure 1.1 Map of the Kingdom of Saudi Arabia presenting the borders (Nations Online, 2013).

Due to the discovery of its rich oil reserves, Saudi Arabia became the most important oil-exporting country in the world. In the last 70 years the establishment of the oil industry led to an economic boom that changed the kingdom into a modern developing country (Mubarak, 2004). As result of that Saudi cities in general and particularly the city of Riyadh have witnessed a significant growth in the urban development field.

Therefore, this research will focus mainly on the city of Riyadh, the capital city of Saudi Arabia. It is located in the middle of the Riyadh Region as can be seen in Figure 1.2 (KAUST, 2011), it occupies an area of 2435 square kilometres and its population is estimated at 5,188,286 people, which is equivalent to approximately 22.36% of the total population of the Kingdom of Saudi Arabia (High Commission for the Development of Arriyadh, 2010). As the location of the state administration and of the emirate headquarters, the city of Riyadh has an instrumental role within the context of the kingdom of Saudi Arabia. This study, however, will focus on the urban planning of the city of Riyadh in relation to sustainability.



Figure 1.2 Map of the Kingdom of Saudi Arabia presenting the regions (KAUST, 2011).

1.3. Problem Statement

There has been a growing interest in subject of sustainable cities through the last few decades. The number of cities with populations greater than one million around the world is approximately 300 cities, and in at least twenty cities the populations exceed ten million (Scott et al., 2001). The majority of these cities are located in China, the west of Europe and North America (e.g. London, Stuttgart, Brussels, Riyadh, Beijing). The distribution of these metropolitan areas and their population are presented in Figure 1.3 (United Nations, 2011).

In the last thirty years the cities and urban areas across the world have faced many waves of migration from the surrounding areas in order to obtain better livelihood opportunities (Al-Hemaidi, 2001, Mubarak, 2004, Rizzo, 2012). As a result of this migration, the populations in many cities and urban areas have increased dramatically in different parts of the world. Cities in the Kingdom of Saudi Arabia, including the city of Riyadh are no exception. This urbanisation in many urban centres is highlighted by many reports and documents that are published by the United Nations and can be seen in Figure 1.4.

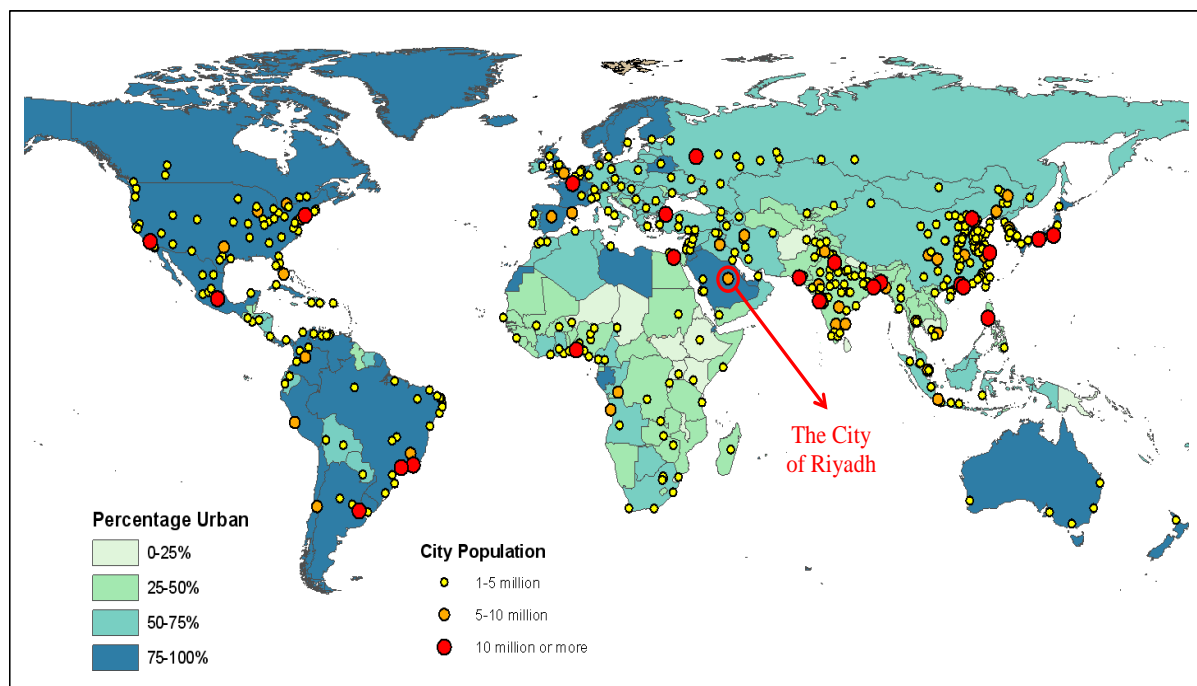


Figure 1.3 Distribution of metropolitan areas with population across the world (United Nations, 2011, p.18).

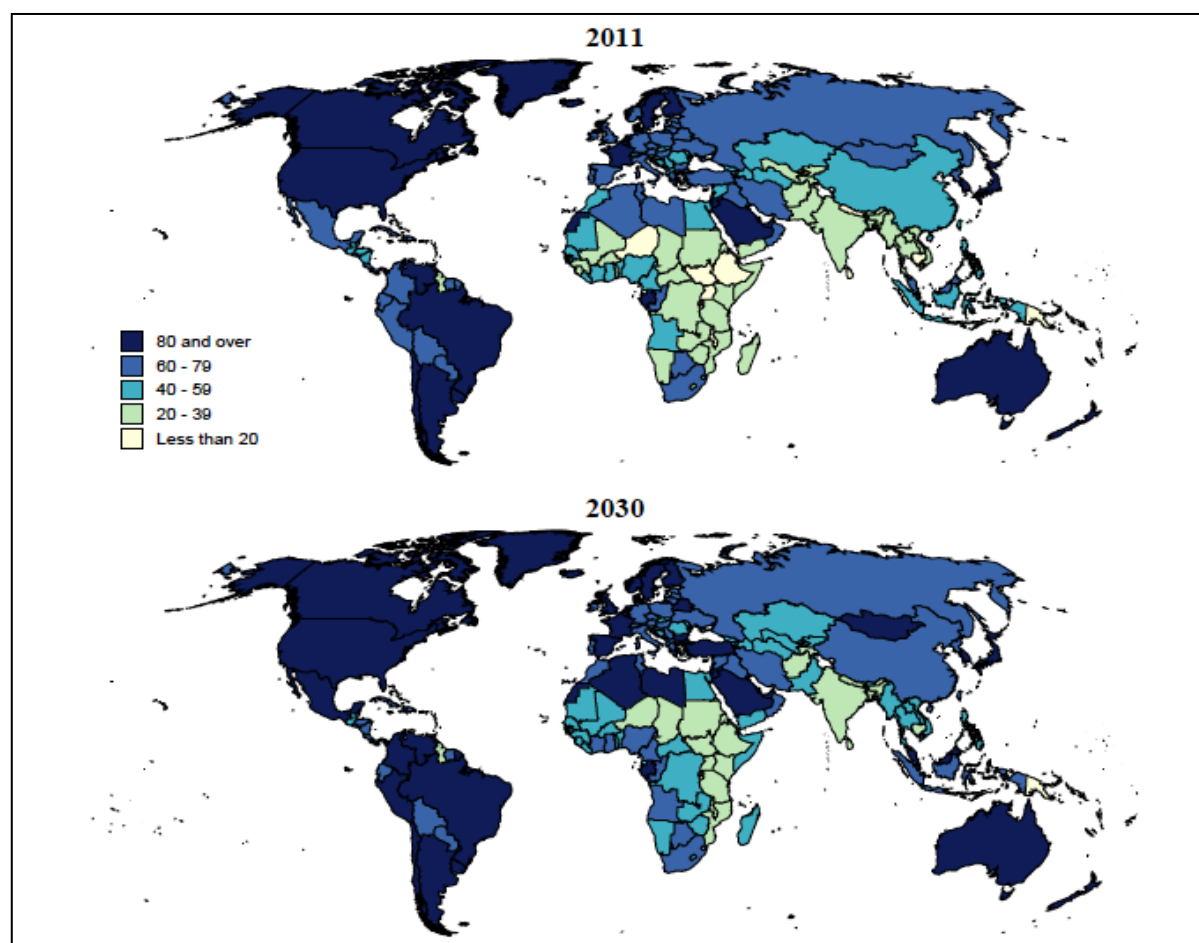


Figure 1.3 Population percentage of urban areas in the World in 2011 and 2030 (United Nations, 2011, p.10).

The location of the Kingdom of Saudi Arabia is positioned in the dark blue zone as it is illustrated in Figure 1.4. This means that the percentage of the urban area population in Saudi Arabia is more than 80 per cent (United Nations, 2011). In Saudi Arabia the excessive urban development has caused a significant imbalance of existing natural resources and demand. For instance, this excessive urbanisation has placed a great deal of pressure on many of the available resources, including oil and natural gas. The Kingdom is currently experiencing a significant process of urbanisation due to strong oil prices and ongoing reforms in the country. This process of urbanization is being supported by a number of different government infrastructure schemes and the implementation of many construction projects.

However, they are accompanied by increased consumption of many resources, including energy, water and materials in addition to the land use, and the result is a depletion of natural resources (Al-Yami, 2008). Regarding the city of Riyadh, the Department of Statistics and Information (2010) indicates that the population of the city has risen dramatically from 100,000 in the early 1950s to almost 5.2 million people in 2010. This population includes fifty different cultures, languages and interests. The city's population is expected to reach 10 million by the year 2020 (Garba, 2004). In less than half a century, the area of Riyadh has grown and expanded more than a hundred times from a small mud-walled town to a modern and global metropolis. The growth of the population and spatial area of Riyadh has led to many changes in the surrounding environment, social context of the city, and economic development. These changes have been highlighted in many research studies (e.g. Mubarak, 2004, Chaaban, 2008, Al-Fouzan, 2012).

One of the most obvious changes is the increase in the numbers of cars, which resulted from the absence of an effective public transport system and the poor planning of the city. This increase has resulted in increased environmental pollution, leading to a rise in the number of chronic respiratory diseases. During the urbanisation process of Riyadh, lands were considered as homogenous regardless of the topographical features or locations of these lands. This issue without doubt has led to the disappearance of many areas of natural habitats and biodiversity (Mubarak, 2004, National Commission for Wildlife Conservation and Development, 2005). This matter in addition to others that related to social, economic and environmental matters increases the need for developing an efficient framework of sustainable urban planning for the city of Riyadh in order to accommodate its further expansion. This framework needs to take into account the fundamental issues of sustainable cities including social, environmental, planning and economic perspectives.

1.4. Research Aims and Objectives

The city of Riyadh has witnessed many environmental, social, economic and urban changes during the last few decades, which resulted from the rapid increase of both its extent and population. Therefore, this study aims to critically discuss the importance of the concept of sustainable urban planning, and give a general idea of internationally leading frameworks for sustainable cities. The main purpose of this research is to assess the urban planning of the city of Riyadh, in terms of sustainability and to develop a comprehensive consensus-based framework for a sustainable urban planning of the city of Riyadh, which deals with different aspects of urban planning including environmental, social, economic issues.

In other word, this research work is carried out to answer the following main question: can the urban planning of the city of Riyadh be managed sustainably through an adapted sustainable urban planning framework? This main research question is addressed through the following sub-questions:

- What are the gaps in current frameworks for sustainable urban planning and how can these be addressed?
- What are the past and current situations of the urban planning of the city of Riyadh?
- What are the main environmental, social, economic, ICT, and planning factors that affect the urban planning process in the city of Riyadh?

In addition to the main aims, this research work has a number of objectives that have been taken into account by the researcher in order to answer the above research questions. These objectives are listed below:

- Review the concept of sustainable development in general and particularly in regards to the idea of sustainable urban planning.
- Critically review established frameworks of sustainable cities, and discuss their limitations and gaps based on the core issues of sustainable urban planning, including social, environmental, planning and economic perspectives.
- Propose a scalable framework for an efficient sustainable urban planning for the city of Riyadh that addresses the limitations and gaps of existing frameworks.

- Evaluate the proposed framework based on the opinion of a number of experts who are familiar with the city of Riyadh and its local context.
- Establish a weighting system for the proposed framework in order to determine the priorities for each element that will be included within the proposed framework.
- Testing the proposed framework based on the current situation of the city of Riyadh in order to demonstrate the practical application of the proposed framework.

1.5. The Research Hypothesis

The subject of sustainable urban planning has emerged as one of the most significant subjects that need to be taken into account by decision makers and both local and national authorities. It covers numerous significant issues that are related to human life (Roseland, 2000, Jansen, 2003, Haapio and Viitaniemi, 2008). Recently, the majority of urban planning systems differ from one country to another (Fowler and Rauch, 2006, Rivera, 2009). The differences have existed not only between each country, but also even between cities within the same country due to the application of different policies and strategies for urban planning.

In every part of the world, including Saudi Arabia, urban planning is essentially formed and influenced by the context in which it functions as well as by taking into account local conditions. Therefore, urban planning practices should exhibit respect for the environmental, social and cultural peculiarities in which they take place. In the city of Riyadh, as is the case with many other cities, there is a lack of a clear framework to manage and control the urban planning process as well as a lack of understanding of the relevant key concepts and methods for developing an effective sustainable urban planning framework (Alkhedheiri et al., 2003, Mubarak, 2004, Al-Faleh, 2005).

Most of the existing frameworks for sustainable city development focus on particular aspects of the cities, for example focusing on the economic or environmental aspects, rather than taking into account the other aspects of the cities (e.g. the cultural context). This without doubt leaves scope for uncertainty and lack of general consensus as to how to manage the current and future development of the urban planning of the city. Therefore, the main hypothesis that underpins this research is that a comprehensive consensus-based framework for sustainable urban planning, informed by an acute understanding of local conditions and supported by clear and comprehensive guidelines, can assist in managing more effectively the urban planning for the city of Riyadh sustainably.

1.6. Scope of the Research

The urban reality of the city of Riyadh will be examined and analysed in this thesis within the theoretical context of sustainable urban planning. Though focusing on an assessment of today's city, this study will also provide an account of its historic development through a discussion of the urban plans that were implemented in the 1970s, 1980s and the 1990s.

However, this thesis also seeks to produce a framework for sustainable urban planning. To this end, it will include a detailed literature review and solicit, record and analyse expert opinions and views. Finally, the testing of the proposed framework will be assessed via applying this framework to three specific area of the city of Riyadh.

1.7. Contribution of the Thesis

The term of sustainable urban planning has emerged widely and has recently become prevalent in numerous policy and academic discussions in several parts across the world. It has emerged as the latest development catchphrase and a wide range of organizations, governmental and nongovernmental, has embraced it as the new paradigm of development (David, 1992, Hald, 2009). Broadly, this research work aims to provide a better understanding of sustainable urban planning processes and establish a comprehensive consensus-based framework for sustainable urban planning, with a particular focus on the city of Riyadh. Furthermore, it aims to determine the significance of having such an effective framework that would deliver substantial benefits to the city.

Unlike previous studies and research, which depended mainly on secondary data gathered from the literature, this study employed different techniques for the first time to design and develop an effective framework for sustainable urban planning for the city of Riyadh. These techniques include the application of both Delphi technique and Analytic Hierarchy Process (AHP). To the best of the researcher's knowledge, the combination of these different techniques can be considered as a unique approach for developing a sustainable urban planning framework that has not been introduced before in Saudi Arabian cities in general and particularly within the capital city of Riyadh. The main contributions of this research work are summarised below:

- Building an evidence-based understanding of the concept of sustainable urban planning.

- Reviewing the most common frameworks of city sustainable development, and discussing the limitations of these frameworks.
- Developing an effective consensus-based framework for sustainable urban planning of the City of Riyadh.
- Identifying the primary dimensions, categories, and criteria for developing the proposed framework.
- Providing a comprehensive framework that can be used as a reference for any city to start a new urban planning or to improve an existing urban planning.
- Adopting different evaluation techniques to establish a sound framework for sustainable urban planning of the city of Riyadh, which include the use of Delphi technique as well as the application of the AHP.

1.8. Ethical Considerations

Ethical considerations and research ethics can be seen as the appropriateness of the researcher behaviour in relation to the rights of those who become the participants or subjects of the research or who are influenced by the research work (Saunders and Lewis, 2012). Cooper and Schindler (2008), point out that research ethics can be defined as the “norms or standards of behaviour that guide moral choices about our behaviour and our relationships with others”. In recent years, the topic of research ethics has become one of the most important issues, and most universities have begun to make their research students more aware of responsibilities researchers have when conducting research and more aware of the significance of research ethics (Saunders et al., 2009).

For that reason, policies and regulations of Cardiff University concerning research ethics have been followed during this study. Participants in this research have received an invitation letter asking them to take part in this research work and providing them with a brief description of the research area as well as the purpose of the study and reassurance of the confidentiality of the data they provide. Moreover, the participants were requested to determine whether they would like their identities to be kept anonymous or not through this research work.

Participants in this study were notified that all the data and information gathered from interviews and questionnaires will be used for the scientific research purposes and these data

and information will be kept strictly confidential. Moreover, in order to ensure anonymity and confidentiality of participants in this research, they were provided with a letter, which ensured that their names will not be disclosed to any organization or third party. All the information provided by them will also be dealt with in full confidentiality, and only summarised information will be reported.

1.9. Outline of the Thesis

This thesis is divided into eight chapters, each of which deals with a specific part of the research. The following key points give an overview of the content of these eight chapters:

- **Chapter One: Introduction**

The chapter provides an overview of sustainable urban planning and introduces the Saudi Arabia context, with focus on the city of Riyadh. In it the aims and objectives of the study will be highlighted. The contribution of this thesis to the body of knowledge will be discussed, and measures taken to observe policies regarding research ethics will be explained.

- **Chapter Two: Literature Review**

The aim of this chapter is to review the literature in the area of sustainable urban planning and provide a full review of key subjects in respect to underpinning concepts, principles and challenges. The chapter targets to critically assess the most common frameworks of sustainable urban planning, and discuss the limitations of these frameworks. It will propose a scalable framework for sustainable urban planning that addresses the limitations and gaps of the existing frameworks.

- **Chapter Three: Research Methodology**

The primary aim of this chapter is to review the main methodology that underpins the study. The chapter begins with an introduction to the different research philosophies, approaches and strategies in addition to the choices of the research methods in general, and then discusses the methodology as applied in more detail. The chapter will highlight the different techniques for the data collection as well as the analysis procedures (e.g. the application of both the Delphi technique and the Analytic Hierarchy Process). Also, it will explain the techniques that have been followed in order to access to various data and information.

- **Chapter Four: The Case Study “The City of Riyadh”**

It aims to introduce the local context of the city of Riyadh. It also aims to discuss its urban planning phases, through a critical analysis of the strategies and plans adopted through these phases. Furthermore, it discusses a number of fundamental issues related to environmental, social, economic, governance, and planning matters. This critical discussion will be carried out based on a proposed framework of sustainable urban planning.

- **Chapter Five: Delphi Consultation Process: Data Analysis Results**

The chapter gives an overview of the Delphi technique and a discussion of its main features, as well as the justifications of the selection of this method. It will discuss the questionnaire formulation of the Delphi consultation process as well as the selection of the panel of experts. In this chapter there will be an explanation of the data collection and analysis methods. This will be followed by highlighting the main results that were gathered through the application of the Delphi technique and will end with a general discussion of the main findings obtained by the study.

- **Chapter Six: Application of Analytic Hierarchy Process (AHP): Data Analysis Results**

The aims of this chapter are to discuss the main features of the Analytic Hierarchy Process (AHP) and present the main results of the application of this technique. It illustrates how the Analytic Hierarchy Process (AHP) can efficiently be beneficial in choosing suitable framework for sustainable urban planning for the City of Riyadh. Furthermore, the chapter will highlight some of the analytical functions that are followed in this research, including the use of analytical functions of Expert Choice software, developed by Expert Choice, Inc.

- **Chapter Seven: Testing the Framework for Sustainable Urban Planning on Three Neighbourhoods in the City of Riyadh**

The aim of this chapter is to demonstrate the practical application of the framework developed in this research work. In this chapter there will be an explanation of the testing procedures that were followed during this research. These procedures include the development of a new scoring and rating system used to examine the current situation of the City of Riyadh based on the principles and contents of the proposed framework of sustainable urban planning. The goal of this examination process is to find out how much of these principles have been already achieved within the City of Riyadh.

- **Chapter Eight: Conclusion and Recommendations**

The fundamental goal of this chapter is to conclude the thesis by emphasising the need for the implementation of an effective sustainable urban planning for the City of Riyadh. This emphasis will be mainly built based on the findings and results that were obtained during the conducting of this research work. Moreover, the chapter gives general recommendations for the application of the proposed framework of the sustainable urban planning for the City of Riyadh, and some ideas to improve and enhance the recent state in the city. Furthermore, the chapter presents some suggestions for future research work.

1.10. Summary

The aim of this chapter was to present an overview of the research background, including the rationale of the study, problem statement, aims and objectives, and the research scope and limitations. The chapter aims to provide the readers with a holistic picture of the research area before the elaboration of the research theme in the subsequent chapters. The Chapter presented a short introduction of the concept of sustainable urban planning, and reviewed a number of the fundamental issues in regard to this concept. Furthermore, it briefly introduced the nature of the Saudi Arabian cities and its local context in general and specifically the City of Riyadh, including a breakdown the main location of the city.

During this chapter the research problems have been underlined, and the research question has been highlighted, “Can the urban planning of the City of Riyadh be managed sustainably through an adapted sustainable urban planning framework?” Furthermore, the chapter determined a number of aims and objectives for this research work, including the development of a proposal for a scalable framework for an effective sustainable urban planning for the city of Riyadh that address the limitations of the existing frameworks. Last but not least, the chapter has discussed a number of key issues regarding this study, which include the consideration of the ethical issues of the research, the theoretical and the spatial scopes of the study, and the potential limitations of this research.

CHAPTER TWO: THE LITERATURE REVIEW

2.1. Introduction

Since 1900, the world has witnessed numerous social, environmental, economic and urban changes due to the fact that the world's population has increased significantly. The urban population of the world increased nearly fourfold in the second half of the twentieth century, from 732 million in 1950 to 2.8 billion in 2000 and to more than 3.2 billion in 2006 as can be seen in Figure 2.1 (United Nations, 2006). In 2007, and for the first time, half of the world's population was living in cities, which is considered as a turning point in human history (Cities Alliance, 2007). This growth, of course, led to increase the urban spaces that took different and unequal forms across the world. It is estimated that at least 90% of the future global population growth will occur in cities meaning that in the next thirty to forty years it will be necessary to double today's total urban infrastructure (Redman, 2010).

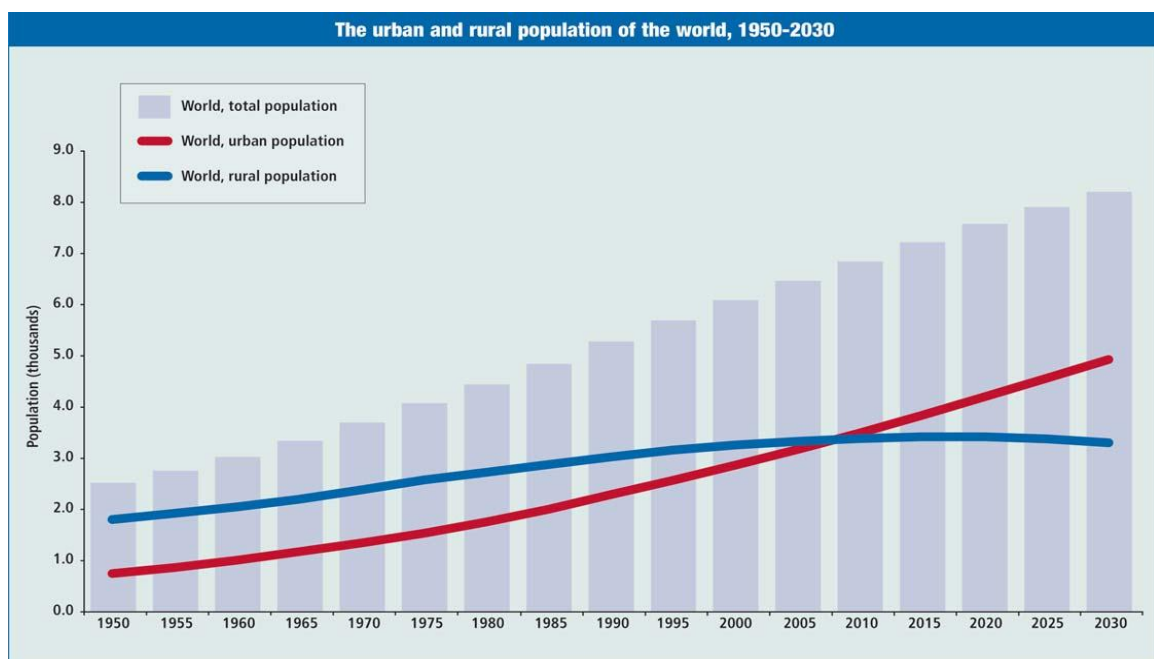


Figure 2.1. The urban and rural population of the world, 1950-2030 (Source: World Urbanization Prospects: The 2005 Revision, <http://www.un.org/esa/population/publications/WUP2005/2005wup.htm>)

This increase has caused a lot of pressure on, and exhausted a huge amount of, environmental and natural resources, exacerbated by a lack of necessary assessments. Awada and Aboul-Ela (2003) point out that the continuous increase in the population of the world is putting additional pressure on our limited natural resources, particularly in developing countries. The rapid expansion of urban areas has been followed by a number of critical negative

consequences, such as poor conditions of housing, inadequate social services, over-crowding, insufficient urban and transport infrastructure services, and many more (Savard et al., 2000, Van Herzele and Wiedemann, 2003, Li et al., 2005, Bhargav, 2010). There is no doubt that urbanization promotes rapid economic and social development, but at the same time, this development comes at an immense social and environmental cost. Not only does the concentration of population in cities produce housing shortages and congestion but it also leads to environmental problems such as biodiversity reductions, resource shortages and air pollution (Savard et al., 2000, Herzele and Wiedemann, 2003, Wang et al., 2004, Li et al., 2005).

The urban concentration has wider environmental repercussions as well. Land uses in various countries around the world are changing affecting the environment, depleting natural resources and eventually adversely influencing both living conditions and the economy. Marsden and Rezgui (2010), state that the 21st century is characterized by a number of severe and significant global environmental challenges, with real and potential risks to our natural and built environment, including: global climate change, increasing population and population density, increasing resource scarcity, and both traditional and asymmetric forms of conflict.

Sustainable urban planning has emerged in response to the above pressing, complex and overarching problems concerning the city. It constitutes a new approach to urban planning and follows the premises of sustainability, which has been promoted in the last decades of the twentieth century as an ideology in many fields all over the world (Elmoghazy, 2010). It has now become an accepted practice that planning experts and relevant authorities must take into account the principles and guidelines of sustainable urban planning before making decisions or undertaking urban development or regeneration projects. Yet, the implementation of the approach is neither simple nor easy.

Over the last few years, a wide range of institutions from both governmental and nongovernmental sectors has embraced sustainable development as a new paradigm (David, 1992, Hald, 2009). For example, members of C40, a group of large cities committed to tackling climate change, have designed mid and long-term climate change action schemes and policies (C40 Cities, 2010). Moreover, members of the World Sustainable Capitals have set up Vision 2030 and have committed to reaching sustainable urban goals by 2030 (World Sustainable Capitals, 2010). Furthermore, the ICLEI, which is one of the global networks of

regional governments formed in 2002, is providing opportunities and information to help those cities to improve their sustainability (ICLEI, 2008).

Undoubtedly, a sustainable development is a primary objective for developing the urban communities. It requires finding innovative approaches and concepts that can be applied and implemented in an effective manner to achieve the concepts and principles of sustainability in urban development areas. Therefore, the main aim of this literature review is to give a comprehensive overview and better understanding of the concept of sustainable development in general, and in particular, on sustainable urban planning. Also, it aims to discuss the most common framework of sustainable urban planning such as CASBEE for Urban Development, BREEAM Communities and LEED for Neighbourhood Development. The purpose of this discussion is to discover the limitations of these frameworks and find the gaps in these frameworks.

This chapter has been divided into five parts. The first part gives an overview of the recent history and the theoretical dimensions of sustainable urban planning. The second part of this chapter presents the different frameworks for sustainable city development and also critically discusses the key issues of these frameworks. Rationale for the research, including the limitations of the existing frameworks, will be discussed in third part. The fourth part proposes a new generic framework for sustainable urban planning that will be designed based on the findings that are obtained from the literature review. This part will also highlight the key dimensions, categories and criteria of this proposed framework.

2.2. Overview of Sustainable Urban Planning Studies

Sustainable development is a broad topic and covers numerous significant issues related to human life and include urban planning aspects, transportation matters, climate change issues, and energy and community concerns. According to Manoj Roy (2009), since the early 1990s the term sustainability has been increasingly integrated with the word urban in different ways, for instance, sustainable cities, urban sustainability, sustainable urban planning and sustainable urbanisation (Maclaren, 1996, Development Planning Unit, 2001, UN-Habitat/DFID, 2002). In this literature review, the researcher will begin with a presentation of the principles and constituent elements of sustainable development and then will continue with a discussion of the relationship between urban planning and sustainable development.

2.2.1. The Concept of Sustainable Development

The phrase sustainable development has many different definitions, which depend on the research area (Tippett et al., 2007). There are more than 70 different meanings for sustainability because of the different academic subjects and disciplines that have their own definitions and approaches (Pearce et al, 1989; Holmberg and Sandbrook, 1992). However, all definitions agree that it is important to consider and respect the planet's future and to enhance and protect the Earth while satisfying the needs of different stakeholders (Boyko et al, 2006). The most widely used definition of sustainable development was defined by the World Commission on Environment and Development in 1987, as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

The Forum for the Future (2002), defined sustainable development as a dynamic process that allows individuals and publics to improve their quality of life and realise their potential in directions that concurrently enhance and protect the life support systems of the Earth. It gives weight to human dignity and social equity as well as ecological integrity (Tippet et al., 2007). Addis and Talbot (2001) stated that the idea of sustainable development focuses on the improvement of the quality of environment, enhancement of social prosperity, and the development of the performance of economy. It emphasises the urgent need for balancing different environmental, social, and economic objectives in ways that adapt with the integrated nature of human activities (Litman, 2011).

According to the EEA (2006), sustainable development explains an approach to decision-making and planning that seeks to reaching a real and lasting reduction of economic and social disparities, as well as protecting the surrounding environment. It can be theoretically divided into three essential pillars or dimensions: environmental, economic, and social sustainability (Ruud, 2006, World Bank Group, 2009).

Additionally, sustainable development seeks to provide the society with a long-term vision (EEA, 2006). Kelley (1998) proposes that sustainability should be defined as “based upon the context of a given situation taking into account the general principles of sustainable development and the wants and needs of the people for whom it is being designed”. Another recognised definition of sustainable development is “the achievement of a better quality of life through the efficient use of resources, which realises continued social progress while maintaining stable economic growth and caring for the environment” (OGC, 2007).

Within the same context, a number of studies have indicated that the idea of sustainable development can be referred to nearly every aspect of life on the Earth, and it has become a wide-ranging expression that is used on different scales from the local to the global level and over different periods of time (Gloet, 2006, Ugwu and Haupt, 2007, EI-Ghonaimy, 2010). However, it was evident through the decade of the 1990s that there was substantial debate and contestation concerning the meaning and practice of sustainable development (Elliott, 2006).

For some, the term ‘sustainable development’ has subsequently been redefined so many times and employed to include so many features of the relationships of the societal environment that there are now uncertainties on whether anything can ever be agreed upon (Mawhinney, 2001). For others, sustainable development is “an idea that makes a difference precisely because it is contested, it requires debate and compromise and because it challenges both researchers and policy-makers” (McNeill, 2000).

The above views clearly reveal that sustainable development is an approach that must be taken into account by both local decision makers and global authorities. It is an over-arching theme that lies at the heart of national and local government policy (Sheweka, 2010). Thus, local governments are in an ideal position to introduce principles of sustainability through the establishment and enforcement of the regulations and rules that should be followed by the end user (Said et al, 2009).

Yet, the initial attempts to adopt policies dictated by sustainability have had less than satisfactory result. Although in recent years, governments have embedded the concept of sustainable development into their constitutions, promulgating countless targets and approving national strategies, and although the business sector has entered into agreements and obligations, the progress achieved with regard to the implementation of sustainable development can only be described as very hesitant (Sanders and Eskridge, 1993, Lafferty, 2006, Loorbach and Rotmans, 2006).

According to Kühtz (2007), there is growing stress on the need for sustainability and related organisations must formulate applicable techniques to reach this and provide a cornerstone for future policies and regulations. The reason for this is that sustainability plays a powerful role in many fields and on different levels. For instance, having the ability to provide access to better health care and education services are all benefits of sustainability (Said et al, 2009). Additionally, sustainable development is significant for the protection and management of the built environment (Ding, 2005, Grace, 2008).

The issues of sustainability deal with a wide range of issues within the local as well as global scale (Gloet, 2006). In the end sustainability should be understood as an approach addressing the pragmatic concerns of society based on a sound ideology. According to the EEA (2006) “sustainable development is an integrated concept involving all human actions down to the local level, and aims to improve the quality of life of both current and future generations and provide a long-term vision for the society”. Moreover, it should be based on the elements of democracy, the regulation of law and respect for essential rights including cultural diversity, equal opportunities and freedom (Said et al, 2009).

However, the application of sustainable development concept is difficult and complicated to be achieved in practice although it is widely accepted that this concept can be understood in fairly simple terms (Tippett et al, 2007). Therefore, the efficient engagement of participants and the establishment of strategies to make the principles of sustainability comprehensible and operational have emerged as one of the most important needs to animate the sustainable development process at the current time (Linehan and Gross, 1998). This is what makes sustainable development an important topic that is being discussed all over the world.

2.2.2. Principles of Sustainable Development

In this research, the review of literature emphasised a number of key issues that must be followed and respected in order to achieve the main aim and objectives of sustainability. For example, one of these issues is the role of the city in the sustainable development process. The city with all its components, including all institutions and authorities, plays a very important role in the process of sustainable development and achieving the desired objectives of sustainability.

According to Diamantini and Zanon (2000), cities play a central role in the perspective of sustainable development, where the majority of the population lives in cities. They indicate that cities consist of the accumulation of the actions of previous generations transforming the territory and improving living conditions, and it is the place where most of the waste production and resource consumption take place.

As far as analysing the urban space is concerned, a number of documents and authors intend to consider the city (and the urbanised or transformed territory) as an ecosystem to form a better understanding of the urban sustainability problems (European Commission, 1996). Redman (2010) indicates that a sustainable approach is still being developed, and he expects it to take multiple forms. However, he does believe that it will involve a series of principles:

respect the environment; recognition the importance of economic success; respect for others; prepare to make difficult decisions and take responsibility for actions; respect the limits of natural resources; and poverty reduction. According to Department of Environment Food and Rural Affairs (DEFRA, 2011), there are five key principles for sustainable development. These fundamental issues can be seen in Figure 2.2.

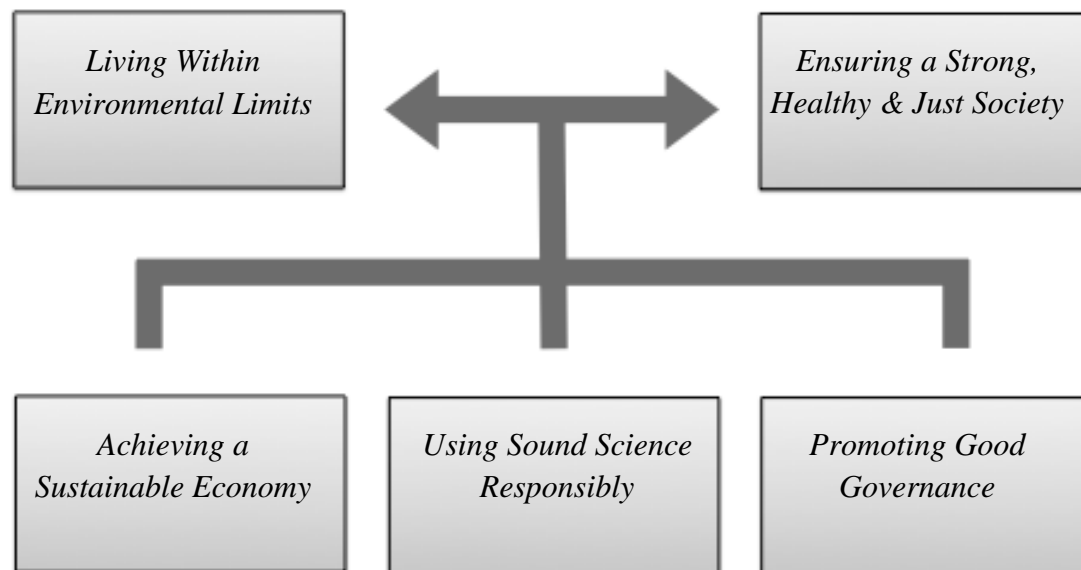


Figure 2.2. The key principles of sustainable development (DEFRA, 2011).

The diagram shows that the objectives of living within environmental limits and a just and healthy society, including the environmental improvement, can be achieved via means of achieving a sustainable economy, using sound science responsibly and promoting good governance. These five principles of sustainable development are outlined in the UK Framework for Sustainable Development “One future - different paths” and agreed by the UK Government, including Northern Ireland. However, the Northern Ireland Sustainable Development Strategy has a sixth principle, which is ‘Promoting Opportunity and Innovation’ (Sustainable Development Strategy for Northern Ireland, 2006).

2.2.3. Elements of Sustainable Development

Previous studies (Pugh, 2000, EEA, 2006, The World Bank Group, 2009), have reported that the sustainable development has a number of core elements, which are often organised into

three dimensions. These are environmental, social and economic dimensions as is illustrated in Figure 2.3. That view is supported by both Addis and Talbot (2001), who point out that the sustainable development focuses on the improvement of the environmental quality, enhancing social prosperity and the improvement of economic performance. However, most of the studies reviewed so far fail to address how these dimensions are related to each other and whether they are on the same level or on three different levels. Therefore, in this research, it is argued that the previous studies would have been far more convincing if they considered this issue.

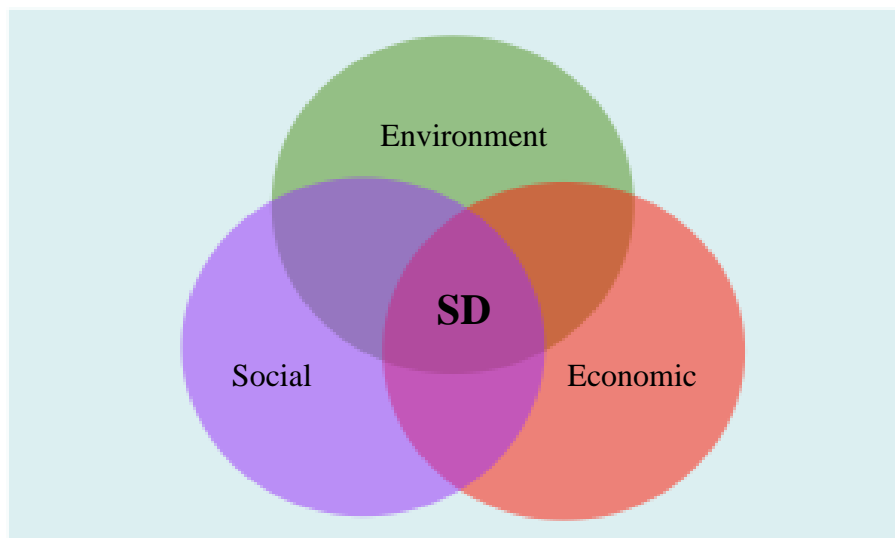


Figure 2.3. Sustainable Development Elements (EPR, 2009).

However, Enterprise Planning and Research Ltd (EPR, 2009), points out that these three key elements of sustainable development must be kept in balance in order to obtain the desired goals of sustainable development. Litman (2011), indicates that sustainable development includes a variety of environmental, social and economic issues. Some of these issues can be seen in Table 2.1. These three dimensions will be discussed in more details through the following sub-sections.

Table 2.1 Variety of economic, social and environmental issues (Litman, 2011).

Environmental	Social	Economic
Pollution prevention	Equity	Cost efficiency
Climate protection	Human health	Employment and business activity
Biodiversity	Education	Productivity
Precautionary action	Community	Resource efficiency
Habitat preservation	Quality of life	Affordability
Aesthetics	Public Participation	Government efficiency

2.2.3.1. Environmental Element

Environmental dimension aims to maintain a stable base for resources, avoiding excessive exploitation of renewable resources and depleting non-renewable resources unless investment is made in adequate substitutes (Harris, 2000). Furthermore, it focuses on a number of key issues, which include reducing waste, effluent generation, emission to environment in addition to reducing impact on human health (Ding, 2005, Grace K.C, 2008, Othman and Nadim, 2010). In general, the environmental dimension aims to determine whether or not the development has an impact on the surrounding environments and how the key aspects of environmental dimension have been considered (EEA, 2006). These aspects include the following key points:

- Limiting global warming.
- Halting loss of biodiversity.
- Controlling and limiting emission of persistent chemical pollutants.
- Returning to natural nutrient cycles.

2.2.3.2. Social Element

White and Lee (2009), point out that sustainable development means balancing not only economic development but also social development through environmental protection. Social dimension looks at responding to the needs of society and local communities (Cooper and Stewart, 2006). The social element is extremely significant due to fact that sustainable development can only be reached through people who feel that they have an adequate share

of safety, wealth, and influence (EEA, 2006). For example, today, socio-economic and socio-cultural linkages have become increasingly prominent (Robert et al., 2002, UNDESA, 2002, Lehtonen, 2004, George and Kirkpatrick, 2006).

Social element supports the civil society, helps to solve various issues within communities and supports the decision makers across different levels (OECD, 2001, EEA, 2006). Planning is a social activity and planners should be prepared to work with people from diverse backgrounds, interests and abilities. Successful planning requires effective involvement of stakeholders include citizens, workers and public officials (Litman, 2011). “The social dimension also includes the fight against poverty through employment, support to sustainable livelihoods, antidiscrimination work, and social security for all” (EEA, 2006).

2.2.3.3 Economic Element.

The third dimension of sustainable development is the economic dimension, which focuses on the importance of achieving stable economic growth. It means working within the capacity of the natural environment, adopting measures from fair and rewarding employment through to competitiveness and trade (OGC, 2007). Hall and Pain (2006), indicate that the sustainable development approach can be employed regularly to reach sustainable and enduring economies in the large cities and regions across the world. The economic process of the large cities and regions in various parts of the world are analysed with particular stress on the ways in which they tend to establish increasing-returns results and outcomes and competitive advantages for national and international producers (Scott, 2001).

There is no doubt that economic prosperity is an incredibly significant element of sustainable development. It enables societies to combat and reduce poverty, to finance remediation of old burdens, and to make changes in economic development and built environment (EEA, 2006). Furthermore, The Working Group on Urban Design for Sustainability to the European Union Expert Group on the Urban Environment (EUROPA, 2004), points out that sustainable development focuses on the qualitative characteristics of economic development. For instance, organising production and consumption processes and selecting shapes of production that minimise the use of resources and reduce environmental pollution. In summary, in this research work, it is argued that these three dimensions are extremely important steps towards creating a new framework for sustainable urban planning.

2.2.4. Relationship between Sustainable Development and Urban Planning

Sustainable development and urban planning concepts have been in constant evolution across the world. Even the definitions of the terms urban and urban planning vary internationally. Urban planning evolved throughout the twentieth century, and this evolution led to a great variety of urban forms that often had little regard for their impacts upon the environment (Ardeshiri, 2010). Hall (2002), points out that urban planning has different definitions, for instance, “it can refer to planning with a spatial component, in which the general objective is to provide for a spatial structure of activities which in some way is better than the pattern that would exist without planning”. It is also defined as a multidisciplinary and comprehensive framework that aims to balance the regional development and physical organization of space in accordance with an overall strategy (He et al., 2011).

Healey (2004), highlights that the urban planning is seen as a self-conscious collective effort to imagine or re-imagine the city. The results are then translated into priorities for area investment, new settlement areas and regulation principles of land use. Furthermore, urban planning is considered as a traditional tool for connecting different aspects and fostering the interaction among sectorial experts and the local community (Diamantini and Zanon, 2000). It is a long-term approach that aims to develop a strong synthesis of environmental, social and economic factors (Li et al., 2009). Vanessa (2009), points out that urban planning in every part of the world is essentially formed and influenced by the context in which it functions as well as by taking into account local conditions.

In addition to the above rather abstract factors that influence urban planning, the local context with its specific spatial, social and environmental characteristics must be taken into consideration. There have been cases in which urban planning frameworks have been imposed or borrowed from somewhere else. In some cases, these foreign schemes and ideas have not changed considerably since they were imported (UN-HABITAT, 2009). This may however cause problems. These systems are based on specific assumptions on the place and time they were designed for, and are therefore usually inapplicable to other places and are often found to be inappropriate in a different context. This underlines the fact that the conditions of urban planning are different from one place to another and that quality of life as well as the influences produced on the environment depends on a variation of local environmental, social and economic factors (Diamantini and Zanon, 2000).

Currently, many of the literature reviews confirmed that urban planning involves a number of principal processes, including creating and realising decisions related to economic policies on housing, recreation, land use, and services (Nghie and Kammeier, 2001). In these processes the use of the public participation as well as the indicators are fundamental in building a shared vision and in motivating and guiding lifestyles and economic activities (European Commission, 1996). Litman (2011), points out that “planning refers to the process of deciding what to do and how to do it, it occurs at many levels, from day-to-day decisions made by individuals and families, to complex decisions made by businesses and governments”. It can sometimes fail initially, but succeed when repeated with changing circumstances, more stakeholder understanding, and commitment.

There have been wide ranging discussions about the relationship between urban planning and sustainable development which is considered to be one of the most debated issues all over the world. The concept of sustainable development has emerged over the past decades as a new requirement for urban and metropolitan level public action, involving conceptual principles and practices applied to land-use and urban planning (EUE, 2009). The 1987 Brundtland Commission and its report “Our Common Future” emphasised the subject of sustainable development and placed it at the heart of urban regulations and planning rules (Vanessa, 2009).

According to the United Nations (2004), sustainability in urban planning has become a critical issue due to the high levels of urbanization in almost all parts of the world. The Sustainable City Conference, held in Rio de Janeiro in 2000, pointed out that the concept of sustainable development, as applied to a city, can be defined as the ability of the urban area to achieve the level of the life quality needed by the community without influencing the needs of current and future generations or causing negative impacts inside or outside the urban border (Wallbaum et al., 2011).

Nowadays, there has been emphasis placed upon sustainable development as an essential principle in urban master planning in order to enhance the quality of life of the citizens, control urbanization, reduce the overexploitation of natural resources, avoid ecosystem destruction and environmental pollution (He et al., 2011, Mahmoud and El-Sayed, 2011). Hald (2009), states that the sustainable urban planning aims to avoid any negative impacts in long-term which change the connection between the natural and humanity as well as the interactions associated with this.

Moreover, sustainable urban planning requires a comprehensive analysis which takes into account all expected impacts and strives for increases in quality rather than quantity and avoids ecological risks such as fossil fuel depletion, habitat loss and climate change (Litman, 2011). Also, it is seen as an approach for developing a stronger combination of environmental, social, and economic aspects through a long-term strategy (Li et al, 2008).

Therefore, it is essential to increase the life quality of the citizens, and minimise the impact of cities upon the resources inside and outside the urban area in order to achieve urban sustainability (Pacione, 2003, Steemers, 2003). Lloyd-Jones (2004) indicates that the fundamental aim of sustainable urban planning is to achieve an equitable and geographically balanced and socially cohesive economic development, which decrease the influence on local and global environments and provide a high and healthy quality of life for the current and future generations.

A number of researchers (e.g. Riley, 2001, Button, 2002, Repetti and Desthieux, 2006, Li et al, 2008) indicate that sustainable urban development attempts to balance social connections, protect the surrounding environment, and enhance the economic growth rather than concentrating on any single social, economic, or environmental subsystem. Sustainable urban planning is characterised by an all-encompassing and comprehensive approach. However, it is this characteristic that also points to the challenging nature of such an undertaking.

Various recent research papers emphasised the significance of a comprehensive strategy for urban planning. Diamantini and Zanon (2000) for example point out that a number of official documents as well as public initiatives of local, national, and international level have demonstrated the importance of awareness of an urban development strategy that can link the economic and social needs with the long-term environmental capacity. The reason for this is that the expansion of urban planning can produce many social and environmental problems in the absence of a clear mechanism to deal with this expansion. These matters include the increase of traffic congestion that causes many health problems, loss of agricultural land and forests, influence of watersheds, and others (Lopez et al., 2001, Frumkin, 2002, Ewing et al., 2003, Munroe and York, 2003, Beck, 2005).

Recently, the significance of a sustainable urban planning strategy, which will minimise or eliminate these matters and risks, is progressively realised by many people (Shearer et al., 2006; Jenny, 2006). Therefore, a number of strategies have already been enacted by many countries in different parts of the world to promote and enhance the urban sustainable

development approach (Costanza et al., 1997, Bolund and Hunhammar, 1999, Diamantini and Zanon, 2000). Vanessa Watson (2009) indicates that “throughout the 1990s, planning grappled with the problem of integrating the issue of sustainable development into planning agendas, and in many parts of the world this has still not been satisfactorily achieved: planning and environmental management often operate in different government silos and with different policy and legal frameworks”.

In the same context, Pinson (2004) points out that sustainable urban planning must overcome these conflicts and contradiction. Thus, the development of new approaches for sustainable urban planning, which aim to address the conflicts underlying the planning, has emerged as one of the most important issues that need to be taken into account by both urban planners and environmentalists which requires an effective collaboration from them (He et al, 2011).

2.2.5. Principles of Sustainable Urban Planning

A number of studies (Sorensen, 2004, EUE, 2009, UN-HABITAT, 2010, DEFRA, 2011), have found that sustainable urban planning has a number of core principles that must be taken into account and understood in order to achieve the desired objectives. These principles should cover many of the key elements for sustainable urban planning that include cultures, populations, urban form, infrastructures, transports, safety and environmental factors. Proper urban planning is an essential tool for making cities inclusive, environmentally friendly, economically vibrant, culturally meaningful and safe for all (UN-HABITAT, 2010).

The Global Planners Network (GPN, 2009), has laid out four of key principles for new sustainable urban planning. First, it should promote both sustainable development and market responsiveness. Second, it needs to develop appropriate planning tools and achieve integrated planning. Third, it needs to be planned with partners and, finally, it requires that the variation of the culture and local conditions is taken into account. Furthermore, Partidario (1992), lists a number of principles to be followed in order to achieve the desired objectives:

- Improve the human life quality.
- Protect the diversity and vitality of the Earth.
- Minimize the consumption of non-renewal resources.
- Allow societies to care for their surrounding environment.
- Establish a national programme for integration development and conservation.

Litman (2011), also points out that “good sustainable urban planning requires a methodical process that clearly defines steps that lead to optimal solutions, this process should reflect the primary principles of sustainable urban planning”. These principles can be seen in Table 2.2.

Table 2.2 Principles of sustainable urban planning (Litman, 2011).

Principle	Features of the principle
Comprehensive	All significant options and impacts are considered.
Efficient	The process should not waste time or money.
Inclusive	People affected by the plan have opportunities to be involved.
Informative	Results are understood by stakeholders (people affected by a decision).
Integrated	Individual, short-term decisions should support strategic, long-term goals.
Logical	Each step leads to the next.
Transparent	Everybody involved understands how the process operates.

2.2.6. Challenges of Sustainable Urban Planning.

Urban settlements areas across the world begin to be influenced by powerful and new forces that require reconsideration from governments. Environmental problems such as resource depletion, climate change, and economic instability have been increasingly observed in many urban areas in both developing and developed countries (UN-HABITAT, 2009). As cities grow and become more crowded and as their economic and political instability increases, researchers agree that sustainable urban planning has become a necessity (Tiwari, 2003, Daigger, 2007, Lee and Chan, 2008).

Morgan (2013), points out that one of the biggest challenges that face urbanisation today is the national conflicts over sustainable development. He indicates that the biggest conflict is between developed and developing countries. On one hand, developed countries need to commit to bigger CO₂ cuts because they caused the problem in the first place. On the other hand, developing countries need to be part of Kyoto 2 because they are growing fast and adding to the problem.

There is no doubt that changing urban planning from its present unsustainable forms and patterns is a very challenging process to be achieved. Consequently, it is not only transportation, urban form, water and energy systems that have to change, but all the systems that are related to urban planning process need to be reformed to reflect a sustainable agenda.

This section of the chapter will discuss a number of the common challenges that are often faced by sustainable urban planning.

The literature review confirmed that the most important challenges of sustainable urban planning can be seen in three key challenges, namely environmental, social, and economic challenges. The Global Report (UN-HABITAT, 2009) debates that “the future urban planning must take place within an understanding of the factors shaping 21st-century cities”. These factors include the environmental challenges of climate change, increased socio-spatial and social and spatial inequalities; and the economic challenges of uncertain future growth.

One of the most important environmental challenges is the need to reduce environmentally damaging activities; a change that can make the life of the citizens more convenient, more enjoyable and more prestigious (Næss, 2001). Tippet et al. (2007) points out that there has been a grown awareness over the last three decades that local actions and activities have regional and global influences, and in turn the regional and global environmental change can affect the local environmental issues. For example, one of the most important concerns is the environmental impact of fossil fuel use in urban areas and the global use of oil as a primary source for the energy (UN-HABITAT, 2009).

Despite the growing concern about the different environmental issues, including climate change, over the past decades, the situation of the ecosystems of the world is still worsening (Millennium Ecosystem Assessment, 2005). A number of environmental matters have only gradually become apparent because of the delay between cause and noticeable influence. This delay is further complicated due to the fact that the effects of pollutants and ecological processes as well as the issues of global climate change can cross boundaries of scale and manifest at a different level of scale from their causes (Gibson et al., 2000). Therefore, sustainable urban planning must address environmental problems that manifest themselves not only across state boundaries but also through time.

On the other hand, uncontrolled urban planning can and has resulted in social problems. According to Cities Alliance (2007), which is a universal coalition of cities and development partners assigned to supporting successful strategies to poverty reduction in cities, a number of problems can be produced as a result of unconstrained urbanization that include shortage of water, shelter, power and other necessities. Cities and towns are seriously affected by a number of key issues related to sustainability and urban planning. These issues include:

environmental degradation, social disruption, underemployment, inadequate housing infrastructure, overcrowding, and services.

Ooi (2005), points out that the cities are the origin of several global environmental problems that related to the pattern of production and consumption, pollution of air and water in addition to waste, where it contributes to many problems regarding the environment and the social conditions. For instance, cities are exposed to traffic overcrowding, environmental disasters and diminished life quality for the poor, which results in the creation of places of social unrest within the cities (Hald, 2009). Tippet et al. (2007), point out that urban problems are severe, especially in less developed areas where a lack of clean water and sanitation results in millions of deaths.

Although air and water quality have improved considerably in recent years in many American and European cities and urban areas, it has become far worse in some cities and urban regions in the developing world (Hald, 2009). Moreover, at present the climate change is also seen as one of the most critical environmental challenges that face sustainable urban planning. As global warming increases, it is predicted that climate change will negatively influence access to water within cities and hundreds of millions of people will be exposed to coastal flooding and related natural disasters (UNHABITAT, 2009).

In terms of social challenges, UN-HABITAT (2009) points out that people have collectively and consciously intervened in the form and nature of urban areas to obtain specific environmental, social, economic and political gains since the earliest days of human settlement. This underlines the fact that societies play a very significant role in the process of sustainable urban planning. One of the most important social challenges is the noticeable growth in the population of the world. Statistics indicate that the world population already exceeds six billion people, and is expected to reach nine billion by 2050, which would double the complexities of sustainable development (Hafez, 2009). This without doubt will directly increase the difficulty of dealing with social challenges alongside the environmental and economic challenges.

Researchers agree that getting people involved is possibly the best strategy in order to achieve a sustainable solution. Tippet et al. (2007), points out that effective participation with community members and other stakeholders is one of the social challenges that face sustainable urban planning. According to Warburton (2002), over recent decades four themes have emerged in community participation and stakeholder in planning: ethics, effectiveness,

opportunities instance and the lack of skilled practitioners able to facilitate participatory processes. These four themes have been recognised by two recent reviews (Commission for Architecture and the Built Environment, 2003, Office of the Deputy Prime Minister, 2004) as a major limiting factor to sustainable development. However, this lack needs a new sustainable urban approach to be addressed in order to engage the different stakeholders in sustainable urban planning and environmental development. The European Sustainable Cities and Towns Campaign (2003), recognises that the lack of integration at many levels, including a lack of a common sustainability vision and interest, is one of the key challenges for sustainable urban management.

Whilst community participation is promising with respect to achieving sustainable urban planning, such as undertaking also contains an economic component and additional challenge. Costs of urban land and housing are pushing the people with low income into locations that can be exposed to natural hazards. For instance, in the developing world, four out of every ten non-permanent houses are currently found in areas exposed to several natural disasters such as landslides and floods (UN-Habitat, 2009). Significantly, such disasters are products of failed sustainable development and urban planning.

Though seemingly directed by individual decisions, the above-unrestrained urbanisation constitutes a result of unprecedented economic practices. In recent decades, the economic restructuring and globalization processes have impacted upon urban areas and sustainable development in both developing and developed countries and it will continue to do so (UN-Habitat, 2009). Manoj Roy (2009), points out that sustainable development is a field that is viewed as not only containing biological and physical challenges but also in a broader economic and social context. However, despite the achievement of sustainable urban planning in the short term potentially costing more, it will enable longer-term strategy to manage the main resources, protect natural ecosystems and the biodiversity that are fundamental to both long-term survival and short-term quality of life needs (EUROPA, 2004).

2.3. Different frameworks for Sustainable City Development

As a result of the emergence of some critical global issues such as urbanization and climate change, more attention is being paid to sustainability and in particular to sustainable urban planning issues. For example, in the 1960s, one third of the population of the United States lived in cities, another third in rural areas and last third in suburban areas, however, thirty

years later, over half of the population lived in suburban areas (Register, 2010). In Europe, nearly 75% of population is living in urban areas and by 2020 this number is expected to have increased to 80% (EEA, 2006). Undoubtedly, this growth is considered as a critical concern because of its detrimental influences on environmental, social and economic aspects (Jaeger et al., 2010).

Sustainable urban planning has become not only a desirable but also an imperative practice due to the wide range of involved issues such as environmental degradation, resource depletion and negative socio-economic effects (Uwasu and Yabar, 2011). Furthermore, the particularities of urban areas in different parts of the world with their specific environmental, social and economic characteristics make any such process more difficult. Researchers, planning officials and policy agencies have produced a multiplicity of comprehensive frameworks and frameworks for the implementation of sustainable urban development. The following paragraphs will provide a brief overview of various such frameworks, but this research will focus mostly on three well-known frameworks: BREEAM for Communities, CASBEE for Urban Development and LEED for Neighbourhood Development.

Häkkinen (2007) did mention one of the sustainable urban development frameworks, which is TISSUE (Trends and Indicators for Monitoring the European Union Thematic Strategy on Sustainable Development of Urban Development model). It belonged to the 6th framework programme area “Integrating and Strengthening the European Research Area” and to the activity “Policy Support and Anticipating Scientific Technological Needs”. The main objective of the framework is to outline the set-up needed for a harmonised set of indicators to monitor the sustainable development of urban environment (Häkkinen, 2007). Another frameworks, originating in China, is the eco-city concept. It proposes a city the design of which has taken into account ecological and environmental requirements in addition to economic and social ones (Yip, 2008, Hald, 2009).

The above theoretical frameworks have inspired actual projects with a strong focus on sustainability. For instance, Arup (a UK-headquartered international engineering consultancy firm) in 2003 designed an eco-city framework for Dongtan City in China in an attempt to be one of the most sustainable cities in the world (Qiang, 2009). Moreover, BRE (Building Research Establishment, UK) developed a leading example of creating sustainable communities and a sustainable regeneration framework on a grand scale, MediaCityUK (BRE Global, 2010), which is a major regeneration project situated in Salford Quays located in Manchester, England’s North West area on a beachfront site.

However, in order to achieve the aim of this research, developing a framework for an effective sustainable urban planning for the city of Riyadh, this study will focus on the most common frameworks known at an international level in the sustainable urban planning field. For this reason and during the review of literature, this research found that there are three of the most popular frameworks for developing sustainable urban planning framework which are internationally well known and agreed upon by a number of researchers and studies. These frameworks are CASBEE for Urban Development, BREEAM Communities and LEED for Neighbourhood Development.

According to Haapio (2012), at current time, the focus is on developing assessment tools and frameworks for sustainability and urban development such as BREEAM for Sustainable Communities from the UK, CASBEE for Urban Development from Japan, and LEED for Neighbourhood Development from the USA. These methods have been used in many academic articles to discuss several key issues that relate to sustainable urban planning (e.g. San-Jose, 2007, Grace, 2008, Nsairat et al, 2009, Assefa et al, 2010). Kawazu et al. (2005) mentioned BREEAM, LEED and CASBEE as the main existing methods for assessing the building environment as well as sustainable development.

Rivera (2009), points out that LEED and BREEAM have both become the national standard in their respective countries, becoming an integral part of the design and construction process. He also added that numerous government bodies and Local Authorities have already mandated these two frameworks into development and planning processes. For example, the city of London may soon require all major developments to attain BREEAM certification. Crawley and Aho (1999), point out that BREEAM is considered as first real attempt to create comprehensive means of simultaneously assessing a broad range of environmental considerations.

Substantially, these three frameworks have been chosen due to their good reputation globally and also because they constitute the most credible methods used globally for the implementation of sustainable urban planning. For example, “BREEAM is the leading and most widely used environmental assessment method and rating system for buildings, with 200,000 buildings with certified BREEAM assessment ratings and over a million registered for assessment since it was first launched in 1990” (BRE Global, 2010). Also, they have been selected because of the constant reference to them in many academic papers (e.g. Grace, 2000, Fowler et al., 2006, Haapio and Viitaniemi, 2008, Tanguay, 2010, Appu, 2012) and mentions of them as important frameworks for city sustainable development.

The following subsections aim to shed-light on the most important key issues of these frameworks and examine their similarities and differences. This discussion will be undertaken in order to work out to what extent these frameworks can be applied to the local context of the city of Riyadh, or use them as a basis to create a new sustainable urban planning framework for the city.

2.3.1. BREEAM for sustainable communities

BREEAM (Building Research Establishment Environmental Assessment Method) was the first commercially available environmental assessment method for buildings, established by the Building Research Establishment Ltd (BRE) in the UK in 1990 (Grace, 2000). The BREEAM framework for creating sustainable communities is based on the established BREEAM methodology, and focuses on mitigating the overall influences of development projects within the built environment (Happio, 2012). It can be defined as a framework, which addresses the key environmental, economic and social issues in addition to planning policy requirements, which have an impact on the urban area within the built environment (BRE, 2011).

This sustainable development framework aims to enable stakeholders to determine the extent to which the key issues of sustainable development and planning system requirements are met within urban areas (BRE Global, 2009). Furthermore, it allows development projects to be documented according to their social, environmental and economic benefits to the local community and ensure the delivery of sustainable communities within the urban environment (BRE, 2011).

Clark and Woodrow (2007) indicate that sustainable communities aim to meet the needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life. In BREEAM for sustainable communities framework there are eight key categories and each one of these categories has a number of assessment criteria (BREEAM, 2009, Haapio, 2012). Table 2.3 shows these eight categories and presents some of their features in addition to shed-light on the most important issues covered under each category.

Table 2.3 Categories and key issues of BREEAM framework for sustainable communities (BREEAM, 2009).

Category	Features of the category	Issues covered
Climate Change & Energy	Focuses on reducing the development contribution to climate change ensuring developments are appropriately adapted to the impacts of present and future climate change.	Flood Risk Issues Design Principles Water Consumption Management Energy Consumption Management Infrastructure
Community	To promoting community networks and interaction, involvement in decision making, supporting public services, social economy and community structure, and community management of the development.	Inclusive Communities Community Consultation Information / Ownership
Place Shaping	Provide a framework for the design and layout of the local area and ensuring that the new development draws from local context and heritage.	Land Use / Mix of the use Form of Development Open Space Inclusive Design
Building	Ensuring that the design of individual buildings contributes to sustainability of the overall development through high environmental and social standards as well as the code for Sustainable Homes / EcoHomes.	Residential Buildings (CSH or EcoHomes) Non-Domestic Buildings (BREEAM)
Transportation	Emphasises on the issues of sustainable transportation methods and improved public transport provision in addition to encouraging walking and cycling for providing a better healthier lifestyles.	Public Transport Cycling Requirements General Policy Car Parking Traffic Management
Ecology	Focuses on conserving of the ecological value of the location and take the full opportunity for ecological enhancement within the urban development and around it.	Ecological Survey Biodiversity Action Plan Native Flora Wildlife Corridor
Resources	Focuses on sustainable and efficient use of resources and appropriate use of land resources, locally reclaimed materials, water resource planning, refuse composting, noise pollution and construction waste.	Impact of Materials Waste Management Water Resources Management Pollution Issues Land Remediation
Business	Aims to provide opportunities for the local businesses and increase the competitive business and employment in the urban development.	Business Investment Employment Business Facilities Connectivity

2.3.2. CASBEE for Urban Development

CASBEE (Comprehensive Assessment System for Building Environmental Efficiency) is a joint research and development project of the Japanese government, industry and academia (Institute for Building Environment and Energy Conservation, 2007). CASBEE for urban development (CASBEE-UD) is an environmental performance assessment method for urban area focusing on the phenomena that can accompany the conglomeration of buildings and outside areas (CASBEE, 2007). It is used as a tool and framework to support the planning of the city with a view to sustainable urban development.

It was developed in 2006 to assess the environmental efficiency of planned projects consisting of multiple buildings and public areas (Murakami et al., 2011). This framework aims to enhance sustainability in regional urban plans and to link it to the operation of related laws, ordinances and systems, such as the comprehensive design of various district and extended site plans in addition to taking into account the important elements of the city and regional planning fields (CASBEE, 2007).

CASBEE for Urban Development framework divides the key issues, which are related to sustainable urban development, into six main categories each one with a number of assessment points (CASBEE, 2007). Three of these categories are related to environmental quality in urban development (Q_{UD}), which focuses on the enhancement of living amenity for the users (residents, workers, visitors) of the designated area, as can be seen in Table 2.4.

Table 2.4. Table of the main categories and criteria included in Environmental Quality in Urban Development (CASBEE, 2007)

QUD 1 Natural Environment (microclimates and ecosystems)	1.1. Consideration and conservation of microclimates in pedestrian space in summer	1.1.1 Mitigation of heat island effect with the passage of air 1.1.2 Mitigation of heat island effect with shading 1.1.3 Mitigation of heat island effect with green space and open water etc. 1.1.4 consideration for the positioning of heat exhaust
	1.2 Consideration and conservation of terrain	1.2.1 Building layout and shape design that consider existing topographic character 1.2.2 Conservation of topsoil 1.2.3 Consideration of soil contamination
	1.3 Consideration and conservation of water environment	1.3.1 Conservation of water bodies 1.3.2 Conservation of aquifers 1.3.3 Consideration of water quality
	1.4 Conservation and creation of habitat	1.4.1 Grasping the potential of the natural environment 1.4.2 Conservation or regeneration of natural resources 1.4.3 Creating ecosystem networks 1.4.4 Providing a suitable habitat for flora and fauna
	1.5 Other consideration for the environment inside the designated area	1.5.1 Ensuring good air quality, acoustic and vibration environments 1.5.2 Improving the wind environment 1.5.3 Securing sunlight
QUD 2 Service functions for the designated area	2.1 Performance of supply and treatment systems (mains water, sewerage and energy)	2.1.1 Reliability of supply and treatment systems 2.1.2 Flexibility to meet changing demand and technical innovation in supply and treatment systems
	2.2 Performance of information systems	2.2.1 Reliability of information systems 2.2.2 Flexibility to meet changing demand and technical innovation in information systems 2.2.3 Usability
	2.3 Performance of transportation systems	2.3.1 Sufficient capacity of transportation systems 2.3.2 Securing safety in pedestrian areas etc.
	2.4 Disaster and crime prevention performance	2.4.1 Understanding the risk from natural hazards 2.4.2 Securing open space as wide area shelter 2.4.3 Providing proper evacuation routes 2.4.4 Crime prevention performance (surveillance and territoriality)
	2.5 Convenience of daily life	2.5.1 Distance to daily-use stores and facilities 2.5.2 Distance to medical and welfare facilities 2.5.3 Distance to educational and cultural facilities
	2.6 Consideration for universal design	
QUD 3 Contribution to the local community (history, culture, scenery and revitalization)	3.1 Use of local resources	3.1.1 Use of local industries, personnel and skills 3.1.2 Conservation and use of historical, cultural and natural assets
	3.2 Contribution to the formation of social infrastructure	
	3.3 Consideration for nurturing a good community	3.3.1 Formation of local centers and fostering of vitality and communication 3.3.2 Creation of various opportunities for public involvement
	3.4. Consideration for urban context and scenery	3.4.1 Formation of urban context and scenery 3.4.2 Harmony with surroundings

On the other hand, the other three categories of CASBEE for Urban Development framework are related to load reduction in urban development (LRUD), for example, prevention of air pollution, noise and vibration as well as consideration for traffic load and regional transportation planning and global warming (CASBEE, 2007). Table 2.5 shows load reduction categories in urban development with the main criteria of each one.

Table 2.5. The main categories and criteria included in Load Reduction in Urban Development (CASBEE, 2007).

LRUD 1 Environmental impact on microclimates, façade and landscape	1.1 Reduction of thermal impact on the environment outside the designated area in summer	1.1.1 Planning of building group layout and forms to avoid blocking wind. 1.1.2 Consideration for paving materials 1.1.3 Consideration for building cladding materials 1.1.4 Consideration for reduction of waste heat
	1.2 Mitigation of impact on geological features outside the designated area	1.2.1 Prevention of soil contamination 1.2.2 Reduction of ground subsidence
	1.3 Prevention of air pollution affecting outside the designated area	1.3.1 Source control measures 1.3.2 Measures concerning means of transport 1.3.3 Atmospheric purification measures
	1.4 Prevention of noise, vibration and odor affecting outside the designated area	1.4.1 Reduction of the impact of noise 1.4.2 Reduction of the impact of vibration 1.4.3 Reduction of the impact of odor
	1.5 Mitigation of wind hazard and sunlight obstruction affecting outside the designated area	1.5.1 Mitigation of wind hazard 1.5.2 Mitigation of sunlight obstruction
	1.6 Mitigation of light pollution affecting outside the designated area	1.6.1 Mitigation of light pollution from lighting and advertising displays etc. 1.6.2 Mitigation of sunlight reflection from building facade and landscape materials
LRUD 2 Social infrastructure	2.1 Reduction of mains water supply (load)	2.1.1 Encouragement for the use of stored rainwater 2.1.2 Water recirculation and use through a miscellaneous water system
	2.2 Reduction of rainwater discharge load	2.2.1 Mitigation of surface water runoff using permeable paving and percolation trenches 2.2.2 Mitigation of rainwater outflow using retaining pond and flood control basins
	2.3 Reduction of the treatment load from sewage and graywater	2.3.1 Load reduction using high-level treatment of sewage and graywater 2.3.2 Load leveling using water discharge balancing tanks etc.
	2.4 Reduction of waste treatment load	2.4.1 Reduction of collection load using centralized-storage facilities 2.4.2 Installation of facilities to reduce the volume and weight of waste and employ composting 2.4.3 Classification, treatment and disposal of waste
	2.5 Consideration for traffic load	2.5.1 Reduction of the total traffic volume through modal shift 2.5.2 Efficient traffic assignment on local road network
	2.6 Effective energy use for the entire designated area	2.6.1 Area network of unused and renewable energy 2.6.2 Load leveling of electrical power and heat through area network 2.6.3 Area network of high-efficient energy system
	3.1 Consideration of global	3.1.1 Construction and materials, etc.

LRUD 2 Management of the local environment	warming	3.1.2 Energy 3.1.3 Transportation
	3.2 Environmentally responsible construction management	3.2.1 Acquisition of ISO14001 certification 3.2.2 Reduction of by-products of construction 3.2.3 Energy saving activity during construction 3.2.4 Reduction of construction-related impact affecting outside the designated area 3.2.5 Selection of materials with consideration for the global environment 3.2.6 Selection of materials with consideration for impact on health
	3.3 Regional transportation planning	3.3.1 Coordinating with the administrative master plans for transportation system 3.3.2 Measures for transportation demand management
	3.4 Monitoring and management system	3.4.1 Monitoring and management system to reduce energy usage inside the designated area 3.4.2 Monitoring and management system to conserve the surrounding environment of the designated area

2.3.3. LEED for Neighbourhood Development

LEED (Leadership in Energy and Environmental Design) for Neighbourhood Development is another example of a sustainable city development framework, which is internationally well known. It was developed by the U.S. Green Building Council (USGBC) in partnership with the Congress for New Urbanism (CNU) and the Natural Resources Defense Council (NRDC) for national use and emphasizes environmental considerations and land use in the United States (USGBC, 2011). LEED for Neighbourhood Development is primarily aimed at improving neighborhood design, land-use patterns and technology in the U.S. (USGBC, 2005).

“It integrates the principles of smart growth, urbanism and green building into a neighbourhood design rating system” (Happio, 2012). LEED for Neighbourhood Development (LEED-ND) promotes best practices in location, design and development at the neighbourhood scale (LEED, 2009). It aims to focus beyond the building boundary and evaluate whole neighbourhoods to prioritize criteria such as site location, urban design, transportation and housing affordability (Welch et al, 2010).

As the case with both of BREEAM Communities and CASBEE for Urban Development, LEED for Neighbourhood Development framework also has a number of categories. It has three main categories and two additional categories (USGBC, 2011). The main categories are smart location and linkage, neighbourhood pattern and design and green infrastructure, and the additional categories are innovation and design process and regional priority credit. Table 2.6 shows these five categories in addition to shed-light on the criteria of each one.

Table 2.6. Categories of LEED for Neighbourhood Development framework (USGBC, 2011).

<i>SMART LOCATION & LINKAGE</i>	<i>GREEN INFRASTRUCTURE & BUILDINGS</i>
Smart Location	Certified Green Building
Imperiled Species and Ecological Communities	Minimum Building Energy Efficiency
Wetland and Water Body Conservation	Minimum Building Water Efficiency
Agricultural Land Conservation	Construction Activity Pollution Prevention
Floodplain Avoidance	Certified Green Buildings
Preferred Locations	Building Energy Efficiency
Brownfield Redevelopment	Building Water Efficiency
Locations w/ Reduced Automobile Dependence	Water-Efficient Landscaping
Bicycle Network and Storage	Existing Building Use
Housing and Jobs Proximity	Historic Resource Preservation and Adaptive Reuse
Steep Slope Protection	Minimized Site Disturbance in Design and Construction
Site Design for Habitat / Wetland & Water Body Conservation	Stormwater Management
Restoration of Habitat/Wetlands and Water Bodies	Heat Island Reduction
Long-Term of Habitat/Wetlands & Water Bodies	Solar Orientation
<i>NEIGHBORHOOD PATTERN & DESIGN</i>	On-Site Renewable Energy Sources
Walkable Streets	District Heating and Cooling
Compact Development	Infrastructure Energy Efficiency
Connected and Open Community	Wastewater Management
Walkable Streets	Recycled Content in Infrastructure
Compact Development	Solid Waste Management Infrastructure
Mixed-Use Neighborhood Centers	Light Pollution Reduction
Mixed-Income Diverse Communities	
Reduced Parking Footprint	<i>INNOVATION & DESIGN PROCESS</i>
Street Network	Innovation and Exemplary Performance
Transit Facilities	LEED Accredited Professional
Transportation Demand Management	
Access to Civic and Public Spaces	<i>REGIONAL PRIORITY CREDIT</i>
Access to Recreation Facilities	Regional Priority
Visitability and Universal Design	
Community Outreach and Involvement	
Local Food Production	
Tree-Lined and Shaded Streets	
Neighborhood Schools	

2.4. Critique on the frameworks of Sustainable City Development

Many organisations and countries around the world have developed sustainable urban development frameworks to lead their urbanization process towards a desired position of urban sustainability (Shen et al, 2011). There is no doubt that these frameworks have been developed for different types of needs and purposes and have a number of similarities and differences between them but share the common goal of achieving sustainable urban planning. Furthermore, dissimilar cultural features and different regulations in different countries make the situation even more complex.

Haapio and Viitaniemi (2008) claim that BREEAM for Sustainable Communities, CASBEE for Urban Development and LEED for Neighbourhood Development vary to a great extent. However, in this research, it is argued that because the technical manuals of these frameworks were published recently, the number of scientific researches analysing them is limited, which makes the comparison of these frameworks more difficult.

Therefore, the main purpose of this subsection is to look at each one of these frameworks and then discuss the main findings that have been obtained throughout their review. Moreover, it is important to gain an understanding of the similarities and differences between them in order to find out the possibility of adopting these frameworks in different parts of the world as well as using their advantages to create a new, effective sustainable urban planning framework for the City of Riyadh. The discussion will focus on six key issues that are highlighted in many research works (e.g. Lockwood, 2004, Tam et al., 2004, Fowler and Rauch, 2006, Grace K.C, 2008, Rivera, 2009, Said et al., 2009, Kyrkou et al., 2011, Appu, 2012). These issues can be summarised in the following key points:

- Categories and criteria.
- Regional variations.
- Management aspects.
- Financial issues.
- Distribution of responsibilities.
- Local context issue.

2.4.1. Categories and Criteria

The main categories of these three frameworks are presented in Table 2.7. It can be seen that BREEAM has eight major categories with 62 criteria, CASBEE presented with six main categories with 80 criteria in total, whereas LEED has three main categories and two additional categories with 56 criteria in total including the criteria of the two additional categories.

Table 2.7. Categories and the number of criteria of the three sustainable city development frameworks.

BREEAM Communities	CASBEE for Urban Development	LEED for Neighborhood Development
<i>Climate and Energy (11 criteria)</i> - focuses on built form mitigation and adaptation issues.	<i>Qud1</i> - Natural environment (microclimates and ecosystems) (17 criteria).	<i>Smart location and linkage (14 criteria)</i> - focuses on protected areas, populations, development
<i>Community (4 criteria)</i> - addresses consultation processes and local community involvement.	<i>Qud2</i> - Service functions for the designated area (15 criteria).	<i>Neighborhood pattern and design (18 criteria)</i> - emphasises public transportation and land use development.
<i>Place Shaping (15 criteria)</i> – focuses on land use, open space, mix of use in addition to form of development.	<i>Qud3</i> - Contribution to the local community (history, culture, scenery and revitalization) (7 criteria).	<i>Green infrastructure and buildings (21 criteria)</i> - addresses environmental impact, energy and water efficiency.
<i>Buildings (3 criteria)</i> - addresses overall sustainability performance of buildings.	<i>LRud1</i> - Environmental impact on microclimates, façades and landscape (16 criteria).	<i>Innovation and design process (2 criteria)</i> - focuses on innovation and exemplary performance.
<i>Transportation (14 criteria)</i> - focuses on sustainable transport options.	<i>LRud2</i> - Social infrastructure (14 criteria)	<i>Regional priority credit (one criteria)</i> - addresses regional priority
<i>Ecology (4 criteria)</i> - addresses protection of the ecological value of the site.	<i>LRud3</i> - Management of the local environment (13 criteria).	
<i>Resources (6 criteria)</i> - addresses sustainable use of resources.		
<i>Business (5 criteria)</i> - emphasizes local and regional economic issues.		
<i>Eight main categories. 62 criteria.</i>	<i>Six main categories. 82 criteria.</i>	<i>3 main categories and two additional categories. 56 criteria.</i>

However, by looking at Figure 2.4 it can be seen that BREEAM Communities places more emphasis on Place Shaping (with 15 criteria) and Transportation (with 14 criteria) and less on Buildings and Business.

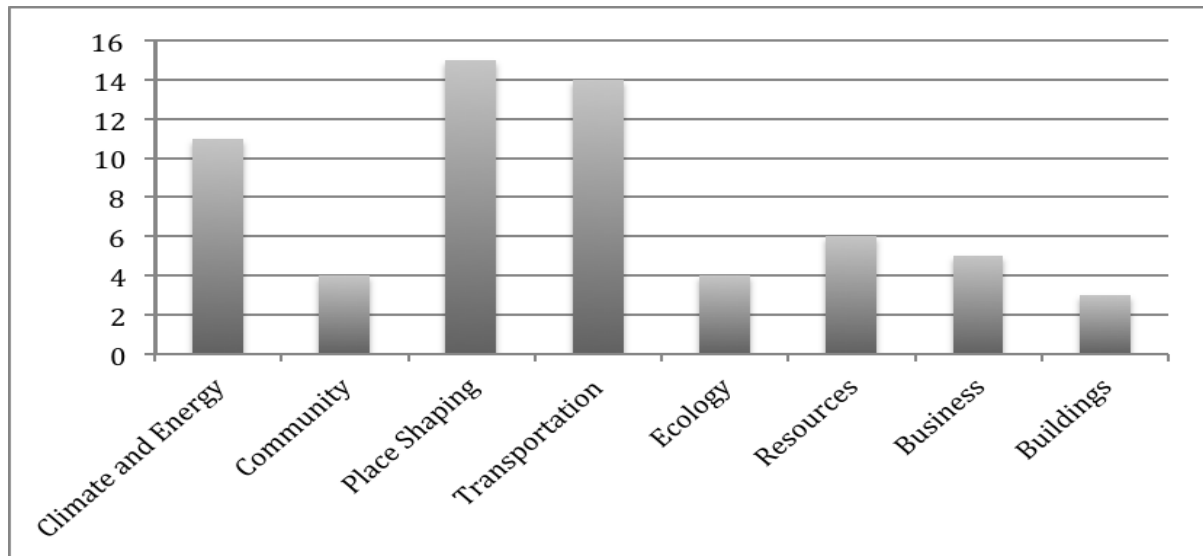


Figure 2.4. The main categories of BREEAM Communities with their criteria.

CASBEE-UD on the other hand, considered Natural Environment, which covers a number of issues such as natural resources, as the most significant category (see Figure 2.5). Moreover, it mentions transportation as a sub-category under Service functions for the designated area, but not BREEAM Communities as mentioned previously. In the LEED-ND framework the most significant two are Green Infrastructure and Buildings as shown in Figure 2.6. These two categories cover a number of issues including energy, water and infrastructure.

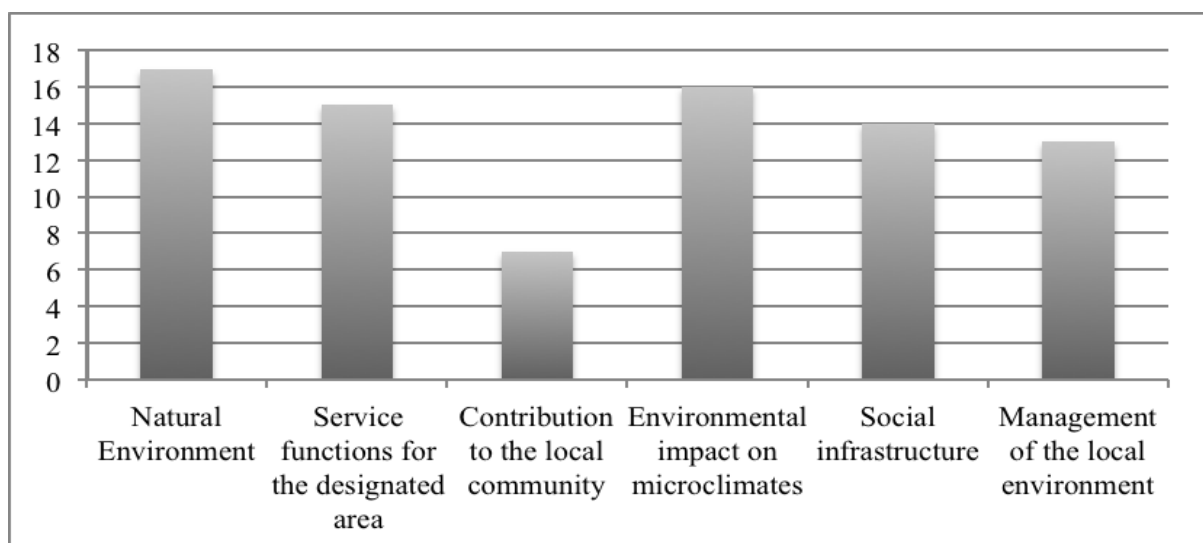


Figure 2.5 The main categories of CASBEE - UD with their criteria.

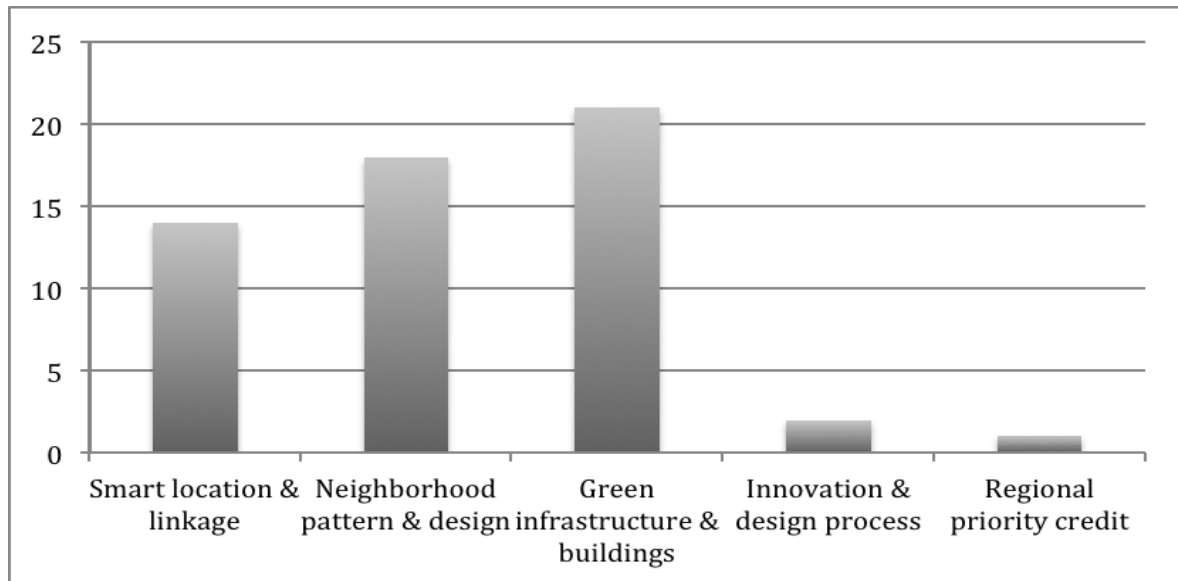


Figure 2.6 The main categories of LEED – ND with their criteria.

Nsairat et al. (2009), point out that BREEAM considers transport as main category and gives this category high credits, on the other hand LEED includes transport within the major aspects of its assessment and does not give it this importance. In terms of evaluating the criteria, Appu (2012), points out that in BREEAM Communities and CASBEE-UD the criteria are equal. BREEAM Communities values criteria from one to three points and CASBEE-UD uses five-step scale based on the rationale of achieved and maximum points, whereas in LEED-ND, the criteria are not equal and are evaluated differently, some of them are worth 10 points, and others only one point.

2.4.2. Regional Variations

As mentioned previously, these three frameworks come from three different countries and have been developed for different aims and needs. For this reason, some scientific articles argue that these methods could be suitable for certain countries more than others. For example, Appu (2012), indicates that CASBEE-UD places emphasis on the characteristics of Japan and Asia, whereas LEED-ND is strongly directed at the North American market area. On the other hand, he points out that BREEAM communities can be applied to urban areas across the world with the use of compliant assessment methodologies.

According to Rivera (2009) all projects which use LEED framework, must follow the U.S.-recognized standards and criteria (e.g. ASHRAE and Imperial Units), regardless of where these projects are located. This is one of the most common difficulties, which face the use of such frameworks due to the differences in the regulations and standards in different parts of

the world and unfamiliarity with the standards of the United States, the UK or Japan. Fowler and Rauch (2006), point out that CASBEE is a relatively new framework, which developed for the Japanese market available in English, but not yet tested in the United States.

Grace (2008), claims that most of the city sustainable development frameworks have been developed for local use and do not allow for national, regional or international variations. These variations include differences in the level of income, climatic conditions, techniques and building materials in addition to appreciation of historic value (Kohler, 1999). For example, although most of the sustainable urban development and design profession are aware of BREEAM framework and have used it as their development basis, it is not recognised by U.S. professionals (Fowler and Rauch, 2006).

In fact a number of countries have used the BREEAM frameworks to create new frameworks, for example, HK-BEAM has adjusted the system to include environmental, social, economic and cultural considerations (Ding, 2005). Reijnders and Roedel (1999), point out that it is improbable that a set of pre-designed environmental criteria could be developed for worldwide use without further amendments, for instance, the use of geographically adapted database. This means that BREEAM Communities, CASBEE-UD and LEED-ND could be used worldwide but only with adjustments to the frameworks, taking into account the particular environmental, social and economic issues of the region and location of the development.

2.4.3. Management Aspects

In general, management issues are considered to be the key for the success of any framework or institutional structure, including those for sustainable urban planning. The absence of successful management and organization of tasks, it is undoubtedly the beginning of the end. Jabareen (2006), points out that there is an urgent need to have modern management programs, often called smart growth programs, to organise and regulate economic, social, and environmental operations. Sustainable urban planning projects pose new management problems that must be carefully considered by policy-makers, planners and managers (United Nations, 2004).

The three frameworks under consideration here do not include management as a main category. On the contrary, they use it simply as a criterion within their main categories. In BREEAM Communities framework, management is referred to more than in CASBEE-UD

and LEED-ND. It includes management aspects within most of the main categories, Climate and Energy, Transport and Resources.

CASBEE-UD mentions management only once in its main categories, LRUD3 Management of the local environment. It is used as a system to reduce energy usage inside of and to conserve the surrounding environment of, the designated area. Management is referred to in CASBEE-UD frameworks to measure transportation demand. This means that CASBEE-UD sees management as tool to manage issues within the main categories not as main category that aims to manage the overall of sustainable urban planning process.

The case is similar with LEED-ND, where management is used as criteria under some of the main categories, the Neighbourhood Pattern and Design category and Green Infrastructure and Building category. In the last a few years, some scientific articles discussed criticism of LEED framework and in particular the criticism, which is focused on management. For example, Tam and Tsui (Tam et al., 2004), point out that one of the criticisms of the LEED framework is that it is concerned mainly with the technical aspect of environmental performance with very little emphasis on the management side of the development.

2.4.4. Financial Issues

The framework of sustainable city development is supposed to be focused on the achievement of the key elements of sustainable urban planning; environmental, social and economic issues as mentioned before. There is no doubt that financial aspects are one of the key issues that are included within the economic element and have a critical role in terms of achieving the objectives of sustainability. However, a review of the relevant literature indicated that some of the sustainable urban planning frameworks give little attention to financial matters.

Many frameworks have been developed to reach sustainable development; however, most of them aim to prevent environmental deterioration and ignore the importance of economic or social goals (Graaf et al, 1996). In terms of the international well known frameworks chosen in this research, Ding (2008) indicates that some frameworks such as BREEAM, CASBEE and LEED do not include financial aspects in their evaluation, which may contradict the ultimate principle of a sustainable development. Financial returns are fundamental to all projects due to fact that a project might be environmentally friendly sound but at the same time very expensive to create.

2.4.5 Delegation of Responsibilities

As stated earlier, sustainable urban planning is a comprehensive process, which requires the involvement of different stakeholders including government, citizens, workers and public officials (Litman, 2011). For instance, government organisations play an important role in achieving the sustainability through the development and enforcement of rules and laws (Said et al., 2009). According to Lockwood (Lockwood, 2004), the planning process should be understood by all stakeholders with clearly defined visions, goals, objectives, evaluation criteria and performance indicators. Thus, a clearly understood distribution of responsibilities is instrumental in avoiding conflicts.

In this research, it is argued that one of the main weaknesses of BREEAM Communities, CASBEE-UD and LEED-ND is their failure to address how the distribution of responsibilities between the different stakeholders within the process can be achieved. These frameworks aim to enable stakeholders to determine the extent to which the requirements of sustainable urban planning are met within the urban areas. Yet these frameworks offer no explanation as to the allocation of duties among the participants. Therefore, these frameworks would have been more complete if they had considered the distribution of responsibilities during the development process in their own methods.

2.4.6. Local Context

Local context, including city background and social considerations of customs and traditions, is considered as one of the most important issues that have emerged from this study and literature review. It must be taken into account by any sustainable urban planning framework. The importance of understanding local conditions is being recognized increasingly worldwide (United Nations, 2004). Therefore, local customs and traditions of urban areas must be respected during the design process of sustainable urban planning in order to achieve the desired goals. Similarly, different frameworks for sustainable urban planning should be designed to take into account the local context, especially, if it used in countries other than the one the system was initially designed to work in (Kyrkou et al., 2011).

However, by looking at the frameworks included in this research, BREEAM Communities, CASBEE-UD and LEED-ND, it can be seen that these frameworks overlook the need to address local context as main issue in their framework. These frameworks place little emphasis on the local context side despite it being considered as one of the most important

issues to achieve the sustainable urban planning. The conditions of urban planning are very different from city to city and the quality of life as well as the impacts produced on the environment depends on a variety of local environmental, economic, and cultural factors (Diamantini and Zanon, 2000). Therefore, all frameworks must understand these local conditions, traditions, and attitudes.

2.5. Rationale for the Research

Throughout this study, the role and importance of sustainable urban planning has arisen as one of the fundamental elements that need to be taken into account (Kühtz, 2007). There is no doubt that sustainable urban planning is a major concern, which must be considered by the relevant authorities. This is because it focuses on the improvement of the quality of the environment, enhancing social prosperity and the improvement of economic performance (Addis et al., 2001).

Moreover, it places emphasis on the integrated nature of human activities and the balance of economic, social and environmental objectives (Litman, 2011). As pointed out previously, the term sustainable urban planning means different things to different people, however, all definitions agree that it is important to ensure that all the environmental, social, economic and planning issues have been tackled in sustainable manner (Boyko et al., 2006, OGC, 2007, Haapio and Viitaniemi, 2008, Hald, 2009). Today there is a wide range of discussion about the key issues of sustainable urban planning and a number of frameworks have been developed for different purposes and needs in different countries.

The most common and internationally well-known frameworks, BREEAM Communities, CASBEE-UD and LEED-ND, were discussed in this study. These three frameworks show different methods of the creation of sustainable city development and the selection of the categories, criteria and indicators. Furthermore, it was discussed how despite the fact that these frameworks were developed in different countries, under different circumstances and for different purposes, all of them aim to achieve sustainable urban planning (Cao and Li, 2011). However, as can be seen through the critique of these three frameworks, there are a number of key issues and differences between them in terms of the division of the main categories and the features of the criteria of each one (Haapio and Viitaniemi, 2008).

For instance, BREEAM has eight major categories; CASBEE has six main categories whereas LEED has five categories. Moreover, each framework focuses on different categories and aspects more than the other, to some extent, according to the purposes and needs. For instance, BREEAM considers transport and energy as the main categories in their framework and gives them more emphasis in terms of the number of the criteria, whereas LEED does not give them this importance, and includes transport and energy within the major categories of its framework instead (Appu, 2012).

However, in general, it is argued in this research that these frameworks have a number of strengths and weaknesses. One of their most important strengths is their addressing of the key issues of the sustainable urban planning within their frameworks. For example, they are more conscious toward the environmental issues that are related to urban areas such as climate change, environmental quality, ecosystems and green infrastructure. Moreover, there are common concerns between these three frameworks in terms of emphasizing the importance of the issues of transportation, energy, resources and material. This means that all of them agreed the importance of these categories (Haapio and Viitaniemi, 2008).

On the other hand, there are a number of weaknesses that have been touched on previously during the critique of these three frameworks. One of the most obvious weaknesses is the failure to address how these methods deal with the management issue as an important factor in the development process. It is almost disregarded and does not have the sufficient importance that it should have (Tam et al., 2004). It is fair to point out that each one of these three frameworks has a number of the key issues in relation to management, but unfortunately with a lack of detail given.

Critics have also argued that these frameworks have not only overlooked the importance of management, but also have not addressed the financial issue within their frameworks. For instance, BREEAM, CASBEE and LEED do not include financial aspects in their framework, which might contradict the principles of the sustainable urban planning (Grace, 2008). There is no doubt that financial issues are considered as one of the most important factors that would determine either success or failure. Therefore, they should have given it the sufficient importance in order to achieve sustainable urban planning.

Furthermore, despite the fact that these frameworks come from different countries, Japan, North America and European countries, and have emphasis on different characteristics, these methods offer no explanation on how to implement these frameworks outside these countries.

For example, dealing with the variations of the regional and local context, include cities and their social background. Additionally, one major drawback of these approaches is the absence of the clear methods of distribution of responsibilities between the stakeholders within these frameworks as mentioned previously.

The above comparative analysis of the three existing frameworks determined their strengths and weaknesses and identified additional issues that should be included in a sustainable urban planning framework. As a result of this analysis, then, this study will attempt to devise a new, comprehensive and effective framework. The new framework will be designed based on two main foundations. Firstly, the scientific research and knowledge, which includes academic research papers and reports on the concepts of sustainable urban planning etc. Secondly, this framework will be based on the strengths of the existing frameworks of sustainable city development, addressing and combating those weaknesses, which were discussed previously in this chapter. The expected outcome of this proposal framework is to have an effective sustainable urban planning framework that could be applied in different countries across the world. It aims to integrate the core issues of sustainability to meet current needs without compromising the needs of the future generations.

2.6. Generic Proposal for Sustainable Urban Planning

Most of the results and findings reached through this literature review have emphasised the need for an effective framework for sustainable urban planning. By the same token, this research argues that the presence of such a framework would return substantial benefits to the communities and cities despite potential difficulties and obstacles. For those reasons, this study intends to develop a new framework in the hope that this can be the first step in creating an effective sustainable urban planning framework, which could potentially be applied across the world.

The core of this framework has four key integrated dimensions, namely, environmental, social, economic and planning dimensions. Furthermore, each one has a number of major categories in addition to a number of criteria. The framework has an additional dimension, the information and communication technology dimension (ICT). This one will be presented as an implicit dimension that will be included within all of the four key dimensions. This proposed framework can be seen in Figure 2.7 including its main dimensions, major categories and the criteria.

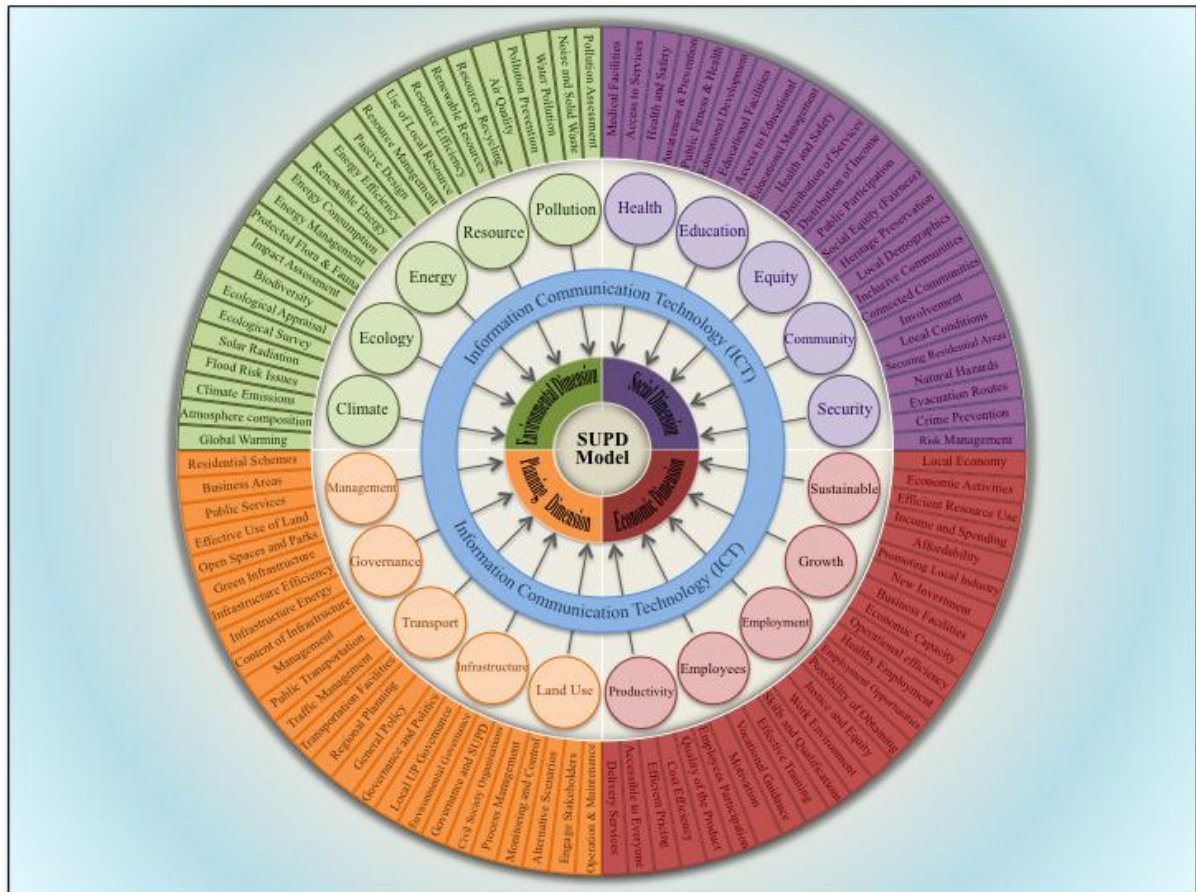


Figure 2.7. Proposal for the sustainable urban planning framework with the main dimensions, categories and criteria

The environmental dimension focuses on a number of critical issues that are related to the environment. For instance, it considers the phenomenon of the global warming and the need to reduce emissions to the environment. Also, it touches the subjects of the biodiversity, as well as the ecosystem in order to reduce the impacts on the environment, which have risen steadily as result of the human activities and natural disasters as mentioned earlier in this chapter. Moreover, the energy and resource issues have been taken into account in this framework in an attempt to maintain a stable resource base.

The social dimension looks at meeting the different needs for people in order to provide high citizens satisfaction. There is no doubt that sustainable urban planning is difficult to achieve without people who feel that they have a faire share of wealth, safety and influence as mentioned before. Therefore, this dimension aims to provide society with the essential services in order to reach citizen satisfaction. This could be achieved through the provision of health and welfare facilities, access to the medical service, and educational development, management and facilities. Moreover, it emphasises a society that includes the equitable distribution of service and income.

The third dimension of the proposal framework for sustainable urban planning is the economic dimension, which deals with a number of aspects regarding the economy. These include economic growth, sustainable economy, employment and productivity. Each of them has a number of issues such as the local economic development, business facilities, economic capacity, employment opportunities as well as the quality of the product. This dimension focuses on the importance of the achievement of stable economic growth. Additionally, it works to organise the production and consumption processes and choose forms of production that minimise the use of resources and reduce environmental pollution.

The fourth dimension that has been ignored by many sustainable development studies is planning. It is argued in this research that sustainable urban planning is not only based on environmental protection, economic growth and social equity, but also on a strong foundation of good planning. However, this dimension highlights several concerns in terms of planning aspects, including the proper use of the land, addressing infrastructure issues and consideration of the importance of transportation matters. Furthermore, it sheds light on the management side in terms of the control and monitoring the overall process of sustainable urban planning.

Finally, this framework includes one of the most important core elements, which has also been disregarded in most of the studies and research papers in the field of sustainable urban planning, the information and communication technology dimension (ICT). Undoubtedly, the role and importance of ICT has emerged as one of the most important key elements that must currently be taken into account. It looks at a number of essential issues that affect the daily human life.

For example, the ICT dimension emphasis on 21st century skills outcomes and the ability of citizens to access technologies, services and resources. Moreover, this dimension has been included in all of the previous dimensions due to the importance of the aspects of technology in the era of globalization. However, these main dimensions with full list of the major categories and criteria can be seen in Table 2.8.

Table 2.8. The main dimensions of the proposal framework with full list of the categories and criteria

Environmental Dimension	Social Dimension	Economic Dimension	Planning Dimension
<i>Climate Change</i>	<i>Human Health</i>	<i>Sustainable Economy</i>	<i>Land Use</i>
Consideration of Global Warming	Medical and Welfare Facilities	Local Economic Development	Residential Schemes
Climate Change Emissions	Access to medical services	Healthy Economic Activities	Employment and Business Areas
Atmosphere Composition	Increased public fitness & health	Efficient Resource Use	Public Services and spaces
Solar Radiation	Awareness and Prevention	Income and Spending	Mixed-Use and Effective Use of Land
Flood Risk Issues	Control and Monitoring	Affordability	Open Spaces and Parks
<i>Ecology</i>	<i>Education</i>	<i>Economic Growth</i>	<i>Infrastructure</i>
Ecological Survey	Educational Development	Promoting Local Industry	Green Infrastructure
Ecological Appraisal	Educational Facilities	New Business and Investment	Infrastructure Efficiency
Biodiversity	Access to Education	Business Facilities	Infrastructure Energy Efficiency
Ecological Impact Assessment	Educational Management	Economic Capacity	Recycled Content in Infrastructure
Protected Flora and Fauna	The Surrounding Environment	Operational efficiency	Infrastructure Management
<i>Energy</i>	<i>Equity</i>	<i>Employment</i>	<i>Transportation</i>
Energy Management	Equitable Distribution of Services	Worthwhile and Healthy Employment	Public Transport
Energy Consumption	Equitable Distribution of Income	Employment Opportunities	Traffic Management
Renewable and Clean Energy	Public Participation	The Possibility of Obtaining	Transportation facilities
Energy Efficiency	Social Equity (Fairness)	Justice and Equity	Regional Transportation Planning
Passive Design Principles	Employment Opportunities	The Proper Environment to Work	General Policy
<i>Resource</i>	<i>Community</i>	<i>Employees</i>	<i>Governance</i>
Resource Management	Local Demographics	Skills, Abilities and Qualifications	Governance and Politics
Use of Local Resources	Prosperous and Inclusive Communities	Effective Training	Local Urban Planning Governance
Resource Efficiency	Connected and Open Community	Vocational Guidance	Environmental Governance
Renewable Resources	Community Outreach and Involvement	Motivation	Governance and SUPD
Resources Recycling	Respect the Local Conditions	Effective Employees Participation	Civil Society Organizations
<i>Pollution</i>	<i>Security and Safety</i>	<i>Productivity</i>	<i>Management</i>
Air Quality Management	Securing Residential areas, open spaces etc.	Quality of the Product	Process Management
Pollution Prevention Measurements	Understanding the Natural Hazards	Cost Efficiency	Comprehensive Monitoring and Control
Water Pollution Reduction	Providing Proper Evacuation Routes	Efficient Pricing	Development of Alternative Scenarios
Noise Control and Solid Waste	Crime Prevention	Accessible to Everyone	Engage Stakeholders
Pollution Assessment	Risk management	Delivery Services	Operation and Maintenance
Information and Communication Technology (ICT)			
21st Century Skill Outcomes			
Universal Access to Technology			
Access to Services and Resources 24/7			
ICT Management			

2.7. Summary

The chapter gave an inclusive view of the current concepts of sustainable urban planning, which is supposed to deal with most of the changes in recent years resulting from urbanisation in the globalization era and affecting the environmental, social, economic and planning aspects. As a result of the facts included within the chapter this research can safely conclude that sustainable urban planning plays a powerful role in terms of addressing these changes and improving the quality of the citizens life in addition to meeting the needs of both of the current and future generation.

In this part of the thesis, there have been many investigations and discussions made to understand the reality of sustainable urban planning today. Moreover, there has been a

discussion of the most common frameworks, which are internationally well known. These are BREEAM Communities, CASBEE-UD and LEED-ND. However, one of the main results that obtained from this part of the thesis is that there is a real need for creating a comprehensive and effective framework for sustainable urban planning that is based on a scientific knowledge. The framework also needs to address the strengths aspect of the existing frameworks of city sustainable development and avoid their weaknesses.

Therefore, this chapter presented a proposal for an effective sustainable urban planning framework, which has been designed to contain the core dimensions of a real development. It is also argued that the institutions and individuals related to this field must coordinate and work with each other to achieve the objectives of this new framework.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

The success of any reasonable study can be accomplished by adopting the proper techniques of research. Hence, the desired aims can be accomplished by the selection of right procedures that must be in line with the purpose of the research. Fulfilling of research objectives along with the confirmation of outcomes could be achieved by choosing the right method that is very significant while going through the research activity (Steele, 2000, Yin, 2003, Bryman, 2006). Therefore, it has been emphasized that the analysis, outcomes, conclusion, standards and legality of the study are heavily dependent upon the suitable data collection techniques (Fellows and Liu, 2009). Thus, the significant literature has been considered to obtain the research methodology to be followed in this study.

This chapter gives a comprehensive and in-depth picture of how this research work is carried out in order to obtain the necessary information and data to answer the research question. This will be based on the discussion of eight central issues, which can be summarised in the following key points:

- Research Philosophy: aims to discuss different research philosophies including the pragmatism, ontology and epistemology philosophies.
- Research Approach: presents different research approaches, including deduction and induction approach.
- Research Strategy: highlights different research strategies such as case study, survey, grounded theory, and experimental strategies.
- Choices of the Research Methods: including the mono method, mixed methods, and multi-method.
- Techniques and Procedures: a review of the techniques and procedures for the data collection and data analysis.
- Research Design: including the different theoretical and practical stages that will be followed in this research work.
- Research Map and Access to the Information: clarify the process of the research from the beginning until the end, and the mechanisms used to obtain the information.

3.2. Research Philosophy of Research

The research study normally pertains to hypothesis developed about the type of human experiences and the truth along with their understandings (Crotty, 1998). Understanding of the scholar with the research question, techniques to be adopted along with the investigation and determination of the findings are likely to be declared in these suppositions. Many real-world factors tend to shape the research idea, and the main impact is possibly the certain interpretation of the researcher towards adequate understanding and the way it is established (Van de Ven and Johnson, 2006).

A proposed remarkable framework has been created, in which the understanding about the research objective, the way to execute the research process from the idea stage to the data acquisition and analysis stage are significantly illustrated to facilitate the researcher. This framework is generally known as the “the Research Onion” depicted in figure 3.1 and has been extensively applied in many research mechanisms (Saunders et al, 2007).

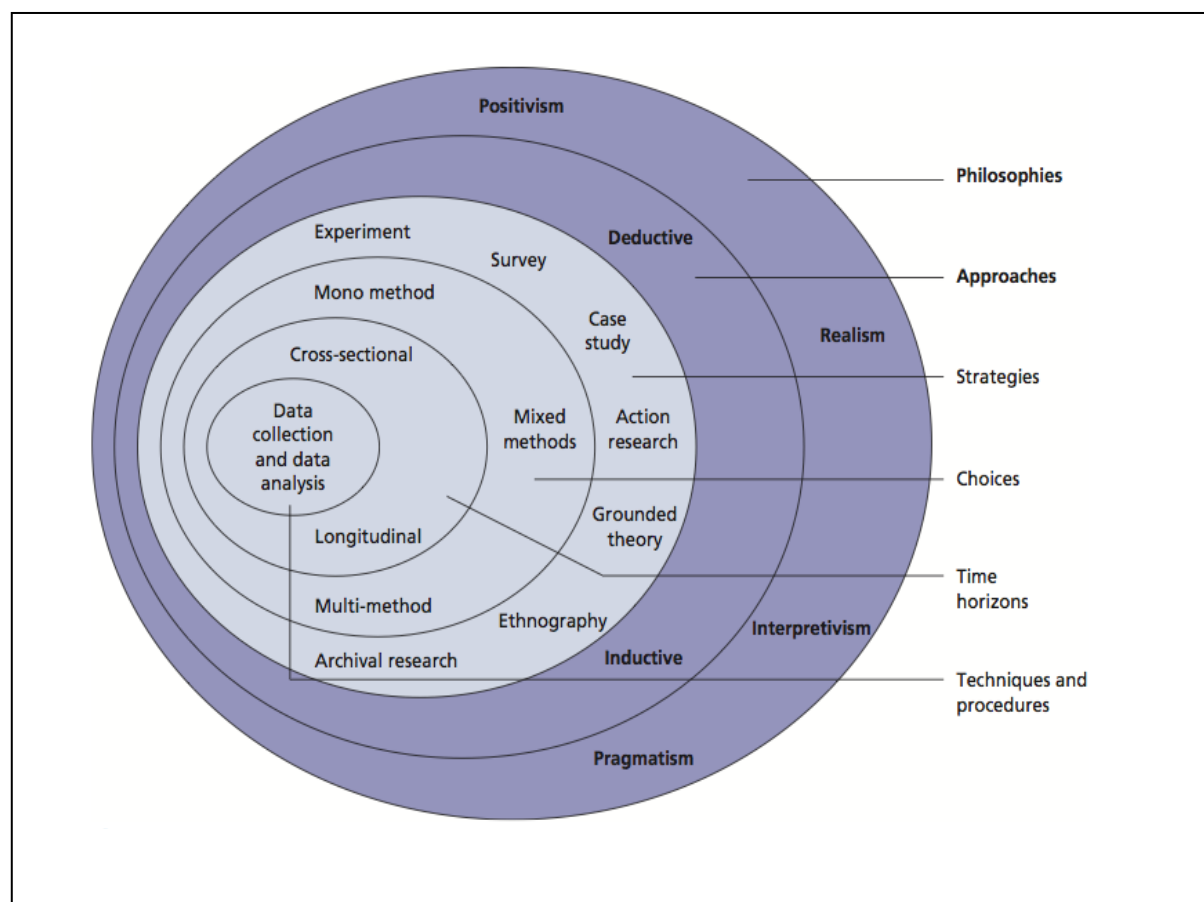


Figure 3.1. Research Onion (Saunders et al., 2007, p.138).

In this thesis, the main research process is based on this conceptual framework. In this framework, there are six main categories to form the research process. These are: research philosophies, research approaches, research strategies, choice of research methods, time horizons, and techniques and procedures for data collection and data analysis. Philosophies of the research aim to distinguish the scientific research from the non-scientific research in order to select the suitable procedures that need to be followed (Smith 2002, Lai, 2013). The research approaches can be defined as the selection between testing theory (Deductive Approach) and building theory (Inductive approach).

Research strategy is generally concerned with the ways of addressing the research question, including the experiment, survey, and case study strategies. Choice of the methods aims to determine the most suitable method for the research, for example, the choice between the mono method and mixed methods. The techniques and procedures stage helps the researchers to understand how the different data will be collected and analysed (Saunders et al. 2007). Some researchers are related to the opinions and approaches of the workers towards their production managers and other researchers play with the factual data like resources needed in the production process, both are different approaches and hence research study is performed differently in both the scenarios (Saunders et al., 2009). Thus, it is of great significance that the logical preferences by the researcher are being implemented considerably and also getting validated corresponding to the alternatives.

According to the literature of research based theoretical studies (e.g. Bryman, 2006, Johnson and Clark, 2006, Niglas, 2010, Rachmawati, 2008, Saunders et al., 2009, Saunders et al., 2012), one of four types of research designs is followed in most of the research activities; Epistemology, Methodology, Ontology and Pragmatism. However, as mentioned in Chapter One, this research concerns with building a new framework for sustainable urban planning for the city of Riyadh based on the scientific theories and the strengths of existing frameworks for sustainable city development, taking into consideration the opinion of experts who are familiar with the local context of the city of Riyadh. This without doubt, requires mixed analytical techniques that include both realistic and theoretical approaches. The following subsections will explain different research philosophies to identify the most suitable one for this research topic.

3.2.1. Pragmatism: Does the Research Have to Adopt One Position?

According to Pansiri (2005), the pragmatism philosophy is seen as the foundation of mixed methods (e.g. ontology and epistemology), which can be adopted to achieve better outcomes, depending on the nature of the research question. Tashakkori and Teddlie (2003), point out that pragmatism philosophy is highly suitable for the researcher in a specific research project to think of the adopted philosophy as a continuum rather than opposite positions. They claim that the pragmatism philosophy is intuitively interesting, fundamentally because it helps the researcher to avoid engaging in what they see as rather useless discussions about concepts such as reality and truth.

However, one of the weaknesses of this philosophy is that it deals more with reality and truth rather than theories and opinions. Therefore, this research would argue that this kind of research philosophies would not achieve the main aims and objectives of this research.

3.2.2. Ontology: Nature of Reality

The feature and kind of reality is likely to explain this concept; such suppositions are built in which the researcher's questioning ability is uplifted regarding the functionalities of the world and the responsibilities pertaining to particular views (Saunders et al., 2012). Mcevoy and Richards (2006) indicate that "Ontology demonstrates the theory or science of being about actuality in life". According to Guba and Lincoln (1989), ontological suppositions respond to questions such as; what can be recognized? Or what is the type of reality? Objectivism and Subjectivism are two main views of ontology as discussed by many researchers, which are given below:

- **Objectivism** is about existence of social objects that are free of social actors; it illustrates the fact that social objects are having a significant truth apart from those common actors related to their life" (Crotty, 1998).
- **Subjectivism** is, basically, a social experience that is developed through the insights and resulting activities of social groups concerned with their presence. It is described as "understanding the connotations that individuals assign to social events" (Saunders et al., 2009).

Ontology philosophy deals with understanding realities in life and their relations to recognize the functionalities and responsibilities rather than establishing theories from social opinions (Bryman, 2012). Hence, this research would argue that this kind of research philosophies also would not achieve the main aims and objectives of this study work.

3.2.3. Epistemology: What Is Considered Acceptable Knowledge?

Epistemology represents “an ability to interpret and justify the philosophy that how we know what we know” (Crotty, 2003). It can be described as the study of understanding or a rational theory that defines the validity of knowledge (Daymon and Holloway, 2011). There are three types of philosophies in epistemology; positivist, realist and interpretivist as specified by Saunders et al. (2012), which are given below:

- **Positivism Philosophy:** researcher is likely to adopt the practices of the environmental scientist and also follow his theoretical perspective. “Researcher[s] choose to perform in an evident group reality in order to deliver the end product such as principles like generalisations parallel to those delivered by the natural experts” (Remenyi et al., 1998).
- **Realism Philosophy:** it explains logical investigations and assumes that our recognition is reality: That presence of objects is independent of the human mind. Crotty (1998) indicates that “realism and idealism are different concepts; there is a theory which only describes the existence of mind and its allied matters”. It generally expresses the question, like: Is the presence of objects and our understanding are interlinked?
- **Interpretivism Philosophy:** the dissimilarities among humans as social actors, the fundamental idea for the researcher to realize the differences between humans in our role as social actors needs to be understood. This emphasizes that research should be performed among people, not on objects like, vehicles and machines (Saunders et al., 2009).

However, Epistemology philosophy concerns with knowledge understanding and how it can be validated and properly understood, rather than extracting knowledge from different people opinions to build new knowledge. Therefore, this research would argue again that this type of research philosophies would not obtain the fundamental aims and objectives of this research.

3.2.4. Methodology: Systematic Manner to Solve Problem

Crotty (2003) describes methodology as “the plan of action, the approach, design or process behind the preference and application of certain techniques and in order to obtain the desired milestones, the research is likely to integrate the use of techniques with the preferences”. Most of the research work has performed by applying one of the three procedural choices according to the relevant literature review: quantitative, qualitative or mixed methods, which are explained as under:

- **Quantitative Research:** it is defined as a technique in which research process significantly moves around facts and figures (i.e. less, more, small and large) instead of unfolding the connotation (Thomas, 2003).
- **Qualitative Research:** it is described as “the research in which the contents and interviews are explored in order to determine important samples so that a specific event can be illustrated significantly” (Auerbach and Silverstein, 2003).
- **Mixed Methods Research:** it employs both the qualitative and quantitative techniques in one study and is also known as ‘Triangulation’ method. According to Gill and Johnson (2002), simultaneous application of two or more research techniques (qualitative and quantitative) is referred to as triangulation technique in a research study.

It can be seen from the above review that the methodology philosophy adopting triangulation method (qualitative and quantitative) is the most suitable research philosophy to be followed in this research work. The following subsection explains this choice in details.

3.2.5. Selected Philosophy of This Study

Burke (2007), indicates that during the research work the researcher could easily fall into the trap of thinking that one research philosophy is ‘better’ than another, and thus miss the point. Some research philosophies are better than others at doing different things. Therefore, as always, the term 'better' depends on a number of critical issues regarding the research area, including the research question the researcher is attempting to answer.

Guba and Lincoln (2005), have compared a number of the research philosophies, which are ontological, epistemological and methodological philosophies. This comparison is mainly built based on three key issues: positivism, critical realism and interpretivism as can be seen in Table 3.1.

Table 3.1. Comparison between research philosophies (Guba and Lincoln, 2005, Lai, 2013).

Elements	Positivism	Critical Realism	Constructivism/ Interpretivism
Ontology	'Naïve realism', in which an understandable reality is assumed to exist, which is driven by immutable natural laws. The true nature of reality can only be obtained by testing theories about actual objects, processes or structures in the real world.	Critical realism – 'real' reality but only imperfectly and probabilistically apprehendable.	Relativism – local and specific constructed realities. The social world is produced and reinforced by humans through their actions and interactions.
Epistemology	Dualistic/objectivist. Verification of hypothesis through rigorous empirical testing. Search for universal laws of principles. Tight coupling among explanations, predictions and control.	Modified dualist/objective. Critical tradition/community. Findings probably true.	Transactional/ subjectivist. Understanding of the social world from the participants' perspective through interpretation of their meanings and actions. Researchers' prior assumptions, beliefs, value and interests always intervene to shape their investigations.
Methodology	Hypothetical-deductive experiments/ manipulative. Verification of hypotheses. Mainly quantitative methods.	Modified experimental/manipulative. Falsification of hypotheses. May include quantitative methods.	Hermeneutical/ dialectical. Interpretive case study. Action research. Holistic ethnography.

This particular research is likely to adopt the number fourth category that is 'Methodology Philosophies' among the previously discussed four types of methodological preferences and research philosophies, and the 'Mixed Methods Research' containing both the qualitative and quantitative methods has been chosen as the most suitable approach to be adopted in this research study. The below mentioned key points will tend to justify this choice:

- Since the reality study of the Saudi capital Riyadh's urban development is being discussed and captured in this research, both the qualitative data (e.g. an interview) and quantitative data (e.g. a questionnaire) must be there to meet the diverse needs.
- The triangulation process is incorporated with the qualitative and quantitative approaches so that both forms of data could be established, which is very useful to obtain beneficial features and desirable consequences along with the effective decision making process as depicted in Figure 3.2 (Fellows and Liu, 2009).
- Access to the significant information and these data collection methods have been emphasized in this technique so that the reality of the urban planning in the Riyadh may be properly reflected. The research questions would be determined and addressed with the help of adopted method: can the urban planning of the city of Riyadh be controlled sustainably via a sustainable urban planning framework?

Creswell (2003) defined quantitative research as an inquiry into a social or human problem,

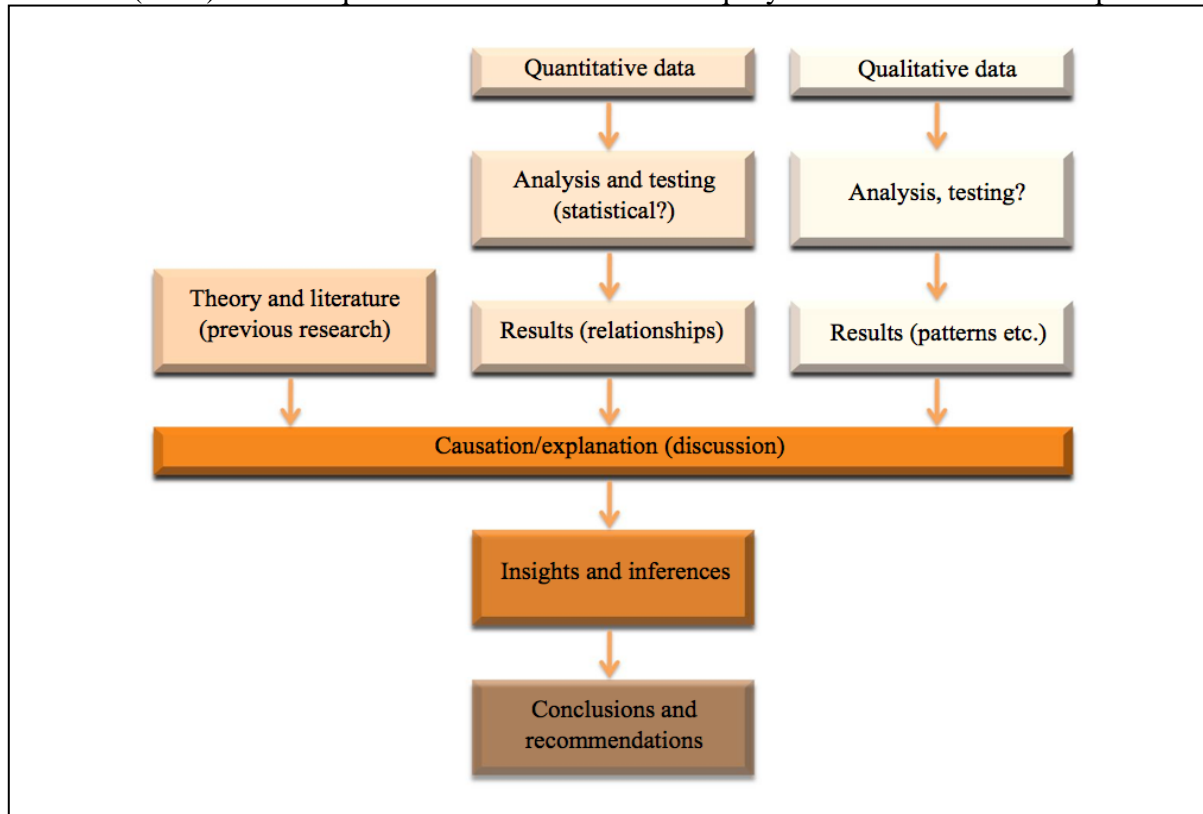


Figure 3.2 Combination of both the qualitative and quantitative data (Fellows and Liu, 2009).

based on testing a hypothesis or theory composed of variables, measured with numbers and analysed with statistical procedure to determine whether the hypothesis or theory holds true. According to Brannen (1992), quantitative research is concerned with attitudes and large-scale surveys rather than simply with behaviour and small-scale surveys.

Qualitative research utilises subjective methods very often based on personal opinion, perception or feeling (Holt and Faniran, 2000). Qualitative research, broadly defined, means any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification (Strauss and Corbin, 1990). In qualitative research, an exploration of the subject is undertaken without prior formulations, the object is to gain understanding and collect information and data so that theories and patterns might emerge (Hoare, 2010).

The qualitative technique (interviews) and the quantitative technique (questionnaire) would have been applied as a methodology in this research study. It is considered on the basis of findings from the literature review since they relate to the Riyadh city. The native context from diverse organizations along with the services of experts in sustainability of urban development would be required to execute this process effectively. The consensus-based approach is followed in this process: the Delphi Technique. Chapter 5 will capture the comprehensive details of this technique.

3.3. Research Approach

Saunders et al. (2009), point out that the extent to which the researcher is clear about the research theory at the beginning of the research raises an important question concerning the research project design. This is focused on whether the study needs to be built based on the use of the inductive approach, which the researcher need to collect data and develop theory as a result of research data analysis, or based on the use of the deductive approach, where the researcher would develop a hypothesis, theory and design a research strategy to test the hypothesis. The following subsections of this part explain these two approaches in addition to a third type, which is the combining research approaches.

3.3.1. Deductive Approach: Testing Theory

Dubois and Gadde (2002), indicate that “deductive approaches are concerned with developing propositions from current theory and making them testable in the real world”. It consists of the development of a theory that will be subjected to a precise test (Collis and Hussey, 2003). Hyde (2000), defines the deductive approach as “a theory testing process which commences with an established theory or generalisation, and seeks to see if the theory applies to specific instances”. Robson (2002), points out that the deductive research approach involves five sequential stages, which can be summarised as follow:

- Deducing a hypothesis from the theory.
- Expressing the hypothesis in operational terms.
- Testing this operational hypothesis.
- Examining the specific outcome of the inquiry.
- Modifying the theory in the light of the findings.

3.3.2. Inductive Approach: Building Theory

Inductive approaches rely mainly on grounded theory, where theory is methodically created from data (Dubois and Gadde, 2002). Saunders et al. (2009), indicate that research using an inductive approach is likely to be specifically concerned with the context of a small sample of subjects. Hyde (2000), defines the inductive approach as “a theory building process, starting with observations of specific instances, and seeking to establish generalisations about the phenomenon under investigation”. Easterby-Smith et al. (2008) suggest three reasons for using the inductive approach. These reasons are:

- It allows the researcher to take a more informed decision about the research design, which is more than just a technique and procedure for the collection and analysis of the data.
- It enables the researcher to think about the different research strategies and choices that will support the research and, importantly, those that will not.
- It assists the researcher in adapting the research design to cater for constraints.

3.3.3. Combining Research Approaches

Creswell (2003), proposes a number of sensible principles to determine a suitable approach for the research and, perhaps the most significant of these is the emphasis on the research and the nature of the research subject. According to Saunders et al. (2009), research with a wealth of literature that can define a theoretical framework and a hypothesis lends itself more readily to deduction, while research with a new topic and little existing literature may be more appropriate to work with inductively. The differences between inductive and deductive approaches generally can be seen in both Figure 3.3 and Table 3.2.

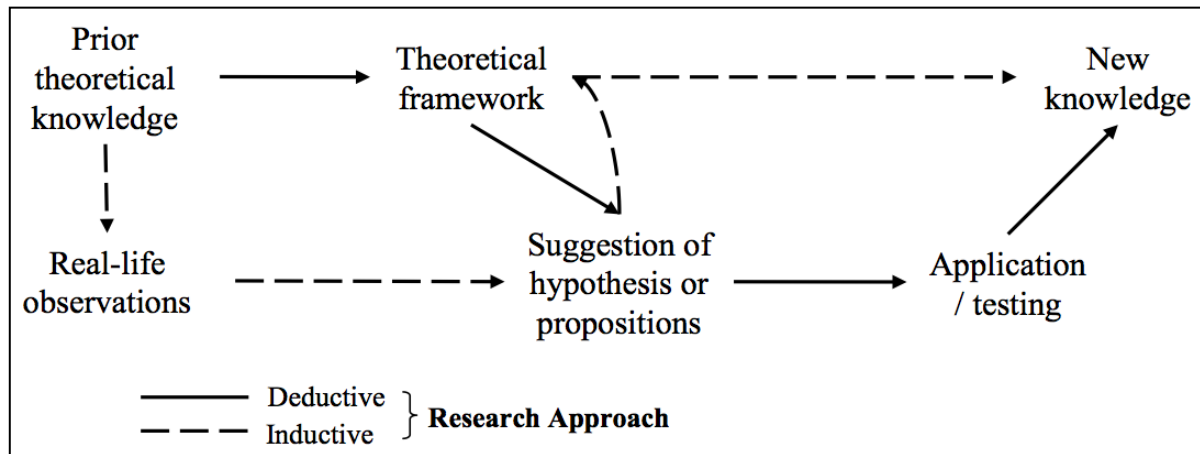


Figure 3.3. The difference between the inductive and deductive approaches (Spens and Kovács, 2006).

Table 3.2. The difference between the inductive and deductive approaches (Saunders et al., 2009).

Deductive Approach	Inductive Approach
<ul style="list-style-type: none"> Scientific principles. Moving from theory to data. The need to explain causal relationship between variables. The collection of quantitative data. The application of controls to ensure validity of data. The operationalisation of concepts to ensure clarity of definition. A highly structured approach. Researcher independence from what is being researched. The necessity to select samples of sufficient size in order to generalise conclusions. 	<ul style="list-style-type: none"> Gaining an understanding of the meanings that humans attach to events. A close understanding of the research context. The collection of qualitative data. A more flexible structure to permit changes in research emphasis as the research progresses. A realisation that the researcher is part of the research process. Less concerned with the need to generalise.

A number of research studies (e.g. Norris and Ortega, 2000, Erlam, 2003) point out that both deductive and inductive research approaches can be described as a continuum of explicitness that ranges from the more explicit (deductive) to the less explicit (inductive). Hyde (2000), indicates that both qualitative and quantitative researchers demonstrate deductive and inductive approaches in their research process: the qualitative enquiry generally adopts an inductive process, while quantitative enquiry generally adopts a deductive process. However, it is significant for the researchers to recognise the combination of these two research approaches in the research. Therefore, for the purposes of this research work, this study chose to use both deductive and inductive approaches. The main reason for this selection is that this

research will follow the ‘Methodology Philosophies’ and has chosen to use mixed methods in this study, which involves both quantitative and qualitative method, as mentioned previously.

3.4. Research Strategy

Saunders and Lewis (2012) indicate that the research question, plan, idea and intentions tend to drive the research strategy and it keeps on fluctuating due to diversified aspects. The research question is likely to be addressed by the strategy, which goes to the research design from the suppositions, and then to data acquisition and analysis in this methodological way (Myers, 2009). Yin (1994) indicates that researcher can answer the research questions through a number of research strategies, which include case studies and ethnography. But, most of the research works are based on one of the eight main strategies that are included within ‘the Research Onion’ introduced by Saunders et al. (2007) and illustrated in figure 3.1 in which much of the research activities are based on one of the eight major strategies within the onion representation. These eight strategies are given below:

- Survey
- Archival Research
- Experiment
- Ethnographic research
- Narrative Inquiry
- Case Study
- Grounded Theory
- Action Research

Hakim (2000), points out, regarding the experimental strategy that “the purpose of an experiment is to study causal links; whether a change in one independent variable produces a change in another dependent variable”. Survey strategy is seen as a useful tool to obtain views, attitudes, perceptions and descriptions in addition to cause-and-effect relationships, and aims to collect the information and data in a standard format from different groups of people (Robson, 1993, Ghauri and Grønhaug 2005).

Archival research is built based on the use of documents and administrative records as the main source of data and information (Saunders et al. 2009). The case study strategy aims to build a detailed intensive knowledge regarding a single case or based on a small number of

cases (Robson, 1993). Yin (2003), underlines the significance of the context within a case study strategy, particularly when the boundaries are not clearly evident between the phenomenon being studied and the context within which it is being studied.

The research question of this study is “can the urban planning of the city of Riyadh be managed sustainably through an adapted sustainable urban planning framework? This question constitutes a case study that is placed within the broader area of sustainable urban planning and will be investigated through an empirical method. According to Robson (2002), the case study strategy can be defined as “a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence”. In regard to this definition, the City of Riyadh will be the particular contemporary topic, and the multiple sources of evidence can be obtained through different methods including questionnaires and interviews that will be carried out through the application of both Delphi technique and the Analytic Hierarchy Process (AHP) as will be seen in Chapter Five and Chapter Six.

The case study is in line with research with the aim to acquire an insight of the actions being legislated and the research background (Yin, 2003, Eisenhardt and Graebner, 2007). Since its goal is to generally understand humans through understanding their actions as a single group or as a community, it is one of the most common strategies for performing social science studies (Thomas, 2003). The explanatory and exploratory research mostly follows this approach due to the simultaneous use of diverse data collection techniques (Yin, 2003). While ‘what?’ and ‘how?’ matters hold great significance in the survey strategy, and responses to the questions along with addressing “why” part is organized in the case study strategy (Saunders et al., 2012). For example, a case study should likely to follow the survey techniques, or incorporate with many other techniques contained in mixed methods (Saunders et al., 2007).

The case study strategy as well as the questionnaire strategy is selected in this research due to its suitability for the nature of the research question. It is considered the most appropriate strategy to use because it offers a systematic method of collecting the data, analysing information, and discussing the findings and results, thus understanding a particular problem or situation in great depth. Moreover, it helps to understand a specific situation or problem in great depth.

3.5. Data Collection Techniques and Analysis Procedures

There are two primary instructions in any research activity regarding data acquisition (Saunders et al., 2009). The first one pertains to secondary data that is previously available through numerous sources including reports and books, journal articles, web portals and newspapers, as depicted in Figure 3.4. The second data acquisition strategy is the primary data, for which the researchers gather original information, facts and figures containing questionnaires, surveys and interviews (see Figure 3.5).

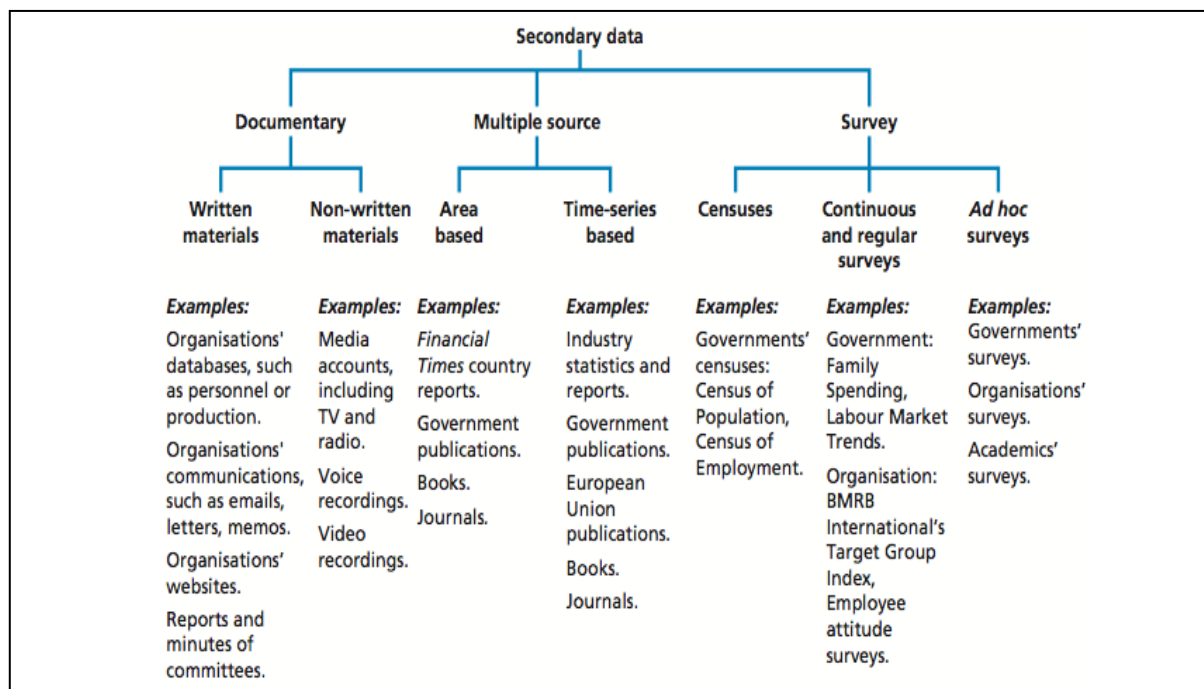


Figure 3.4 Various techniques to gather the secondary data (Saunders et al., 2012, p.259).

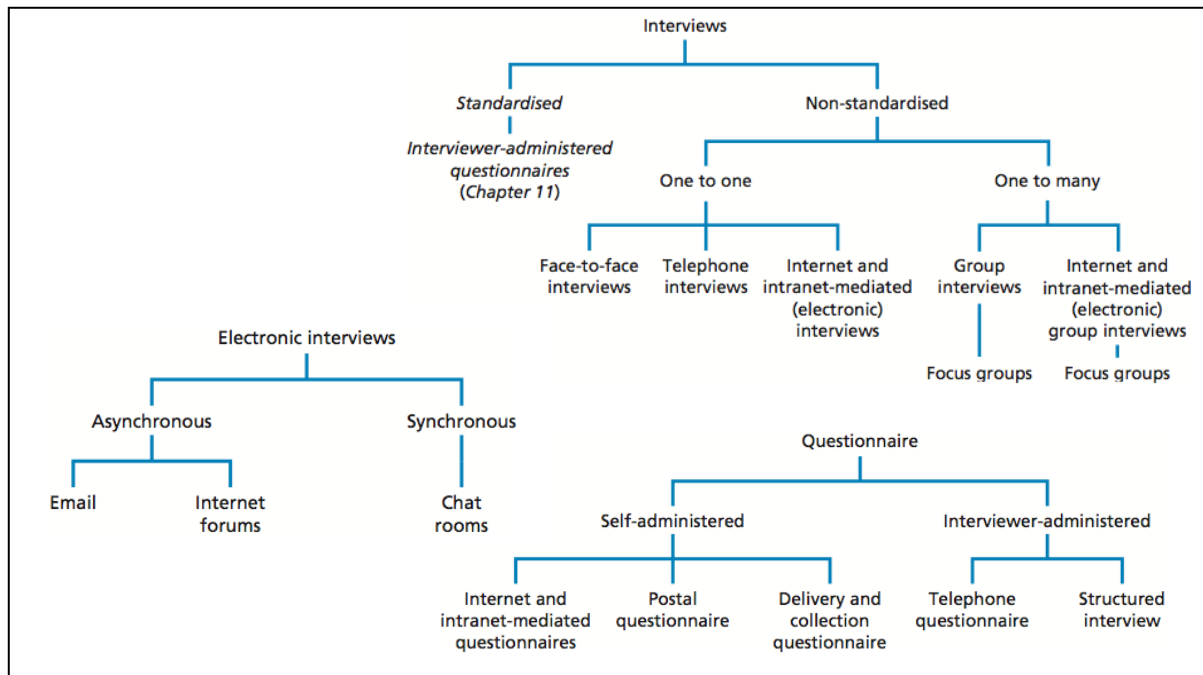


Figure 3.5 Various techniques to gather the primary data (Saunders et al., 2012, p.321).

There is a wide range of data collection methods, which include surveys, questionnaires, interviews, and observation. The main decision regarding the type of selected method that will be used depends on the aim of the research and the availability of the data and information that is required (Naoum, 2007, Oates, 2006). In this research, the gathering of primary data will rely on interviews and questionnaires. Moreover, the researcher has followed the pilot study process before starting these two methods. The main aim of this process is to validate the questionnaires as well as to improve its quality and clarity. These two types of methods will be explained in the following subsections.

3.5.1. Interviews

According to Saunders et al. (2009), the employment of the interview method for the purpose of collecting the primary data helps researchers to gather reliable and valid data that is related to their research questions and objectives. Furthermore, it enables the interviewer to steer the discussion in the most appropriate ways for collecting information from participants (Ghashat, 2012). Interviews help the researchers to gather more data, especially more complex data, and provide the interviewers with a comprehensive picture of the research area that helps with the questionnaire design (Hall and Pain, 2006, Nathens and Moore, 2006, Saunders et al., 2009).

Generally, the interview method can be divided into three main categories: structured interviews, semi-structured interviews, and unstructured or in-depth interviews (Greener, 2008). These three types of method are discussed by Saunders et al. (2009) and can be explained in the following key points:

- **Structured interviews** use a set of predetermined questions that are in most cases concise, clear, and closed, therefore, it requires precise answers in the form of a set of options presented on paper or read out (Thomas, 2003). This type of interviews is considered as most suitable method to be followed as long as the aims of the research are clearly understood and the research questions are specifically identified (Krueger and Casey, 2000).
- **Semi-structured interviews** have the features of both structured and unstructured interviews. In this interview the researcher usually has a list of questions and themes that need to be covered during the interview. Researchers who follow the semi-structured interviews use both open and closed questions (Saunders et al., 2009).
- **Unstructured interviews** allow the interviewer to ask some open-ended questions and give the interviewees the opportunity to present their own views freely (Thomas, 2003). In this type of interview there is no predetermined list of questions to be asked during the interview, where the direction of the interview is determined by both the interviewer and interviewee (Krueger and Casey, 2000, Saunders et al., 2009). However, the interviewer needs to have a clear idea about the research aspects that need to be explored and investigated.

It can be argued that there are many issues that may not be reached through the review of previous studies or through the questionnaire process, yet can be obtained through the exchange of views during interviews with people who have first-hand experience in the subject area. For this reason, a number of people who are considered as experts in the sustainable urban planning field will be interviewed to discuss the critical issues of this research area. These interviews are mainly designed based on the findings from the initial phase, the literature review.

During these discussions, experts will be asked a number of key questions, branching into several sub-questions on various issues related to the research subject matter. These issues mainly focus on the current status of urban planning in the city of Riyadh and the discussion of the proposed framework for sustainable urban planning for the city of Riyadh, including its

main dimensions and categories. Some of these questions include short, closed questions and others include open-ended questions. Therefore, this research has selected the semi-structured interview method to be followed in this study.

3.5.2. Questionnaires

According to deVaus (2002), the questionnaire method can be defined as “a general term to include all techniques of data collection in which each person is asked to respond to the same set of questions in a predetermined order”. The use of the questionnaire method is considered as one of the most widely used techniques for collecting the data, and it is discussed in several research methods texts (e.g. Oppenheim 2000, Bell 2005, Dillman, 2007, Saunders et al., 2009). Sekaran (2006), points out that the questionnaire technique is a powerful tool for collecting data, however, that researchers need to ensure that it will collect the precise data that they need to answer their research questions and achieve their objectives.

In this research, the questionnaire is used as one of the central parts of the main methodology. It is designed based on the results and findings that were discovered through the extensive process of reviewing the literature. The purpose of this method is to obtain the views of individuals experienced in the subject of research, and to achieve the main aims and objectives of the study. In this study, the questionnaire is divided into four main sections.

The first one is aimed at providing the participants with general knowledge regarding the scope of the research and main aims and objectives. The second section is intended to review the current status of the urban planning in the city of Riyadh. The third section aims to assess the need for such proposed framework for sustainable urban planning for the city of Riyadh from the participant's point of view. Last but not least, the fourth section discusses the different issues regarding the proposed framework including the environmental, social, economic, planning, and ICT issues.

This study employed qualitative and quantitative types of data as already discussed. Hence, the nature of the data will rely on data analysis. For example, the explanatory frameworks of the sustainable urban planning in general and principally for city of Riyadh will be acknowledged through the illustration of interviews. However, the attributes and statistical data pertaining to the city of Riyadh will be emphasized by the investigation of the questionnaires (the quantitative data). Moreover, the acquired data during the research process would be analyzed by the different tools, like SPSS software app, the use of logical

functions of Expert Choice, developed by Expert Choice, Inc., would be utilized for detailed examination.

3.6. Research Design

Research design can be seen as a logical approach and as a master plan of research work that sheds light on how the research will be conducted (Thomas, 2003). Yin (2003), defines the research design process as “a logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions (answers) about these questions”. Gill and Johnson (2002), point out that the “research design provides a blueprint that enables the researcher to structure a research problem in such a way that the outcome is the production of valid, objective and replicable answers.” De Vaus (2002), determines that one of the main functions of the research design process is assisting the researchers in making sure that the evidences obtained through their research enables them to answer the research questions as unambiguously as possible.

According to Bryman and Bell (2011), the selection of the research design depends on the decision regarding the priority that will be given to a number of aspects that are related to the research process. In other words, it provides the researchers with guidance for collecting and analysing the data in their research in order to ensure this data is relevant to their work and address the research needs (Churchill and Iacobucci, 2009).

Regarding this study, the research design will be based on four key stages; one stage is considered as a theoretical stage, while the other three stages are considered as practical stages. The first stage, the theoretical stage, focuses on the literature review in order to form a comprehensive picture of the concept of sustainable development particularly as it applies to urban planning. Also, this stage aims to achieve one of the research objectives, which is the review of the different existing frameworks for sustainable city development. The main aim of this review is to propose an effective framework for the city of Riyadh.

The second stage of this research is a practical study, which employs the Delphi Technique. During this stage, a number of experts will be selected to evaluate the proposed framework of sustainable urban planning for the city of Riyadh. This stage aims to obtain expert opinions in regard to the importance of the proposed framework. Furthermore, it investigates expert views about the nature of urban planning in the city of Riyadh at the current time. The third stage focuses on the application of the Analytic Hierarchy Process (AHP) to evaluate the proposed framework, which will be built, based on the results that will be obtained through the employment of the Delphi technique in the stage two. Analytic Hierarchy Process (AHP)

is employed in this research to give weight to each dimension, category and criterion of the proposed framework by the use of analytical functions of Expert Choice software, developed by Expert Choice, Inc.

The fourth stage is the testing process stage. The main purpose of this stage is to test the proposed framework of sustainable urban planning based on the local context of the city of Riyadh. The testing process is mainly built based on the result of both Delphi technique and AHP technique in addition to the scoring and rating system that will be designed during this research. An overview of these four theoretical and practical stages will be presented in the following subsection, while the full detail and main results will be provided during this thesis in chapter five, chapter six and chapter seven respectively.

3.6.1. Stage One: The Literature Review

Tranfield et al. (2003) points out that the literature review stage is extremely significant for any research work and is an important part that needs to be considered by the researcher. A literature review is a stage that examines the collection of references or citations related to the area of research (Weissberg and Buker, 1990). This is one of the most important issues that needs to be completed before carrying out any scientific research. According to Anderson (2004), the main purpose of the literature review can be summarized in the following points (see Figure 3.6):

- Position the investigation.
- Examine the context of the problem or issue.
- Identify relevant concepts and issues as well as methods of enquiry.
- Devise a framework for the analysis of your information.

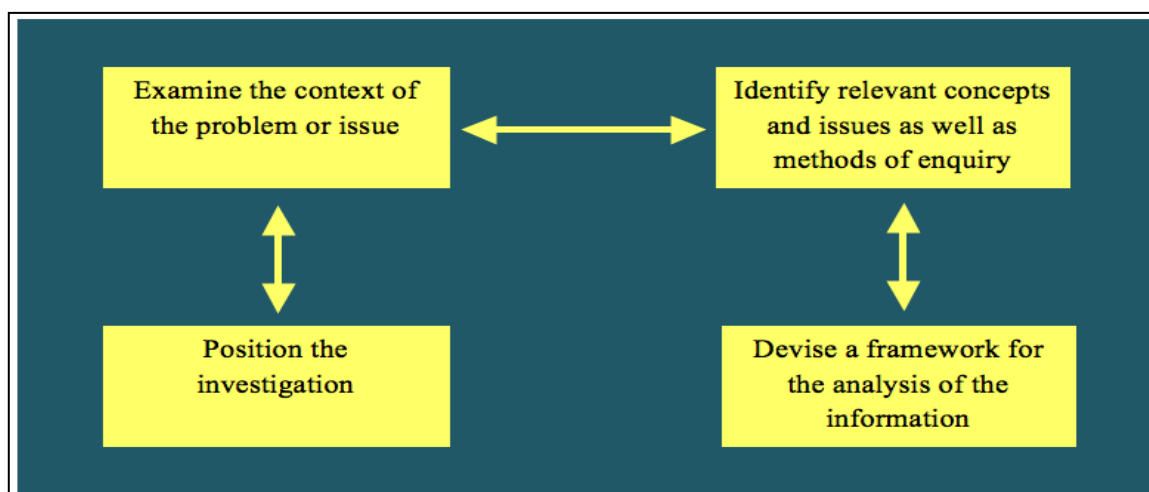


Figure 3.6. The main purposes of the literature review (Anderson, 2004)

The literature review helps the development of the research problem and determines the dimensions and area of the study. Researchers usually structure their literature review from general to specific in order to identify the main areas of focus and discuss each area under separate subheadings (Weissberg and Buker, 1990). It critically provides the researchers with a solid foundation on which their research works are built, and helps them to create a better understanding and insight into related previous research works and the findings that have emerged (Saunders et al., 2009). Reviewing the literature also has a number of aims that are highlighted in many research works, the most important of these purposes have been emphasised by Gall et al. (2006) and can be summarised in the following key points:

- Helping the researchers to refine further their research questions and objectives.
- Identify the possibilities of the research, which have been overlooked implicitly in many research.
- Discovering obvious recommendations for further research that provides researchers with valuable justifications for their own research questions and objectives.
- Directing the researchers to avoid the repeating research works that have been done previously.
- Presenting views in academic and professional journals in order to form insights about the aspects of the research questions and objectives that are considered within the research.
- Provide the researchers with an insight into different research approaches, strategies and techniques, which can be suitable for their research questions and objectives.

According to Saunders et al. (2003), “the process can be likened to an upward spiral, culminating in the final draft of a written critical literature review”. The suggested literature review process identified by Saunders et al. can be seen in Figure 3.7.

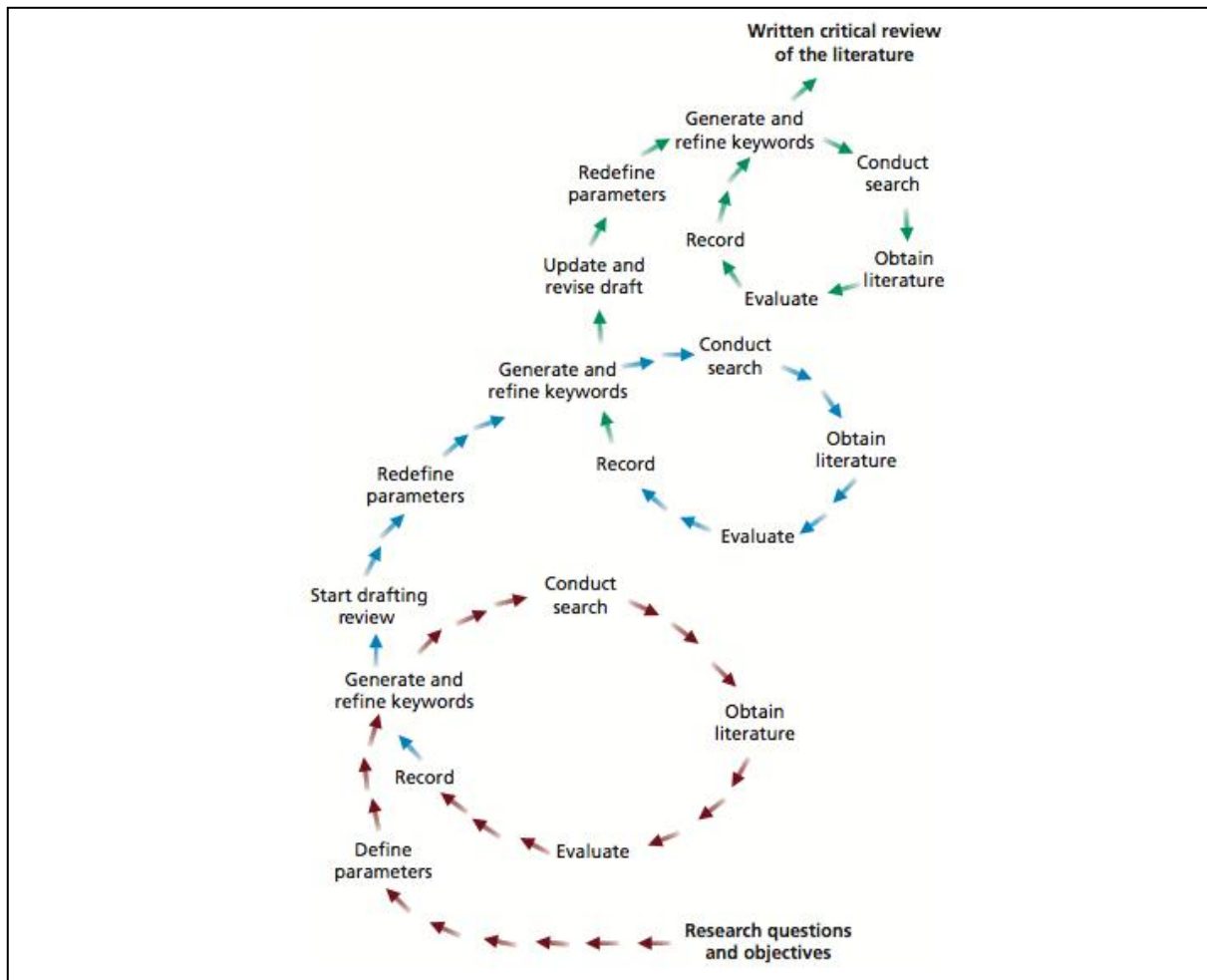


Figure 3.7. An upward spiral process of the literature review stage (Saunders et al., 2003, p.60).

The literature review in the study not only provided a comprehensive understanding of the topic under consideration, but also brought up the related critical issues and their significance. It also provides a range of information, facts and opinions, which reflect the concept of sustainable urban planning in different parts of the World.

3.6.2. Stage Two: The Delphi Technique

The Delphi technique can be described as a team decision technique, which needs skilled experts with profound knowledge on the issues (Okoli and Pawlowski, 2004). There are diverse types of the Delphi Techniques that have been employed including the Policy Delphi, Real-time Delphi and Decision Delphi (Hasson et al., 2000, van Zolingen and Klaassen, 2003). This research makes use of the Delphi Technique to identify and record views regarding regions of sustainable urban planning and to acquire consent with regards to a group of categories and criteria. Thus, the Decision Delphi approach has been followed in this research. It consists of a team of decision-makers and professionals who are chosen in

accordance with their position in the hierarchy of decision-makers and their proficiency. The objective is to constitute ideas so that agreement can be reached (Hanafin, 2004).

To consider a procedure as a Delphi, it must incorporate four elements: anonymity, iteration, controlled feedback and the statistical aggregation of group response (Rowe and Wright, 1999, van Zolingen and Klaassen, 2003, Landeta, 2006, Geist, 2010). In this research, the approach of a "ranking-type" Delphi survey, proposed by Schmidt (1997), is considered for the organisation of the questionnaires, data collection and investigation of the information. This method has been referred to in numerous scientific papers (Powell, 2003, Schmidt et al., 2001, Okoli and Pawlowski, 2004, Vidal et al., 2011). It is derived from the distribution of the process of the Delphi survey into three rounds: brainstorming; narrowing down; and ranking round, which will be explained in detail in following subsections.

The Delphi technique is used in this research in order to gather experts' opinion regarding the proposed framework for sustainable urban planning for the city of Riyadh, which is one of the main objectives of this research work. Indeed, it aims to address the underpinning of the research question: can the urban planning of the city of Riyadh be managed sustainably through an adapted sustainable urban planning framework? The main reason behind the use of this technique is that this research is concerned with determining the issues that are anticipated in promoting sustainable urban planning in the city of Riyadh. This is a crucial matter and thus needs accurate knowledge from the highly experienced people who identify with the diverse environmental, social, economic, planning and political matters of the city.

3.6.2.1. Overview of Delphi Technique

The workers at the RAND Corporation introduced the Delphi technique during 1950s while working on a project sponsored by U.S. Air Force (Okoli and Pawlowski, 2004, Landeta, 2006, Geist, 2010). This project was concerned with applying theories from professionals to choose the best U.S. industrial target system, having a subsequent estimation of the quantity of atom bombs needed to minimise arms production by a recommended quantity (Rowe et al, 1999). This technique used a chain of concentrated questionnaires combined with controlled opinion feedback to attain a consensus of dependable expert opinions (Dalkey & Helmer, 1963).

Hence, the strength of this technique consists in its ability to synthesize diverse opinions and possibly to address conflicts. Over the years this tool has been widely accepted and has proven its worth in building structures, predicting, and prioritizing matters and decision-

making processes (Landeta, 2006, Vidal et al., 2011). Moreover, it has been applied as a tool to define research priorities (Cohen et al., 2004, Nathens et al., 2006, Marshall et al., 2007, Ota et al., 2008, Rushton et al., 2011).

According to Linstone and Turnoff's (1979) definition, the Delphi Technique is an approach used to build a group communication process to allow a team to tackle intricate issues effectively. In other words, the Delphi technique can be described as a team decision method, which needs skilled and knowledgeable experts (Okoli and Pawlowski, 2004). It is generally perceived as one of the consensus techniques, which offers a methodical system for collection and aggregation of knowledgeable verdicts from a team of experts on a particular problem (Rankin et al, 2012).

The aim behind the development of the Delphi technique was to build up a system which helps to rise above the unconstructive consequences of one-on-one interactive teams. It facilitates, for example, low-status members who would otherwise accept the opinions of high-status members despite having a different opinion (Torrance, 1957, Van de Ven, 1974). Furthermore, this is a special purpose technique. It finds application in such cases where individual opinions must be collected and merged to reach certain decisions, which cannot be generated by a single person (Bryant et al, 2007).

Different researchers have adopted Delphi as a research methodology but have expressed it differently. For example, Wang et al. (2003) presented it as a survey, Rogers and Lopez (2002) as a procedure, Linstone and Turoff (1979) and Crisp et al. (1997) as a method and it has been presented as a technique by Broomfield and Humphries (2001), Snyder-Halpern et al., (2002) and Sharkey and Sharples (2001). There exist multiple types of 'Delphi' studies (Hanafin, 2004). According to Hasson et al. (2000), findings, there are diversified types of Delphi techniques that have been employed. These include the: 'Modified Delphi', 'Policy Delphi' and 'Real-time Delphi'. Zolingen and Klaassen (2003), offered more types of Delphi techniques like, Classical Delphi and Decision Delphi.

This study makes use of the Delphi Technique to generate views regarding regions of sustainable urban planning and to acquire consent with regards to a group of sustainable urban planning categories and criteria. Thus, the Decision Delphi approach was followed in this study. The Decision Delphi approach is a team of decision-makers and professionals who are chosen according to their position in the hierarchy of decision-makers and proficiency and the objective is to establish ideas so that agreement can be reached (Hanafin, 2004).

3.6.2.2. Features of Delphi Technique

To consider a procedure as a Delphi, four main elements are considered essential. These are: anonymity, iteration, controlled feedback and the statistical aggregation of group response (Rowe et al, 1999, Zolingen, 2003, Landeta, 2006, Keeney et al, 2001, Geist, 2010). A Delphi method is expected to have the above four attributes, even though there are various ways of applying it.

The first characteristic of anonymity is accomplished by using questionnaires; in this way individual group members get a chance to express their views and judgments confidentially, without any social stresses, from leading or inflexible individuals, or from a majority (Rowe et al, 1999). This technique ideally allows each person in the group to judge every idea entirely on the basis of merit and not on the basis of potentially unacceptable standards, for example the position held by a supporter of a particular opinion (Mozaffari et al, 2012). Geist (2010) highlights the principle by stating that with this method an individual can assess a matter on its virtues only while being anonymous, without peer pressures. Face-to-face interaction can be stressful for experts and might influence their decisions, whereas Delphi overcomes this problem.

The second attribute of iteration is observed in round one when a prompt is given to panel members, describing a concern, crisis, or focus of the study and then they initiate thoughts and remarks about that concern or crisis from individual analysis (Geist, 2010). Besides, with the iteration of the questionnaire over multiple rounds, the personnel are then allowed to make alterations in their views and decisions with no apprehension of damaging their reputation in front of other group members (Rowe et al., 1991). These responses are then refined by the researcher and reported to the experts in the form of a survey for a second round of input. This process completes three such rounds, for a total of three iterations (round one, round two, and round three).

The panel members are informed about the views of their anonymous colleagues by providing controlled feedback between the questionnaires (Mozaffari, 2012). Most of the times the feedback is simple: a statistical summary of the group response, generally having a mean or median value, for example, the average group estimate of the date by when an incident is predicted to occur. However, sometimes supplementary data may also be provided, like point of views of individuals who have a judgment that is out of the pre-set

confines. In this way, feedback consists of views and verdicts of all group members and not only dominant ones (Rowe et al, 1999).

The statistical compilation of the responses from the group members consists of quantitative feedback (e.g. medians and inter quartile ranges, or means and standard deviations), which is derived from the numerical ratings of each point (Geist, 2010). The views and perceptions of individuals are listed in conjunction with the explanatory statistics of the ratings after the final round of iteration. After polling participants (i.e., after several rounds of questionnaire iteration), the overall decision of the group is expressed as the statistical average (mean / median) of the experts' estimates on the final round and the final decision may thus be taken based on an equivalent weighting of the members of the group (Rowe et al, 1999).

3.6.2.3. Justification for the Selection of the Delphi Technique

A key decision of the success of any research project is the proper selection of a suitable technique to achieve the main aims and objectives of the research. In this specific research study, a number of consensus methods are reviewed in order to find out what is the most appropriate method to be followed. This research concerns with building a new framework for sustainable urban planning for the city of Riyadh based on the scientific theories and the strengths of existing frameworks for sustainable city development, taking into consideration the opinion of experts who are familiar with the local context of the city of Riyadh.

The Delphi technique would be the most suitable technique to be used in this specific study comparing with the others consensus methods including Nominal Group Technique (NGT), Interacting Groups, and Staticized Groups. The following context gives a general idea about each of these consensus methods and the reasons behind the selection of the Delphi technique.

- Nominal Group Technique (NGT)

The nominal group technique (NGT), also referenced in literature as “Brainstorming”, depends on small group discussions to reach consensus. NGT collects information through moderator-participant discussions, then asks participants to rank ideas collected from all individual discussions (Hallowell and Gambatese, 2009). It uses similar procedure like that used in Delphi, while the feedback information is collected through inductive meetings, which sometimes difficult due to geographical limitations, while in Delphi technique, there is no need for face-to-face meetings. This method also suffers from limited discussions, which

limit the extraction of ideas and possesses less stimulation of grouping process than Delphi method due to individual moderator-participant discussions. The main problem linked to this method is its biased results and conformity (Rowe and Wright, 1999).

- Interacting Groups

Interacting Groups technique, also known as “focus groups”, depends on gathering experts in the subject concerned in one location or via telecommunication facilities at the same time for mutual interactive brainstorming and discussions (Powell, 2003). This method suffers from bias in its results as well due to the fact that the panel is not anonymous in addition to the potential dominance of one or more group members over the others (Hallowell and Gambatese, 2009). Moreover, gathering experts in the same location or at the same time via telecommunication facilities is not always an easy task to accomplish. In contrast, Delphi technique allows individual group members to express their views and judgements confidentially without interference from other members.

- Staticized Groups

The Staticized Groups method adopts the same procedure as Delphi technique, while disregard the feedback stage and iterations (Hallowell and Gambatese, 2009). In other words, it uses the collected results from the first round to aggregate the responses of individual experts. In this way, the cross correlation between experts opinions is carried-out away from their interference (Rowe and Wright, 1999). In some cases, this method is preferred due to the fact that experts are less likely to conform in case of incorrect output (Hallowell and Gambatese, 2009). However, this method is not honoured in this study, as the feedback and iteration are essential parts of this study type.

This study could be performed using a traditional survey method to collect data and information from the individuals within prominent groups of people related to sustainable urban planning and practices. However, the Delphi technique was found to be a better methodology in terms of comprehensiveness of the results from experts and stakeholders. The Delphi approach was compared and contrasted with the traditional survey approach by Okoli and Pawlowski (2004), on the basis of their strengths and weaknesses, as a research strategy. This comparison is illustrated in the following Table 3.3.

Table 3.3. Comparison of Delphi method with traditional survey (Okoli and Pawlowski, 2004).

Evaluation Criteria	Traditional Survey	Delphi Study
Representativeness of sample	The researches use statistical sampling techniques to randomly choose a sample, which represents the population of interest.	The queries addressed by a Delphi study are of a highly doubtful and speculative nature. For this reason, a general population might not adequately and correctly answer the questions.
Sample size for statistical power and significant findings	The researchers are required to select a sufficient sample size to get a generalised result for a large population. This will help in determining statistically important effects in the population. To determine the suitable sample size, power analysis is performed.	To achieve an accord among experts, group dynamics is used to determine the Delphi group size. This size is not derived from statistical power. Therefore, 10 - 18 experts are recommended by the literature for a single Delphi panel.
Reliability and response revision	Reliability of procedures is a significant criterion to assess a survey. Generally, researchers ensure this by pretesting and retesting to guarantee test-retest reliability.	In the Delphi method, although pretesting is a vital reliability reassurance measure, still test-retest reliability is irrelevant. This is because the researchers anticipate respondents to modify their answers.
Construct validity	Vigilant survey design and pretesting ensures construct validity.	Delphi technique can perform extra construct validation by requesting the professionals to authenticate the researcher's version and classification of the variables. This validation practice is possible as unlike many surveys, Delphi is not anonymous to the researcher.
Anonymity	The participants are not only anonymous to each other at all times, but are also mostly anonymous to the surveyor.	Participating experts are anonymous to each other but always known to the researcher. This allows researchers to communicate with them for additional explanations.
Non-response issues	To be sure that the sample remains representative of the population, researchers need to explore the chances of non-response bias.	Generally in Delphi surveys, there are very little chances of non-response as most researchers have attained declaration of participation in person.
Richness of data	The framing of the questions and the opportunity of follow-up, such as interviews are the factors on which the richness of data relies. In cases where researchers fail to find the respondents, follow-up is often limited.	Traditional surveys undergo richness issues while Delphi studies essentially supply richer data due to their numerous iterations and their response review due to feedback. Also, the experts taking part in Delphi are positive towards follow-up interviews.

Keeping in mind the aforementioned comparison, the Delphi technique was preferred due to a number of core reasons. One of these reasons is that this research is concerned with determining the issues that are expected to promote the development of sustainable urban planning in Saudi Arabia. This is a crucial matter and thus needs accurate knowledge from highly experienced people who identify with the diverse environmental, social, economic, planning and political matters of the place. Therefore, the Delphi study would be more appropriate and accurate when answering the study questions. Furthermore, the research questions can be addressed in a superior way if a panel study is adopted instead of individual expert opinions.

The Delphi technique is more preferable than other well-known group decision investigation approaches like the nominal group technique and social judgment analysis (Rohrbaugh, 1979). Another feature, which makes Delphi popular, is that experts do not have to be there in person as this is often an unrealistic thing for professionals from around the globe to attempt. Even though not many experts have absolute knowledge about the research questions, the panel size in the Delphi study is moderate and it would be feasible to aim for four panels with ten to eighteen members each (Paliwoda, 1983). Additionally, the nature of the Delphi study is quite flexible and allows the researcher to conduct follow-up interviews. In this way, richer data is collected which ensures a profound understanding of the basic issues discussed in the research.

This research seeks to form an efficient framework for sustainable urban planning amid a dependable list of categories and standards. Also, this study aims to identify the most prominent and imperative categories and standards among those. The Delphi technique was selected as the major methodology for appraising the system for sustainable urban planning in this study. This research argues that this technique is useful in providing richer data and information to the researcher, because it leads to a deeper understanding of various features of the sustainable urban planning. Furthermore, it uses repetitive controlled feedback to determine the convergence and closure of features, which are a part of the framework. Indeed, this proves that the method of data collection and confirmation of information has been correctly deployed.

3.6.2.4. Data Collection Process and Analysis Method

Different ways have been adopted to organise the Delphi questionnaires, such as e-mail and websites. Firstly, an introductory email was sent to the experts, followed by emails with the questionnaire for each round, asking them to visit the link attached in the email. Secondly, the questionnaires were evaluated with the help of an online survey site. This is extremely important while using the Delphi method, as the elapsed time required for data collection is one of its drawbacks. For example, according to Delbecq et al. (1975) the average Delphi study could be completed between 45 days and 5 months, if all experts are available in the same country and the researchers send and receive questionnaires through postal mail.

These fast media are beneficial as it takes very little time to turnaround the data between each round of the questionnaires. Also, it is more feasible for experts from different countries. Similarly, the direction of the questionnaires in this research was international. The experts took little time to complete and send back the questionnaires related to sustainable urban planning and the completed questionnaires were received and assessed within a month, before the next round had been sent out. This is due to the consideration that the researcher could not send out the next questionnaire until all the results from the experts were received.

This research included the review of various survey software and questionnaire tools, for instance, SurveyMonkey, Zoomerang and QuestionPro. This was done so as to determine which of these tools is most suitable to be used with the Delphi technique. Certainly these software and tools are different from each other in terms of the type of information and data that required to be generated plus the type of the questions that will be asked. On the basis of these reviews, the study found that SurveyMonkey software is by far the most suitable. It is widely accepted as the best web survey software, which is capable of providing the most refined survey methods. As proposed by Gordon (2002), SurveyMonkey is an exceptional survey and assessment tool for online learning environments and for research in the field of online learning environments.

SurveyMonkey is an online survey site, which not only simplifies the survey process significantly but also helps to develop a survey for use over the internet (Waclawski, 2012). Moreover, it provides formats to ask questions such as close-ended, multiple choice or open-ended questions. A basic subscription offers surveys with 10 questions, 100 responses, 13 question types, 15 design themes and full analysis facility (Gordon, 2002).

In terms of performance, SurveyMonkey can effectively track participants so that the researcher can contact them for follow-up interviews and does not bother those who have already participated. For each question, SurveyMonkey produces frequencies and gives you the option to transfer data into programs like SAS or SPSS for more complex analysis (SurveyMonkey, 2012). Due to all these reasons, SurveyMonkey is used as the web survey software during each round of the study.

Throughout this study, the approach of the "ranking-type" Delphi survey, proposed by Schmidt (1997) was employed for the organisation of the questionnaires, data collection and investigation of the information. This method has been referred to in numerous scientific papers (Schmidt et al., 2002, Powell, 2003, Okoli and Pawlowski, 2004, Vidal et al, 2011). It is derived from the distribution of the process of the Delphi survey into three rounds. These three rounds are brainstorming for significant categories and standards, narrowing down the original list to the most important ones and lastly ranking the list of imperative categories and standards. Figure 3.8 given illustrated this.

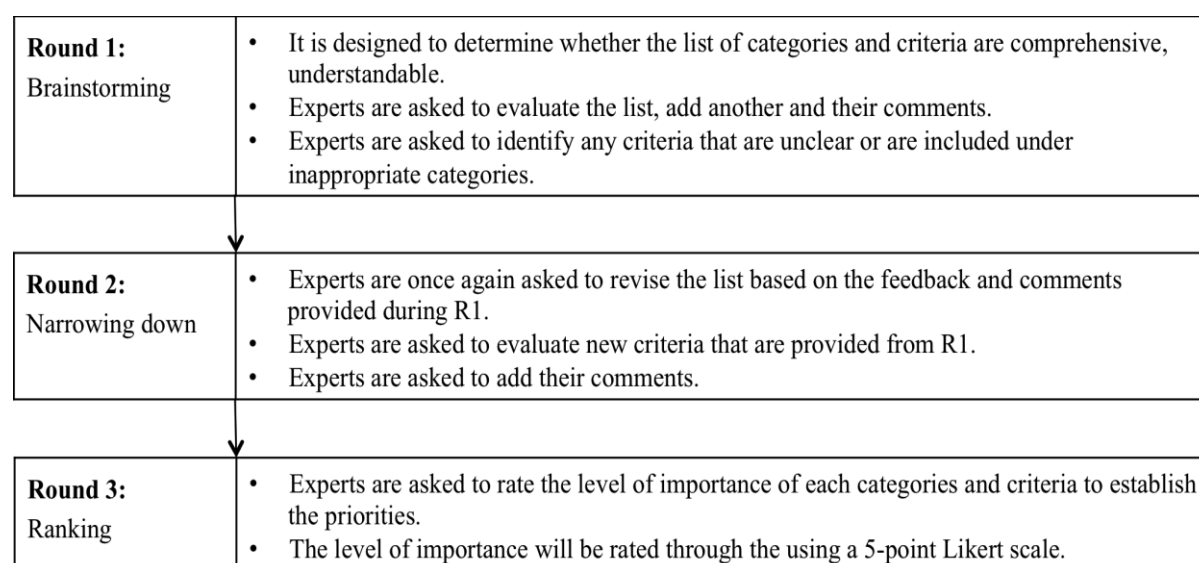


Figure 3.8. Delphi technique process (Schmidt et al, 2001, Okoli and Pawlowski, 2004).

The first round of the Delphi technique usually starts with a questionnaire including open-ended questions. This acts as the foundation of exploring particular data regarding an area from the Delphi subjects (Custer et al, 1999). This round is structured in order to verify whether the list of categories and standards are complete and comprehensible enough to allow the experts to recommend extra elements, which they might have overlooked before (Schmidt et al, 2001, Okoli and Pawlowski, 2004). This stage requires experts to evaluate the

categories and standards considered in this study for the appraisal of the planned system for sustainable urban planning designed in this research. Moreover, in this round, experts are asked to give their remarks and identify any measures that are absent, uncertain or incorporated in improper categories.

Each Delphi respondent is provided with a second questionnaire in the second round and requested to analyse the matters reviewed by the experts on the basis of the data collected in the round 1 (Chia, 2007). During this stage, the revision of the lists by experts is repeated. These lists are based on the opinions and remarks given during the first round. Moreover, they are asked to assess the new criteria provided from the first round and give their opinions. Experts are then asked to abridge the categories and criteria to formulate the list of the most significant and pass it on for the third round. The lists are shortened in this round and the aim will be to comprehend the ranking of significance of the issues according to the contradictory standpoints of diverse expert teams (Okoli and Pawlowski, 2004).

A questionnaire is also sent to each expert in the third round. This questionnaire consists of the issues and rankings recapitulated by the experts in the last round. Experts are then allowed to make improvements to their earlier decisions. During this round, the list of residual issues, their ranking, alternative views and issues which are agreed upon, are provided to the experts and they are asked for the final time to make any changes to their decisions. The third round seeks to establish an agreed decision about the grading of the applicable factors regarding a definite issue. In addition, expert ratings are obtained for the list of categories and standards on the basis of their comparative significance. A 5-point Likert scale is used to perform the significance ranking (Okoli and Pawlowski, 2004).

3.6.2.5 Selection of the Delphi Panel

Numerous researchers have addressed the significance of the Delphi experts and the relation of their skills and qualifications with standards like the efficiency (i.e., accuracy) of the method (Keeney et al, 2001, Schmidt et al, 2001, Zolingen et al, 2003, Geist, 2010, Vidal et al, 2011). It has been suggested by Rowe and Wright (1999), that the most important quality possessed by an expert is his/her expertise or experience. Comprehensive principles are stated by Delbecq et al. (1975) regarding the ways used to recommend competent experts for a nominal group technique study. They clarified that this method is also applicable to a Delphi study. They presented a thorough approach aimed at ensuring the classification of appropriate experts and provided them with a chance to contribute in the study. A study using the Delphi

technique is not dependant on a statistical sample, which represents the entire population. It is based on group decision and requires skilled experts who have profound knowledge of the research questions (Okoli and Pawlowski, 2004). Hence, one of the most decisive requirements is the choice of competent experts. According to the principles provided by Delbecq et al., this study will be conducted in multiple-step iterative process to recognise the experts. Five key steps can be used to summarise this entire technique, as stated in the following Figure 3.9.

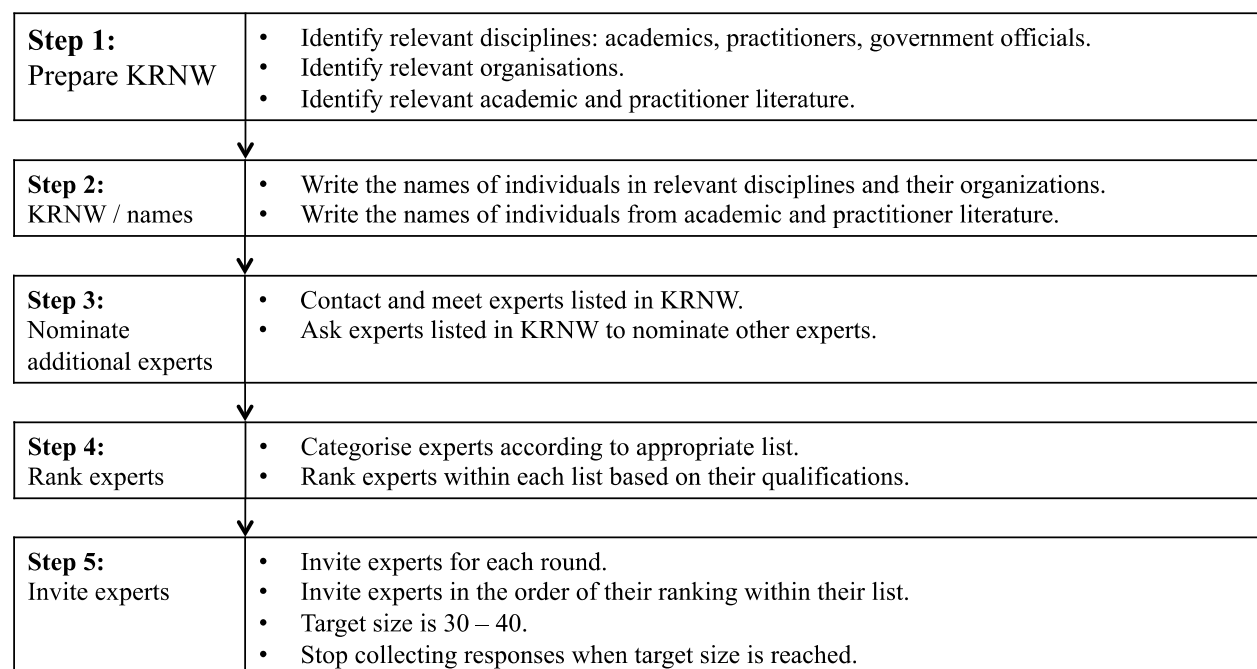


Figure 3.9. Procedure for selecting experts in Delphi Technique (Okoli and Pawlowski, 2004).

- **Step 1. Prepare a Knowledge Resource Nomination Worksheet (KRNW)**

The Knowledge Resource Nomination Worksheet is used to assist in the classification of the experts before recognising them. This is done to avoid neglecting any imperative category of experts (Okoli and Pawlowski, 2004). The study has distinguished the most fitting disciplines, organisations and literature which would play a vital role in spotting world-class experts on sustainable urban planning, all of whom have a profound understanding of the issues relating to the urban planning in Saudi Arabia in general and the city of Riyadh in particularly. These suitable disciplines include sustainable development, urban planning, built environment, transportation and infrastructure. Additionally, the Ministry of Municipal and Rural Affairs, the High Commission for the Development of Arriyadh and King Saud University are considered suitable organisations.

- **Step 2. Populating KRNW with Names**

An iterative methodology has been applied to place the names of likely experts in the categories for the Delphi study, after the completion of KRNW. Different criteria (e.g. qualifications and years of experience) are used to identify and consider experts for different headings (disciplines, organisations and literature). Although, there could be a great overlap of expert names among and within the headings. It is important to have this multiple criteria viewpoint so as to consider as many experts as possible. The study will initially assess the private contact list for each category, to place most of the names into suitable groups. This point is the basis of this stage.

- **Step 3. Nominate Additional Experts**

The third step involves contacting the recognised experts and providing them with a brief report of the Delphi study and explaining that in this study they are considered as the international experts related to sustainable urban planning in Saudi Arabia. Furthermore, the identified subjects will be requested to recommend more experts whom they deem appropriate because of the knowledge of the field of urban planning and their understanding of cities in Saudi Arabia. This step is chiefly concerned with expanding the KRNW to ensure the inclusion of as many experts as can possibly be admitted. For instance, some of the Delphi panel members have nominated a number of experts who are familiar with the subject of urban planning for the city of Riyadh and are currently working outside the city of Riyadh (e.g. experts from Cairo University).

Several techniques are deployed in this study to assemble as much information as possible regarding the qualifications of the selected experts in order to find out what skills they hold to be considered as experts. One of the approaches involves collection of as much biographical information as possible regarding each expert on the recommendation list (Okoli and Pawlowski, 2004). Another important selection principle is the amount of publications and presentations made by selected experts and how long they have been worked as professionals in their field. Once all the information is collected, the experts will be ranked according to their expertise for the subsequent step. As this step ended, a total of forty experts were selected for this study.

- **Step 4. Rank Experts**

In the fourth step, the objective of the study is to perform an evaluation of the qualifications of identified and nominated experts. This helps to set their priority level for invitation to the study. The years of experience and contributions in the relevant field are included in these qualifications. For this reason, three sub-categories of experts are listed in this study, namely; practitioners, government officials and academics as can be seen in Table 3.4.

Table 3.4. The characteristics of the Delphi panel members.

Distribution of the experts	Details	Absolute value	Percentage
Organisation	King Saud University	12	34%
	University of Dammam	6	17%
	King Fahd University of Petroleum and Minerals	3	8%
	Cairo University	2	6%
	Ministry of Municipal and Rural Affairs	5	14%
	Ministry of Interior	2	6%
	Riyadh Municipality	2	6%
	High Commission for Development of Arriyadh	2	6%
	Housing, Building National Research Centre	1	3%
Qualification	BSc	3	8%
	MSc	2	6%
	PhD	30	86%
Years of experience	1-10	8	23%
	11-20	16	46%
	21-30	11	31%
Age	30-40	7	20%
	41-50	18	51%
	51-60	10	29%
Gender	Male	31	89%
	Female	4	11%
Field of experience	Urban Planning and Development	6	17%
	Urban Policy and Management	1	3%
	Landscape and Architecture	1	3%
	Urban Planning and Urban Laws	2	6%
	Urban Design	5	14%
	Environmental Planning	3	9%
	Urban Design and Environmental Psychology	1	3%
	Urban and Regional Planning	4	11%
	Urban Economics	2	6%
	Transport and Land-use Planning	3	8%
	Urban Planning and Space Management	2	6%
	Urban Information Systems	2	6%
	Infrastructure Planning	3	8%

The experts are then divided into these three sub-lists according to their qualifications considering the organisations, which they are belonging to. For instance, academics, who have been chosen from academic institutions such as the King Saud University and the University of Dammam, have been ranked based on their qualifications and the same criteria is followed for the government officials. In the final part of this stage, the research finalised the lists and created the three sub-lists as ranked by qualifications.

- **Step 5. Invite Experts to Participate**

The experts are requested to take part in this study on the basis of their positions. Various methods were employed to process these invitations, for instance, some of the experts were invited in person through an appointment while some were invited by email. With the invitation, they were given an overview and the essential information required to get know-how of the main objectives and concerns of the research including the proposed system for sustainable urban planning, and a clarification of the study matter with the methodologies used and the commitment required. This five-step procedure was utilised to ensure that the most competent experts were recognised, invited and included in this study. In this particular research, the researcher would like to acknowledge that due to the nature of the urban planning field in Saudi cities as well as the cultural context of the society the majority of the experts who participated in this study were male. This issue will be highlighted in the section of research limitation in the thesis conclusion chapter.

3.6.3. Stage Three: The Application of Analytic Hierarchy Process (AHP)

Analytic Hierarchy Process (AHP) is seen as a sort of multi-criteria decision methodology for decision making, and is considered as one of the most widely used decision making tools (Samari et al., 2011). Initially, it was developed and introduced by Thomas L. Saaty in 1980 at the Wharton School of Business in the University of Pennsylvania (Saaty, 1990, Forman and Selly 2002, Shin et al., 2009).

AHP has been developed to deal with both intuitive and rational judgements to reach the most appropriate choice from a number of alternatives assessed according to numerous conflict criteria in order to assist decision makers in making complex decisions (Saaty 1999). Analytic Hierarchy Process emerges as a comprehensive method that aims to eliminate the different problems and issues associated with the traditional methodologies to a great extent (Mendoza and Prabhu, 2003, Kangasa and Kangas, 2005). AHP not only formulates the

problem on a hierarchical basis, it also offers the opportunity to take into consideration several quantitative and qualitative criteria for the problem (Samari et al., 2011).

The Analytic Hierarchy Process is employed in this study to identify the most suitable framework for sustainable urban planning for the City of Riyadh. In essence, it has been used as an assessment mechanism to give weight to each dimension, category and criterion through the use of the analytical functions of Expert Choice software, developed by Expert Choice, Inc., which simplifies the implementation of the steps of AHP. The process of the AHP will be mainly built based on the results that will be obtained from the Delphi Technique stage.

The process aims to achieve one of the main objectives of the study; that is to establish a weighting system for the proposed framework through the use of the Analytic Hierarchy Process (AHP) technique, which involves a follow on consultation with the experts. The different features and steps of the Analytic Hierarchy Process (AHP) will be explained in detail following subsections.

3.6.3.1. Overview of Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) method is considered as one of the most comprehensive and widely used methods for analysing complex alternative decision problems with multiple criteria (Saaty, 1988, Saaty, 1990, Eakin and Tapia, 2008, Shin et al., 2009). Originally, it was developed by Thomas L. Saaty in 1980 at the Wharton School of Business at the University of Pennsylvania (Saaty, 1990, Forman and Selly 2002, Shin et al., 2009). Since it has been introduced, the AHP has been used in many scientific research studies in different fields (e.g. Zahedi, 1986, Golden et al., 1989, Vargas, 1990, Saaty and Forman, 1992, Forman and Gass, 2001, Kumar and Vaidya, 2006, Omkarprasad and Sushil 2006, Liberatore and Nydick, 2008).

AHP emerged as one of the most valuable techniques of the multi criteria decision making (MCDM) that essentially aims to remove the problems and issues associated with the traditional methodologies to a great extent (Mendoza and Prabhu, 2003, Kangasa and Kangas, 2005). It is an idea for assisting decision making by structuring insights, reactions, and judgments into a hierarchic structure with multiple-levels in order to exhibit the forces that affect the decision (Joshi et al., 2011). Furthermore, the AHP is concerned with dividing the main problem into sub problems and subsequently grouping the solutions of all these sub problems into the conclusion.

Eakin and Bojorquez-Tapiá (2008), indicate that the AHP can be defined as “a mathematical theory of value, reason and judgement, based on ratio scales for the analysis of multiple-criteria decision-making problems”. It decomposes the decision making problem into a hierarchical structural tree with three levels: the top level presents the overall goal; the intermediate level presents the lower level criteria, which contribute to the goal; and the bottom level presents the discrete alternatives (Shin et al., 2009).

In the same context, AHP is designed to deal with both intuitive and rational issues, when choosing the most appropriate alternatives that are assessed based on a number of criteria (Lai, 2013). Nsairat (2009), points out that “AHP allows consideration of both qualitative and quantitative aspects of decisions; it can reduce complex decisions to a series of one-on-one comparisons by assisting with identifying and weighting selection criteria, analysing the data collected for the criteria and expediting the decision-making process”.

According to Javadian et al. (2011), the AHP is seen as a structured method as well as a multi-attribute decision technique for coping with complicated decisions, which refers to a host of quantitative methods employed to facilitate decisions that contain multiple competing criteria. Generally speaking, it helps the decision makers to determine the most suitable decision that achieved their overall goals, and assist them also to understand the key issues related to the problem, rather than only prescribing the correct decision (Steiguer et al., 2003).

Saaty (2008), points out that the Analytic Hierarchy Process (AHP) has been widely used in numerous settings to make the decisions (e.g. environmental fields, urbanisation processes, public administration, military and political applications). Saaty adds that a number of authors had written several books on the Analytic Hierarchy Process: examples of these books are those by Saaty and Kearns (1985), Saaty and Alexander (1989), Rabbani and Rabbani (1996), Hummel (2001), Schmoldt et al. (2001), and Bhushan and Ria (2004).

3.6.3.2. Justifications for the Selection of Analytic Hierarchy Process

As mentioned previously, the desired aims of this study can be achieved by the selection of right techniques and procedures that must be in line with the purpose of the study. Therefore, in this particular research work, a number of multi criteria decision analysis (MCDA) methods are reviewed. The main aim of this revision is to find out what is the most suitable

method to be followed in this study to establish a weighting system for the proposed framework for sustainable urban planning for the city of Riyadh, which involves a follow on consultation with the experts. The Application of Analytic Hierarchy Process (AHP) technique would be the most appropriate technique to be used in this particular research comparing with the others Multi Criteria Decision-Making (MCDM) methods including the Analytic Network Process (ANP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. The following context briefly explains each of these two MCDM techniques and the reasons behind the selection of the AHP technique.

- Analytic Network Process (ANP)

Thomas L. Saaty, the developer of the Analytic Hierarchy Process (AHP) method, also developed the Analytic Network Process (ANP) technique. ANP technique is known as the general form of AHP method dealing with multi criteria decision-making structure (Velasquez and Hester, 2013). ANP technique clusters the information received from interactions and influences of the systems elements (alternatives and criteria) and perceived from decision makers (Vidal et al., 2011). The presence of the decision makers' feedback in the process increases the time consumed in the study as well as adds difficulty in convincing them with the study results.

- Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

The TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution) selects the best-chosen decision based on the Euclidian distance measure between this decision and the both the ideal positive maximal benefits solution and the negative least minimal benefits solution (Velasquez and Hester, 2013). If the selected decision possesses the shortest distance to the ideal solution as well as the longest distance to the least favourable solution, it is selected as the best decision (Joshi et al., 2011). In this way, for multi-decision making a ranking process is obtained for different alternatives.

However, the use of Euclidian distance as a measure for selecting best decision ignores the cross correlation between features of decisions. It also lacks weighting process for decisions features and losses consistency of proper judgment, especially for multi features linked to each decision. This method not honoured in this type of research as it is important to take into consideration cross correlation between different features for each decision selected.

The AHP is perhaps the most common tool of Multi Criteria Decision-Making (MCDM) that is widely followed for assessing and ranking several alternatives (Eakin and Bojorquez-

Tapiá, 2008). It is currently widely followed for both linear and non-linear planning processes, and provides the opportunity to take into consideration various quantitative and qualitative criteria for the processes, and not limited only on the problem formulation on a hierarchical basis (Samari et al., 2012). Moreover, AHP allows for sensitivity analysis of both criteria and sub-criteria, where it contains various choices in the decision making process. It facilitates calculations and judgements of the decision making process by the use of the pairwise comparison approach.

Saaty (1990), emphasises that the AHP serves to make effective decisions when complex problems should be dealt with by accelerating and simplifying the decision making process. AHP has many obvious benefits that help the decision makers to select the accurate decision among a number of alternatives. One of the most important benefits of this application is the formalisation of the organisation and assessment of all the criteria and their interactions in a decision domain (Shin et al., 2009). Boucher and MacStravic (1991), point out that most of the multi-attribute decision techniques fail to incorporate consistency checks, but the AHP approach has the ability to incorporate systematic checks on the consistency of judgements in the pairwise comparison matrices.

In this study, the Analytic Hierarchy Process (AHP) is found to be the most appropriate technique to be followed in terms of comprehensiveness of the results. Keeping in mind the aforementioned significance, AHP is preferred in this research due to a number of core reasons. One of these reasons is that this research is concerned with developing an effective sustainable urban planning framework for the city of Riyadh, which need to be assisted in the decision making process by structuring different insights and judgements into an obvious hierarchic structure. This is a crucial issue and thus needs accurate application to be implemented. Therefore, this study argues that AHP would be more appropriate and accurate when it comes to answering the study questions. It is considered as a beneficial tool for establishing the weighting system for the sustainable urban planning framework for the city of Riyadh, which is one of the key objectives of this research. It is applied in this study to give the weight to each dimension and category included within this proposed framework.

3.6.3.3. Analytic Hierarchy Process (AHP) Method

Numerous scientific research studies have widely discussed the different application stages for the AHP approach (Saaty, 1994, Sloane et al., 2003, Mau-Crimmins et al., 2005, Saaty, 2008, Wong and Li, 2008, Shin et al., 2009, Joshi et al., 2011, Yupu et al., 2012, Lai, 2013).

However, the AHP proposed by Saaty (2008) has been selected for this study and consists of four steps:

- **Step one:** define the decision problem and determine the main goal and the type of knowledge required.
- **Step two:** structure the decision hierarchy from the top level with the goal of the decision, and the objectives from a broad perspective, through the intermediate levels (criteria on which subsequent elements depend) to the lowest level that typically contains the list of the alternatives.
- **Step three:** create a set of pairwise comparison matrices, each component in an upper level is used to compare the components in the level immediately below with respect to it.
- **Step four:** setting the priority of each component based on the results that will be obtained from the pairwise comparison to weighing the priorities.

The first and second steps aim to break down the decision problem into its component parts and then arranging all these components in a hierarchy tree, which provides an overall picture of the complex relations. This process assists the decision makers to assess whether the elements in each level are of the same importance so that they can be compared accurately (Saaty, 1990, Kasperczyk and Knickel, 2005).

Setting of the pairwise comparison matrices, step three, aims to determine the relative importance of the components (criteria) and preferences among the alternatives by making pairwise comparisons using Saaty a nine-point scale system (Mau-Crimmins et al., 2005, Zhang et al., 2012). The nine-point scale has been used widely as a standard rating system used for the applications of the AHP (Saaty, 2000). This scale ranging from 1, which means that the two selection options are equally important, to 9 which means that one selection option is extremely important over the other as can be seen in Table 3.5.

Table 3.5. The fundamental scale of absolute numbers (Saaty, 2008).

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity <i>i</i> has one of the above non-zero numbers assigned to it when compared with activity <i>j</i> , then <i>j</i> has the reciprocal value when compared with <i>i</i>	A reasonable assumption
1.1–1.9	If the activities are very close	May be difficult to assign the best value but when compared with other contrasting activities the size of the small numbers would not be too noticeable, yet they can still indicate the relative importance of the activities.

The fourth steps aims to give the overall score for each option by combining the option score with the criterion weight. “The extent to which the options satisfy the criteria is weighed according to the relative importance of the criteria” (Kasperczyk and Knickel, 2005). Finally, judgements can be made on the importance of all the elements, and priorities can be computed for the hierarchy tree as a whole, although sometimes the priorities can be recalculated throughout, either with or without changing the judgements (Saaty, 1990). The main characteristics of the application of the AHP can be seen in the operational process that is highlighted by Saaty (2008) and illustrated in Figure 3.10.

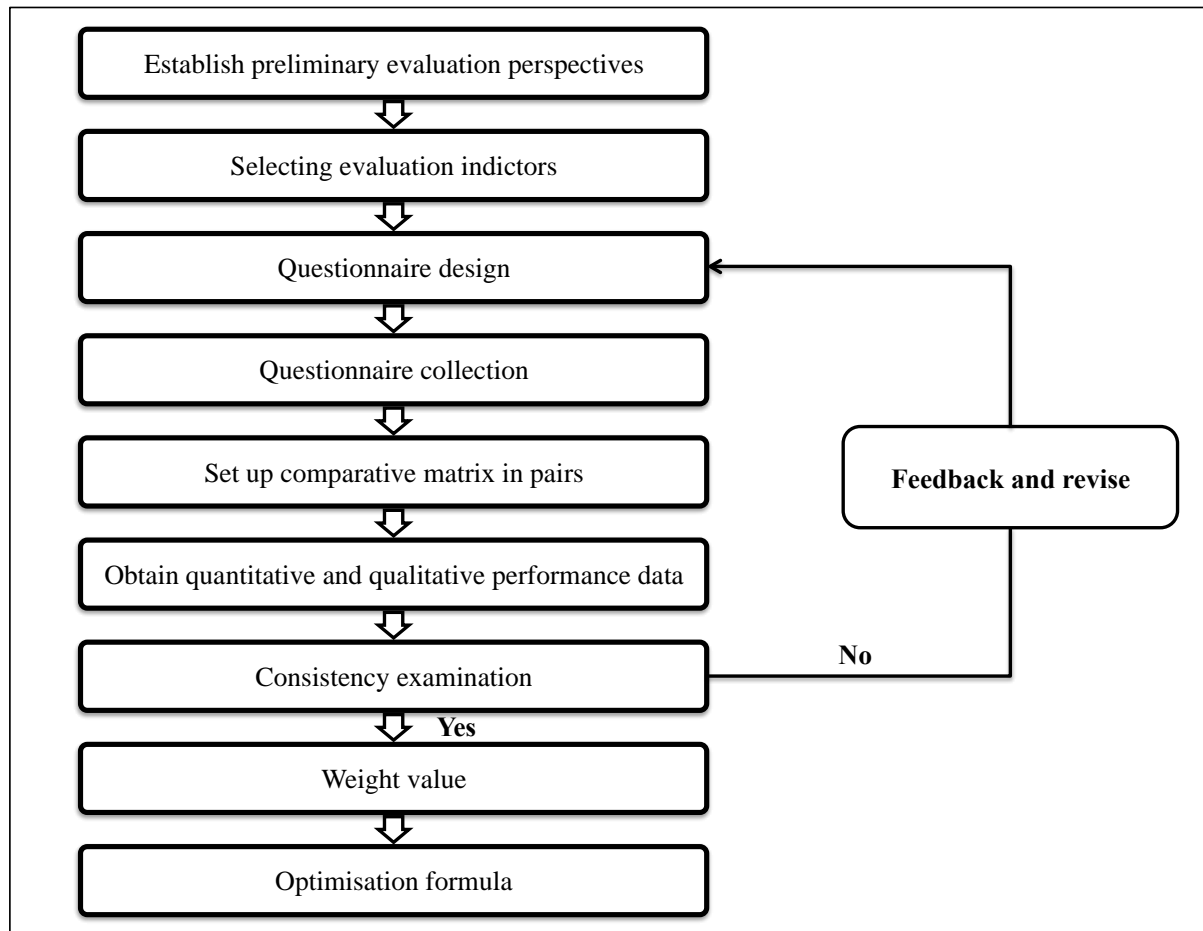


Figure 3.10. The operational process of the Application of the AHP (Saaty, 2008).

3.6.4. Stage Four: The Testing Process

The main aim of this stage is to demonstrate the practical application of the framework developed in this thesis. The testing process is seen as a fundamental part of any framework development, which increases and enhances the confidence in these frameworks, and makes it more valuable and applicable (Kennedy et al., 2006). The testing process has a number of different techniques to be used. These techniques include animation, comparison with other frameworks and case study technique. In this research the central purpose of the formal testing process is to check the practicality of the proposed framework of sustainable urban planning. Therefore, in this study the proposed framework will be tested based on the real-world case studies. Three neighbourhoods will be selected from the City of Riyadh during this research. The different features of the testing process will be discussed in detail in Chapter Seven.

3.7. Research Map

Before the inception of any research process, it is very evident that the data analysis and data collection methods must be carefully considered for the desired consequences. Precise and reliable information that is acquired holds great significant for the successful achievement of the framework of the research question along with the application of accurate techniques for data collection. The map of this research consists of three main parts: the findings from the literature review, the results of the Delphi technique and the applications of the AHP. The review of the academic research aims to look at the concept of sustainable urban planning in addition to discussing the international well-known existing frameworks for the sustainable city development.

It also aims to identify the most appropriate dimensions and categories to form the proposed framework for the city of Riyadh. The Delphi technique is first undertaken in order to identify the most relevant dimensions, categories and criteria of the sustainable urban planning framework that would be suitable for the local context of the city of Riyadh. In order to refine and enhance the Delphi Technique results, the AHP was conducted to assign and prioritise the weightings for the dimensions, categories and criteria of the proposed framework. The layout and research map of this research work are illustrated in Figure 3.11.

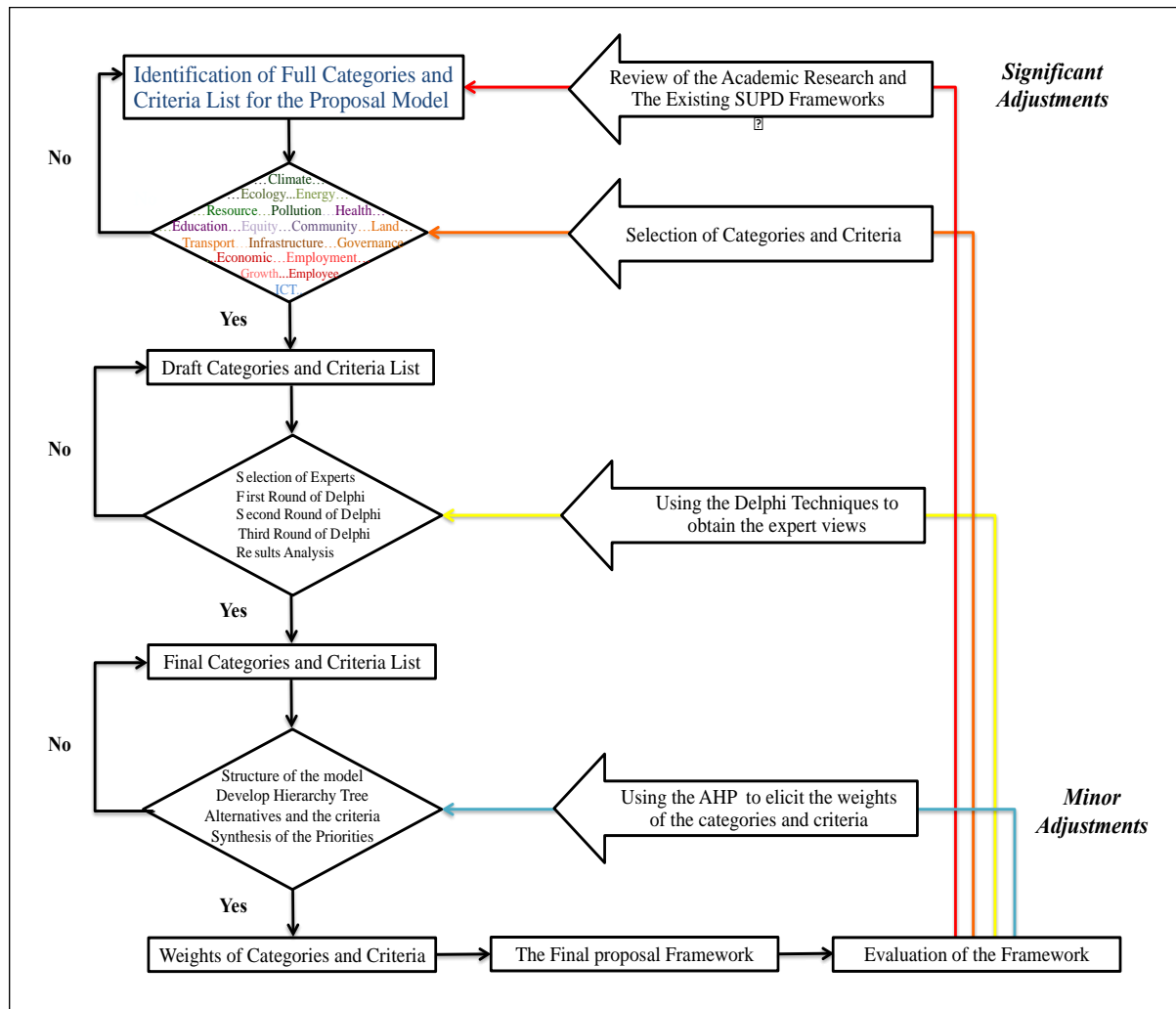


Figure 3.11. Research map for developing an effective sustainable urban planning framework for the city of Riyadh.

3.8. Access to Information

The access to pertinent information regarding the research area along with the suitable procedures to gather the desirable data is really essential to carry out a research activity. Thus, the research scholar considers this aspect right from the start of the study. Data collected from diversified sources has been applied in this research study, such as from private and public institutions, educational institutions, in addition to the institutions related to the urban development in Riyadh, the Saudi Capital. These sources used in data collection process are given below:

- Riyadh Municipality
- Riyadh Principality
- Ministry of Housing in the Kingdom of Saudi Arabia
- Ministry of Municipal and Rural Affairs
- High Commission for Development of Riyadh
- Libraries at Cardiff University
- Library of Prince Salman at King Saud University
- Libraries at King Fahd University of Petroleum and Minerals
- Electronic journals and websites (e.g. Elsevier, Scopus, Science Direct)

3.9. Summary

The main purpose of the chapter was to provide an overview of the research methodology of this research work. It includes an explanation of the different research philosophies and approaches in general and particularly the selected research philosophy and approach that are to be used in this research. The research methodology used for the purposes of this research was introduced in detail throughout this chapter, including the discussion of different research methods such as quantitative method and qualitative method. Different research strategies are highlighted in this chapter, which include the case study strategy, and questionnaire strategy that will be used in this study.

This chapter has briefly discussed the questionnaire strategy within the Delphi technique section. The chapter only gives an overview of the Delphi technique process, as this technique will be discussed in detail in Chapter Five. Moreover, the chapter presented a number of techniques for data collection and analysis that will be followed in this study including the application of Analytic Hierarchy Process (AHP). The chapter provides a general idea about this application and full detail will be provided in Chapter Six.

The testing process of the proposed framework for sustainable urban planning for the city of Riyadh is highlighted in this chapter. It gives an idea of the processes that will be conducted to confirm the applicability of the proposed framework to the local context of the city. This process is mainly built based on the result of both the Delphi technique and the AHP technique in addition to the scoring and rating system that will be designed during this research. The testing process is discussed in detail in Chapter Seven. Last but not least, the chapter presented the main map of this research as well as the mechanisms for obtaining the information from different institutions including the Ministry of Municipal and Rural Affairs and the High Commission for the Development of AR Riyadh.

CHAPTER FOUR: THE CASE STUDY “THE CITY OF RIYADH”

4.1. Introduction

The purpose of this chapter is to give a comprehensive review of the current state of sustainable urban planning in Saudi Arabian cities and specifically within the capital City of Riyadh. Moreover, it aims to shed light on the historical development of urbanization in the City of Riyadh and critically discuss some of the strategies and schemes that have been adopted and impacted the urban planning in the city, going back to the early twentieth century schemes such as Doxiadis and SCET. Limitations of these plans will be discussed, along with the local context and background of the City of Riyadh and its population.

Furthermore, the chapter will examine these development phases based on the proposed framework of sustainable urban planning, designed and presented previously in Chapter Two. This chapter first provides a review of sustainable urban planning within the context of the City of Riyadh. This is followed by a discussion of the most important urban planning phases. Factors affecting the urban planning in the City of Riyadh will be highlighted within this discussion. Then it will discuss the results based on the proposed framework for effective sustainable urban planning, finishing with a general discussion on the most important issues that will arise.

4.2. Historical Background of the City of Riyadh

Riyadh, the capital city of the Kingdom of Saudi Arabia, is generally considered the largest Arab city. Due to its significant expansion in numerous fields, the city of Riyadh is also seen as one of the fastest developing cities in the world. The city of Riyadh lies in the centre of the Arab Peninsula, located at latitude 34°-38 north, longitude 46-43 east and approximately 600 metres above sea level (Riyadh Municipality, 2011). In less than half a century, the area of Riyadh has expanded more than a hundred times from a small town surrounded by walls to a modern city that occupies an area of 2435 square kilometres (High Commission for the Development of Arriyadh, 2010) and has global aspirations.

According to the Department of Statistics and Information (2010), the population of Riyadh has risen dramatically from 100,000 in the early 1950s to almost 5.2 million people in 2010, and includes about fifty different cultures, languages and interests. Following the same pattern, the population of the city is expected to reach 10 million by the year 2020 (Garba,

2004). In order to accommodate this growth there is an increasing need for developing a comprehensive sustainable urban planning framework for the city of Riyadh.

Many researchers indicate that the city of Riyadh began its growth and evolution as a modern city at the beginning of the twentieth century when it was reinstated by King Abdul Aziz bin Abdul Rahman bin Faisal Al Saud (known universally as Ibn Saud) the founder of the Third Saudi State (Al-Hemaidi, 2001, Al-Hathloul, 2003, Garba, 2004). During his reign the late King Abdul Aziz enhanced his control over the city of Riyadh and made it his capital between 1924 and 1953. Subsequently, the city grew from an area of almost two square kilometres and a population of 8,000 people in 1900 to an area of approximately 2,700 square kilometres and a population of 5,200,000 people at the current time.

For the purposes of this study, however, the discussion of the historic development of the city of Riyadh will be limited in the evolution of the city in the twentieth century. As result of a comprehensive review of the relevant literature (Eben Saleh, 2001, Al-Hemaidi, 2001, Mubarak, 2004, Garba, 2004, Gamboa, 2008, Al-Ahmadi et al., 2009), this research has found four important periods. These periods are considered turning points that have played an obvious role in the formation of the city and led to many changes in the surrounding environment, social context, and economic development.

These four periods are the pre-foundation period (1900-1930), the foundation period (1930-1970), the oil boom period (1970-1990) and the post-oil boom from 1990 until the present. During these four periods the Saudi Arabian government applied a number of strategies and schemes in order to manage and control the urban planning in the city of Riyadh. Therefore, this section of the research will be divided into four parts to discuss these four periods in further detail. The main purpose of discussing each phase is to create a comprehensive overview of the development patterns that have been followed by the city of Riyadh during its growth. Furthermore, it aims to identify the most important factors and forces that have shaped the evolution of urban planning in each one of these four phases from the early 20th century until the present day.

4.2.1. Pre-Foundation Period (1900 - 1930)

During the first few decades of 20th century the city of Riyadh started its evolution and growth as a vibrant city. At the beginning of 1900, a population of the city was approximately 8000 and covered an area of almost one square kilometre (Riyadh Municipality, 2011). At that point, the city of Riyadh was enclosed by impervious walls that

were enhanced with fortified gates almost eight metres high, built using bricks and mud. These historical architectural features, which have been mostly obliterated as a result of the boom witnessed by the city, can be seen in both of Figure 4.1 and Figure 4.2.



Figure 4.1. The walls and towers of the city of Riyadh at the beginning of the twentieth century (High Commission for the Development of Arriyadh, 2012).



Figure 4.2. Al-Thumairi Gate in the past and in the present (Riyadh Journal, 2012).

In the same context, at that time one of the most important of the structures located inside the walls of the Old Riyadh was Al-Masmak Fortress (known also as Al-Masmak Palace). It was the first part of the city to be overtaken by King Abdul Aziz in 1902 and was renovated in recent times as can be seen in Figure 4.3.



Figure 4.3. Al-Masmak Palace in the early of the twentieth century and in the current time (Riyadh Journal, 2007, High Commission for the Development of Arriyadh, 2012).

4.2.2. Foundation Period (1930 - 1970)

Many of the previous studies indicate that the period from 1930 to 1970 is considered as one of the most important phases with events that played a great role in the formation of the current city of Riyadh. For instance, in 1932, King Abdul Aziz unified all the regions and parts of the Third Saudi State under the banner of one country that is known today as the Kingdom of Saudi Arabia, including Al-Hasa, Al-Hijaz and the rest of Nejd region (CSBE, 2003). The population of the City of Riyadh grew rapidly from almost 15000 in 1918 to 47000 in 1938 (High Commission for the Development of Arriyadh, 2010). At the end of 1930s, and for the first time, the city of Riyadh expanded outside the mud walls of the old city.

This expansion was demonstrated by the building of Al-Murabba Palace, which was erected by the King Abdul Aziz in 1937. It was located a few kilometres to the north of the old city of Riyadh and expanded over an area of 16 hectares (Al-Hathloul, 2003). The creation of Al-Murabba Palace influenced the urban planning of the city, causing it to expand considerably. The expansion in the north began as the primary direction for the growth of the city when the citizens realised that living within the walls was no longer essential and that they would be secure and safe living outside the walls. Therefore, the expansion of urban areas outside the walls of the city was begun. Moreover, Alkhabbaz (2010), points out that the oil discovery at the end of the 1930s and the production of commercial amounts of crude oil in the 1940s started an urban revolution in the city of Riyadh in particular and across the country in general.

In the early 1950s there was another turning point in the urban planning of the city of Riyadh. This was marked through the construction of Al-Nasiriya Palace located at Al-Nasiriya Farm in the west of the old city of Riyadh. This without doubt had an effect on the urban planning of the city and the city has expanded to almost seven kilometres to the west. Moreover, at the end of 1950s, two important infrastructure projects were implemented in the city of Riyadh, and contributed further to the future growth of the city (Al-Hathloul, 2003). The first one was the construction of a small airport in the north part of the city. The second one was the inauguration of a railway line that links the city of Riyadh with the city of Dammam, which lies on the Eastern Province of Saudi Arabia, about 300 kilometres in the east, and is considered as one of the most important cities in the Kingdom.

In the same context, in 1953 King Saud (King Abdul Aziz's son) arranged the transference of the government offices from the Holy City of Makkah, which is located in the Western Province of Saudi Arabia, and which until that time was considered the religious and administrative capital of the kingdom, to the city of Riyadh (Mubarak, 2004). As result, numerous buildings were built adjacent to the road that leads to the airport to meet the needs of these different government offices and ministries. Moreover, a residential project of enormous scale was built to accommodate their staff. The project was known as the Al-Malaz Project and was located nearly 5 kilometres in the northeast of the old city of Riyadh.

The project involved around 750 villas and three apartment buildings in addition to the essential facilities which covered a total area of approximately 500 hectares (Middleton, 2009). Al-Hemaidi (2001), points out that the Al-Malaz Project included several public institutions and facilities that were developed for the first time in Riyadh. It included a public garden and library, football stadium, racecourse and public zoo in addition to the first university in the Kingdom. This without a doubt had a significant and clear influence on the growth of both the population and spatial area of the city of Riyadh.

The implementation of such large projects that have been touched upon previously in addition to other projects, including the Water Tower, had a significant influence on the direction of the urban planning of the city during the 1950s and 1960s as can be seen in Figure 4.4. According to CSBE (2003), these projects had an apparent impact on the architectural pattern and urban expansion of the city of Riyadh where they introduced a new method of planning, design and construction in the city. For instance, the adoption of the gridiron planning approach in Al-Malaz Project is considered a new framework for residential schemes in the more recent planning projects for the city of Riyadh and other cities across the kingdom.



Figure 4.4. An aerial photograph of Riyadh reflects the expansion of the city from 1968 until the current time (CSBE, 2003, High Commission for the Development of Arriyadh, 2010).

As a result of these events and developments in the city of Riyadh during the establishment phase (1930-1970) the population of the city increased significantly. The spatial area of the city was estimated at 3, 9, 64 and 85 square kilometres in 1940, 1950, 1960 and 1970 respectively (High Commission for the Development of Arriyadh, 2010). In the same context, the population was estimated at 50,000, 80,000, 160,000 and 420,000 in 1940, 1950, 1960 and 1972 respectively (Riyadh Municipality, 2011).

4.2.3. Oil Boom Period (1970 - 1990)

During the 1970s, 1980s and 1990s, the city of Riyadh witnessed a number of different urban planning patterns that reflected several development policies. In 1972, the Council of Ministers approved the first master plan for the city of Riyadh, which was prepared by Doxiadis Associates, the Greek consulting firm (Alkhedheiri et al., 2003). Choguill (2008), points out that, in 1968 Doxiadis International was assigned to design a comprehensive master plan for the city of Riyadh in order to guide the urban development and growth of the city.

The master plan was focused mainly on the growth in a northern direction and was intended to be parallel to Wadi Hanifah, which is located to the west of the city and considered as dry water basin that consists of a number of agricultural oases (Al-Fassam and Qhtani, 2011).

The plan presented the concept of linear growth along central routes operating in the north-south and east-west directions taking into account Wadi Hanifa as a natural boundary to the expansion to the west and proposed an industrial area in order to create an artificial boundary to the east.

The Doxiadis master plan for the city of Riyadh concentrated on the division of the city into a number of residential neighbourhoods with a total area of 4 square kilometres for each neighbourhood. Additionally, it considered the use of the car as primary means of movement within the city and because of that a comprehensive road network was designed in order to meet the huge demand for mobility during that time (Al-Ahmadi et al., 2009). According to Mubarak (2004), the Doxiadis master plan was designed to create a functional and feasible city that would be based on a modular grid and would be easy to control. Moreover, it was planned to meet the growth of population as well as spatial area of the city up to the year 2000 with a total area of 300 square kilometres and population estimated to be increasing at 100,000 per annum.

However, most of the previous studies reviewed during this research have indicated that this master plan was more a technical document rather than a realistic program that could be implemented in the real world to meet the different needs of the citizens. Therefore, the Doxiadis plan failed to address the expansion of the city of Riyadh at a time when the urban area exceeded that of the proposed plan and covered a total area of 700 square kilometres by the year 1977 (Mubarak, 2004). Furthermore, the population of the city has increased noticeably to almost double at the end of the 1970s. Alkhabbaz (2010), points out that the urban area exceeded the limits of Doxiadis scheme by the time the master plan was approved in 1974 due to unexpected growth in the population of the city in addition to the unregulated expansion in the spatial areas. It became noticeable that this plan needs to be reviewed regularly due to this rapid urban planning that exceeded all planning expectations.

As a result of these changes as well as other issues such as the oil boom at the beginning of 1970s and the increase in the quantity of oil production, the Ministry of Municipal and Rural Affairs decided to revise the Doxiadis scheme. Hence, in 1976 another consulting firm was contracted to revise the existing master plan, SCET International. Garba (2004), points out that in 1980, the revised plan prepared by SCET International had been produced to improve on the Doxiadis scheme. It was primarily aimed at updating the Doxiadis plan in order to accommodate this enormous urban revolution up to the year 1992 which can be seen in Figure 4.5 (CSBE, 2003).

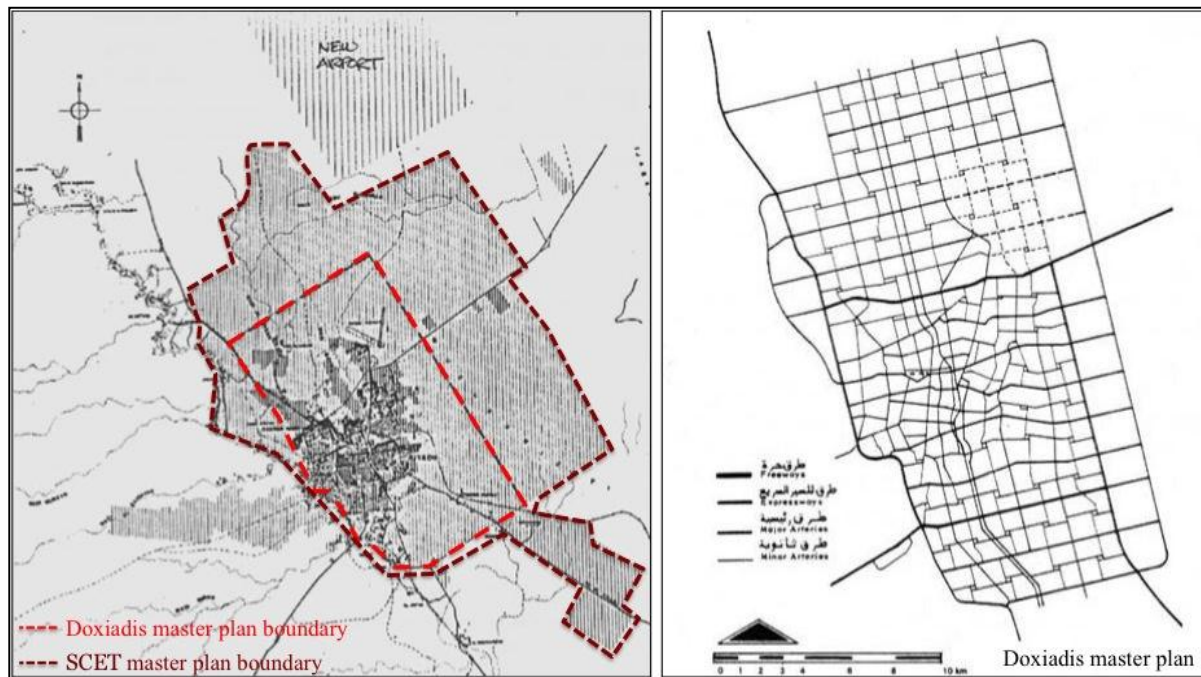


Figure 4.5. The boundaries of Doxiadis and SCET master plans (CSBE, 2003, Mubarak, 2004).

The revised plan focused on the adoption of different strategies in the short and long term taking into account the local context of the city as well as the different needs of the citizens and effectively translated the plan from just a nominal paper exercise to a practical agenda. However, by 1985, the rapid urban planning and policies of the central government created a random pattern of urbanisation in the city of Riyadh in particular and in other cities in the Kingdom (Alkhedheiri et al., 2003).

According to Arriyadh Development Authority (1993), the urban planning of Riyadh in the 1980s was marked by the haphazard expansion of subdivision, dispersal of facilities and services to areas with low population densities and a lack of coordination between service providers. As a response to this problem, the Council of Ministers was ordered to determine the boundaries of the existing urban areas and freeze all the urban expansion in the Kingdom from 1985 to 1987. In the same context, Garba (2004), indicates that the imposition of urban boundaries in 1989 was an implicit recognition of the difficulties in managing and controlling the urban planning of the city.

4.2.4. Post-Oil Boom Period (1990 - Present Time)

During the 1990s and the beginning of 21st century, the city of Riyadh witnessed rapid growth in the field of urban development that extended to all the cities in the Kingdom due the increase in oil prices and production quantities. According to High Commission for the

Development of Arriyadh (2011), the population of the city has increased significantly at a rate of approximately 8% per annum in the last decade in addition to reaching a phenomenal rate of almost 16% during the last few years of the 1980s and the beginning of the 1990s. It was estimated at 2,100,000, 3,829,000 and 5,200,000 in 1990, 2001 and 2010 respectively (Riyadh Municipality, 2011). Moreover, it is expected to reach 10 million by the year 2020 as mentioned previously. This remarkable evolution in the city population has created an enormous construction boom that has led to a dramatic increase in the demand for urban areas, which has led to a significant expansion in the spatial area of the city of Riyadh.

The spatial area of the city was estimated at 765, 2435 and 2700 square kilometres in 1996, 2008 and 2011 respectively (Ibrahim, 2010). At the beginning of 1990s and as a result of the expiry of the SCET scheme, as well as other changes that have occurred in the city, the Ministry of Municipal and Rural Affairs decided to develop a new strategy for the planning of the city of Riyadh over the next 50 years in order to manage and control this urbanisation (Al-Ahmadi et al., 2009). The strategy is known as the Metropolitan Development Strategy for ArRiyadh (MEDSTAR) and has been divided into three key phases that can be seen in Figure 4.6.

The first phase was designed to accommodate the urban planning of the city up to the year 1995. It covered the existing buildings as well as governmental ministries and departments at the time. The second phase was designed to absorb the expansion of the city up to the year 2005, which included a number of land subdivisions that have been approved. The third phase is located outside the urban boundary of the second phase, which was designed to meet the needs for the future expansion for the city of Riyadh beyond the year 2005. The overall aim of the strategy focuses on providing a short as well as long term plan to direct the urban planning of the city (Al-Fouzan, 2012).

Moreover, the strategy aims to help the different stakeholders participate in the development process for the future in order to create a sustainable urban development. However, Middleton (2009), indicates that the MEDSTAR strategy points to increase of the oversupply business and other service spaces and distributes them throughout the urban surroundings. He also notes that the marginal expansion has overlooked the spatial strategy and has resulted in poor distribution of services in the city.

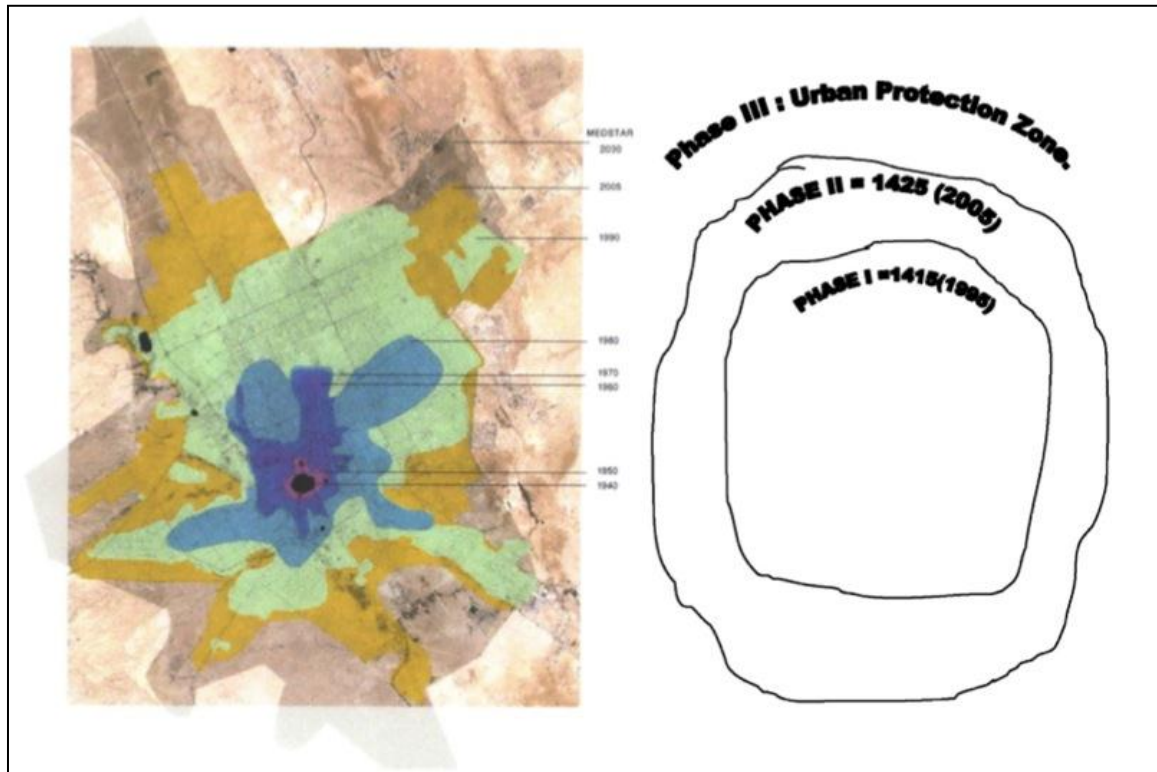


Figure 4.6. Urban development boundaries of the City of Riyadh since 1940s until the year of 2030 (Alkhabbaz, 2010, Al-Hathloul and Mughal, 2004).

The city of Riyadh currently accommodates approximately 5.2 million people including fifty different cultures, languages and interests covering a total urban area of almost 2700 square kilometres. The continuous growth in the population and spatial area of the city is placing further concerns that must be dealt with properly. Therefore, the study would argue that the recent strategy for dealing with the urban planning of the city would obstruct the achievement of the fundamental concept of sustainable urban planning and will influence negatively on the city of Riyadh and its population.

4.3. Examine Development Periods based on the Proposed Framework

From the beginning of the 20th century, the city of Riyadh has witnessed enormous alterations. It has transformed from a small mud-walled town that covered an area of almost one square kilometre to a global metropolis that occupies an area of 2700 square kilometres as can be seen in Figure 4.7. Moreover, the population of the city of Riyadh has risen dramatically from 100,000 in the early 1950s to almost 5.2 million people in 2010 as is illustrated in Figure 4.8. This population includes different cultures, languages and interests. Table 4.1 gives an overview of the characteristics of the population in the city of Riyadh including the percentage of Saudi and non-Saudi population.

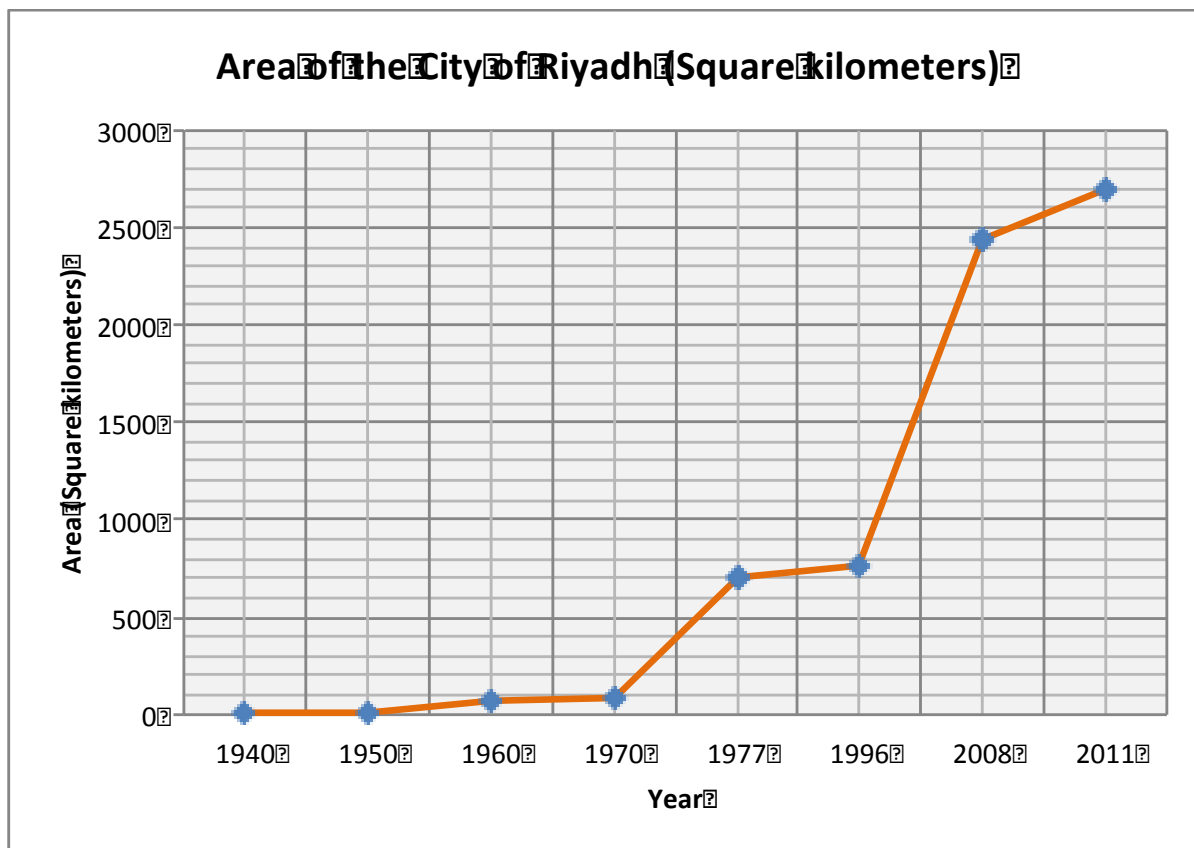


Figure 4.7 the expansion of the spatial area of the city of Riyadh since the beginning of the 20th.

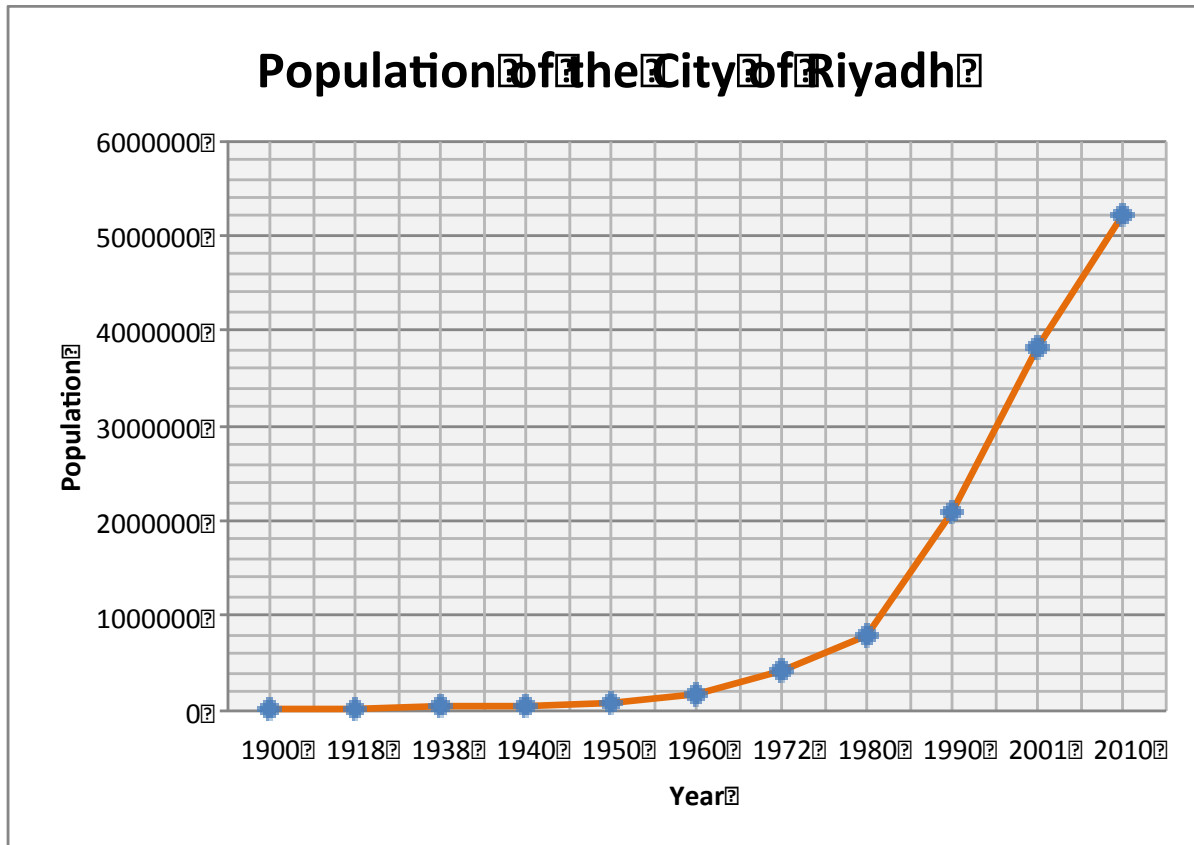


Figure 4.8 the growth of the population of the city of Riyadh since the beginning of the 20th.

Table 4.1 the characteristics of the population in the city of Riyadh (High Commission for the Development of Arriyadh, 2012).

Population	5.7 million	Population Growth Rate	4% per annum
Saudi Population	61%	Non Saudi Population	39%
Saudi Population (Aged 0-14 years)	32.4%	Saudi Population (Aged 15-59 years)	64.7%
Saudi Population (Aged 60 or over)	2.9%	Saudi Male	52%
Saudi Female	48%	Non Saudi Male	69%
Non Saudi Female	31%	Number of Families	919,000
Average Number of Family Members	6.2		

Undoubtedly, it is sometimes difficult to imagine, recognise or understand such a phenomenal transformation, especially with the absence of required resources and essential institutions concerned with supervising and guiding the urban planning of the city. Al-Hemaidi (2001), points out that the massive urban development and planning patterns that have taken place during the last few decades were unknown to the relevant authorities at the time.

Today there have been wide ranging discussions about the most important factors that influenced the urbanisation of the city of Riyadh. Most of the previous studies have indicated that the most obvious factors include a number of direct and indirect issues that affect the city as well as the citizens. For instance, these factors include local context, environmental issues and conflicts of interest between the different policies in addition to institutional problems. However, in order to examine the growth of the city of Riyadh this study has analysed the development phases by evaluating the developmental patterns that have taken place in the city based on the proposed framework of sustainable urban planning that has been designed in this research and can be seen in Figure 4.9.



Figure 4.9. Proposal for the sustainable urban planning framework with the main dimensions, categories and criteria.

The dimensions of this proposed framework are categorised into five issues, which are social, economic, planning, environmental and information and communication technology (ICT). Therefore, this part of study has been divided into five subsections which examine the urban planning of Riyadh in the light of each one of these five dimensions to determine whether the city of Riyadh has been developed in a sustainable manner during the last period or not.

4.3.1. Social Dimension

White and Lee (2009), point out that sustainable development means the balancing of economic, environmental protection, and social development. The social dimension looks at responding to the needs of people, supports the civil society, helps to solve various issues within the communities and supports the decision makers on different levels (OECD, 2001, UNDESA, 2002, EEA, 2006, George and Kirkpatrick, 2006). It aims to provide society with the equitable distribution of services and essential facilities in order to improve the living

conditions of the city and its citizens such as human health, educational development and security.

During the last century, the city of Riyadh experienced a number of severe difficulties in its development as a result of the abandonment of the core of the city and the traditional neighbourhoods. According to Eben Saleh (2001), throughout the last five decades, the planning of the city has focused on a series of self-sustained communities along the edges of the city of Riyadh, as dictated by the Doxiadis Master Plan. These communities have contributed clearly in creating many job opportunities, shopping centres, and leisure activities away from the core of the city, which influenced the social side in many aspects. For example, it led to the disintegration of social connections between citizens as a result of scattering of the neighbourhoods away from the core of the city.

According to Al-Hemaidi (2001), the traditional built environment has changed dramatically since the narrow and shaded streets, which provided the local residents and their children with a suitable open space for their social activities, have disappeared. Furthermore, the growth of the population and spatial areas of the city of Riyadh was caused by several factors. For instance, one of the matters that emerged from this population and spatial boom, which can be linked to the subject of poverty, is the emergence of the social and economic deprivation among some strata of society (Eben Saleh, 2001).

These issues interfere with many of the principles contained in the proposed framework for the social dimension. There is no doubt that local social interaction must be taken into account as a first step toward public participation in a decision-making process of matters that affect the city and its inhabitants (Choguill, 2008). Therefore, it is very important to consider the current state of the social issues in the City of Riyadh and include it within a comprehensive sustainable framework along with economic, environmental and planning issues.

4.3.2. Economic Dimension

The economic factor in general focuses on the importance of achieving stable economic growth. Combating poverty and working within the capacity of the natural environment is an essential aspect of sustainable urban planning (OGC, 2007). In this research the economic dimension, included within the proposed framework, deals with a number of aspects

regarding the economy. These include economic growth, sustainable economy, employment and productivity. Each one of them has a number of issues such as local economic development, business facilities, economic capacity, employment opportunities and equity as well as the quality of the product.

The oil wealth during the last few decades has enabled the Saudi government to begin several urban planning strategies for the city of Riyadh. The main aim of these strategies is to improve the living conditions of citizens by all possible means and by improving the built environment in order to achieve economic prosperity in the future (Mubarak, 2004). There is no doubt that both the oil boom and the post-oil boom phases provided the government with millions of dollars that allowed for continued development in several fields. Enhancement of economic environment due to the discovery and increase of oil production in addition to the improvement of the supplementary petroleum and chemical industries have led to expansion of the city. However, this certainly is considered as one of the matters conflicting with the principles of a sustainable economy.

Choguill (2008), points out that in order to achieve sustainable economy it is essential to limit the random expansion of the city to reduce the cost of infrastructure and transport. Additionally, it is fundamental to consider the diversification in the economic sources and look at the alternatives that can support the city economy, not focusing primarily on oil as the only source to enhance the economy. Examples of these alternatives are tourism, the industry or the use of solar energy instead of petroleum products to generate energy and thus reduce the excessive use of the oil wealth and save it for future generations.

According to Eben Saleh (1998), during the 1950s, the city of Riyadh faced a number of economic changes that impacted the urban planning of the city as well as the lifestyles of its residents. At that time, the traditional built environment and nature of standard of living had started to deteriorate combined with the loss of the traditional daily life of the city. Moreover, at the current time there are a number of critical economic issues, such as the provision of a sustainable economy, that are affecting the citizens of the city of Riyadh. For instance, one of the most obvious issues is the emergence of so-called social and economic deprivation in some levels of society as mentioned earlier.

In fact, there are a number of challenges regarding the economic side that face the development Riyadh. One of the most significant ones is the reduction of people with middle incomes and the increase of the percentage of population with low incomes (High

Commission for the Development of Arriyadh, 2003). This can be ascribed to a number of related issues such as the absence of analysis of the functional and economic foundation that could be due to the time limitations or a lack of the management and resources (Al-Hathloul and Mughal, 2004).

4.3.3. Planning Dimension

Generally, sustainable urban planning is not based on environmental protection, economic growth and social equity alone, but also on a strong foundation of good planning. In the planning dimension, within the proposed framework, there are several concerns around planning aspects that have been highlighted. These issues include the proper use of the land, infrastructure issues, consideration of the importance of transportation matters and good management. During the pre-foundation and foundation periods the urban planning of the city of Riyadh was built on the traditional principles of urban planning that have been followed in the city for a long time.

During these periods there was no clear strategy to manage and control the process of urban development for the city of Riyadh which used to use a case-by-case principle with decisions creating direct outcomes (Fassam and Qhtani, 2011). From the 1970s Riyadh has started to witness a number of schemes such as Doxiadis and SCET plans and many development regulations have been adopted. The main aim of these plans and regulations was to manage and control the growth of the urbanisation of the city of Riyadh.

However, it was not created on the city's long-standing values of urban planning. Unfortunately, these imported schemes failed to understand the cultural background of the city and deal properly with the local context of the society. Many research papers would argue that these forms of planning were more a technical document rather than a realistic program that could be implemented in real life. Al-Faleh (2005), states that the city of Riyadh was initially designed as a compact city, but this design could not cope with the huge influx of people and the large growth in population. The city started to expand in a horizontal manner, unexpected by those responsible for the urban planning, and the system in the city could not cope efficiently with the large growth.

The random urban planning of the city during the beginning of the oil boom in the 1970s and 1980s has resulted in the disorganized development of residential and business enclaves that were either accessible only by car or its surrounding community (Mubarak, 1995). As a result of poor planning in the Third Phase of development for Riyadh, the distance of the city also

yielded highway congestion in commercial nodes on a level not previously seen in Middle Eastern cities (Gamboa, 2008). There are many studies confirming that Riyadh was planned and designed to be appropriate for private vehicles only without taking into account the importance of public transport system. The previous strategies, including Doxiadis and SCET plans, have not taken into consideration the significance of a public transport system within the city.

According to Saeed (2000) the absence of public transportation system in the early master plans for Riyadh caused a serious matter in the city planning today. For instance, the traffic amount on the middle part of King Fahd Road, one of most important central routes of the city that was adopted within Doxiadis master plan, has exceeded 320 thousand vehicles per day, exceeding its normal capacity of 160 thousand vehicles per day (Al-Manie, 2001).

As it is very clear from the review of the historical development of Riyadh, this study argues that there is no determining of responsibilities among a number of concerned authorities related to the urban planning which has led to a lack of good planning, organisation and coordination. Moreover, Mubarak (2004), indicates that the poor condition of urban planning and the weakness of the municipal authorities have resulted in a centralised approach to urban planning. According to Gamboa (2008), the city agencies provided the city with poor planning in the development, planning and leasing of the land during the outward expansion of the city of Riyadh.

4.3.4. Environmental Dimension

Consideration of environmental matters is a very important issue that helps to determine whether or not the design of the built environment has been considered the key aspects of environment. These aspects focus on a number of key issues including climatic matters, pollution prevention, reducing waste, effluent generation, emission to environment and reducing negatives effects on human health (Ding, 2005, Grace, 2008). In the same context, Harris (2000), points out that the environmental dimension aims to maintain a stable base for natural resources, avoiding excessive exploitation of renewable resources and depleting non-renewable resources.

Therefore, in the proposed framework, the environmental dimension focuses on most of the critical issues that have been stated previously. For instance, it considers the phenomenon of global warming and reduction of emissions to the environment. It touches on the subjects of preserving biodiversity, the natural environment as well as the ecosystem in order to reduce the impacts on the environment. Moreover, the energy and resource issues have been taken into account in this framework in order to maintain a stable resource base. In the city of Riyadh and during the last few decades there were a number of changes, which occurred, in the built environment that overlooked the importance of climate issue of the city of Riyadh and caused many climatic problems.

An example of these climatic problems is the need to use different modern technologies to adapt to temperature, increasing emissions and consequently adversely affecting the ecosystem whilst elevating operational costs. Clearly, human activities constitute a threat to the natural environment. Continued usage of such technologies will exacerbate the existing problems and challenge the environment further. Unfortunately, the conditions of this local environment have not been taken into consideration since the beginning of the planning process otherwise there would be no need to use these technologies.

Redman (2010), indicates that the methodology of a sustainability approach is still being developed and expects to take multiple different forms, however one of the most important principles of this concept is that the nature of the environment must be respected during the development process. In the city of Riyadh, lands were considered as homogenous during the development process without taking into consideration the topographical features or the location (Mubarak, 2004). Therefore, it has led to a dramatic increase in the demand for urban areas, which directly led to a significant expansion in the spatial area of the city of Riyadh, thus affecting the natural environment. Yigitcanlar (2009), indicates that the expansion of the cities leads to loss of biodiversity and natural habitat.

Moreover, the idea of landscaping, which is considered as one of the most important issues in a desert environment was unfortunately was not taken into account. Choguill (2008), points out that in order to improve the natural environment and obtain sustainability, it is very important to provide the city and its neighbourhoods with sufficient open spaces and green areas. Although green and open areas are extremely significant to improve the built environment and obtain the satisfaction of the citizens by reducing noise and temperature, it has been overlooked in numerous areas within the city of Riyadh as can be seen in Figure 4.10.

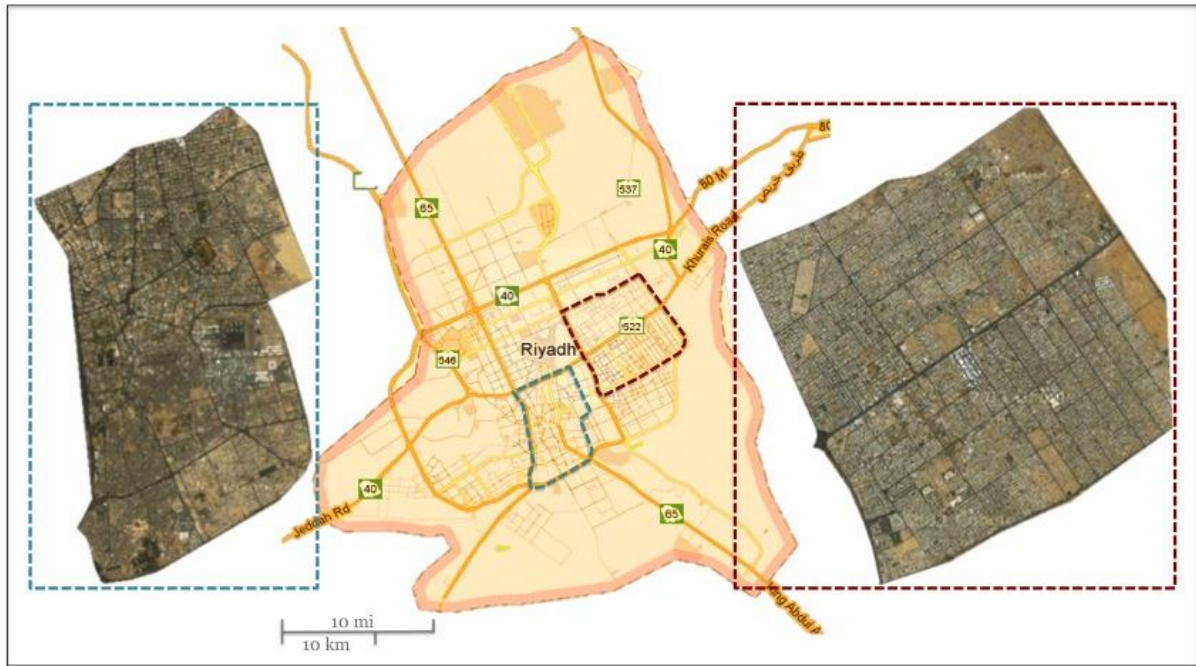


Figure 4.10. The absence of the landscape and green areas in most of the neighbourhoods in the City of Riyadh.

4.3.5. Information and Communication Technology (ICT) Dimension

In the present era, ICT concepts have been in constant mutation across the world and are becoming more and more in demand. It is a very important element in order to keep up with modern developments in light of the concept of turning the world into a small village. The importance of ICT has emerged as one of the most valuable tools that need to be taken into account at the current time in order to reach the level of sustainable cities. It looks at a number of essential issues that affect daily human life (The Welsh Assembly Government's Outline Framework for Action, 2010).

For instance, it emphasises the 21st century skill outcomes and the ability of citizens to access technologies, services and resources (Economist Intelligence Unit, 2010). However, this research would argue that this important dimension has been disregarded in most of the studies and research papers in the field of sustainable urban planning within cities in the Kingdom of Saudi Arabia and specifically within the capital city of Riyadh.

It is very clear from the examination introduced so far that during the development process of the city of Riyadh there were several plans, strategies and policies that have been adopted. However, most of them focused on the social, economic, environment and planning issues regardless of the importance of information and communication technology as an effective

tool to connect these core dimensions with each other and realise the realistic concept for sustainable urban planning.

Although the governmental authorities have adopted a number of schemes such as Doxiadis, SCET and MEDSTAR, the focus was on improving the urban environment and controlling the significant growth of the population and spatial area rather than connecting the city with a comprehensive system such as ICT in order to manage the whole city properly. For this reason, the city was beyond the scope of these schemes each time they were applied due to the lack of a technological system for decision-makers containing a clear mental picture for the growth of the city and all the required data and information.

Therefore, it is argued in this research that there is a significant need for a comprehensive framework for sustainable urban planning based on the ICT system as one of the key issues that must be taken into account by the relevant authorities and experts. Moreover, it needs to be accommodated in the factors affecting the growth of the city, including social, economic, environmental and urban issues.

4.4. Discussion of the Obtained Results

The city of Riyadh has witnessed a significant growth in the urban development field during the last few decades. This growth was not built on the traditional principles of urban planning but on a number of imported schemes and regulations for urban planning which have been adopted in the city by a number of foreign experts. However, as can be seen throughout the previous review of the historical development of the city of Riyadh, the imported schemes failed to deal appropriately with the cultural background of the city and its citizens.

Moreover, they have not dealt realistically with a number of critical issues, including the size of the typical Saudi family, the importance of privacy in families in Saudi society, particularly women, in addition to the nature of the climate of the city. Brebner (2007), indicates that modern urban planning in most of the Saudi Arabian cities has been designed in a random manner, based on foreign consultancies, western methods and managed without referring to a particular local regulation. Therefore they have not reached the desired goals that they were designed to achieve.

There is no doubt that traditional urban planning reflects the social and cultural values as well as the local identity of the city and its residents, and usually responds to the local context and climate. However, Eben Saleh (1998), points out that most of the structures constructed

before 1950 have been destroyed and deserted. For instance, the most indicative example of this deterioration was the demolition of the initial central area of the city of Riyadh in the mid 1970s. In the same context, despite the design of the villa style and its planning regulation having been introduced for almost four decades, it is still not suitable for the local context of the city. Neither is it suited to the local climate nor the culture of the citizens.

Unfortunately most of the previous studies indicate that the examples of the traditional urban planning that have been successfully adopted in the city of Riyadh are very few (Al-Hemaidi, 2001). One of the most common ones is the Ministry of Foreign Affairs Staff Housing, which takes into account the cultural background and local climate of the city in addition to the urban form and architecture of the neighbourhoods of Saudi Arabian cities in a contemporary style (see Figure 4.11).

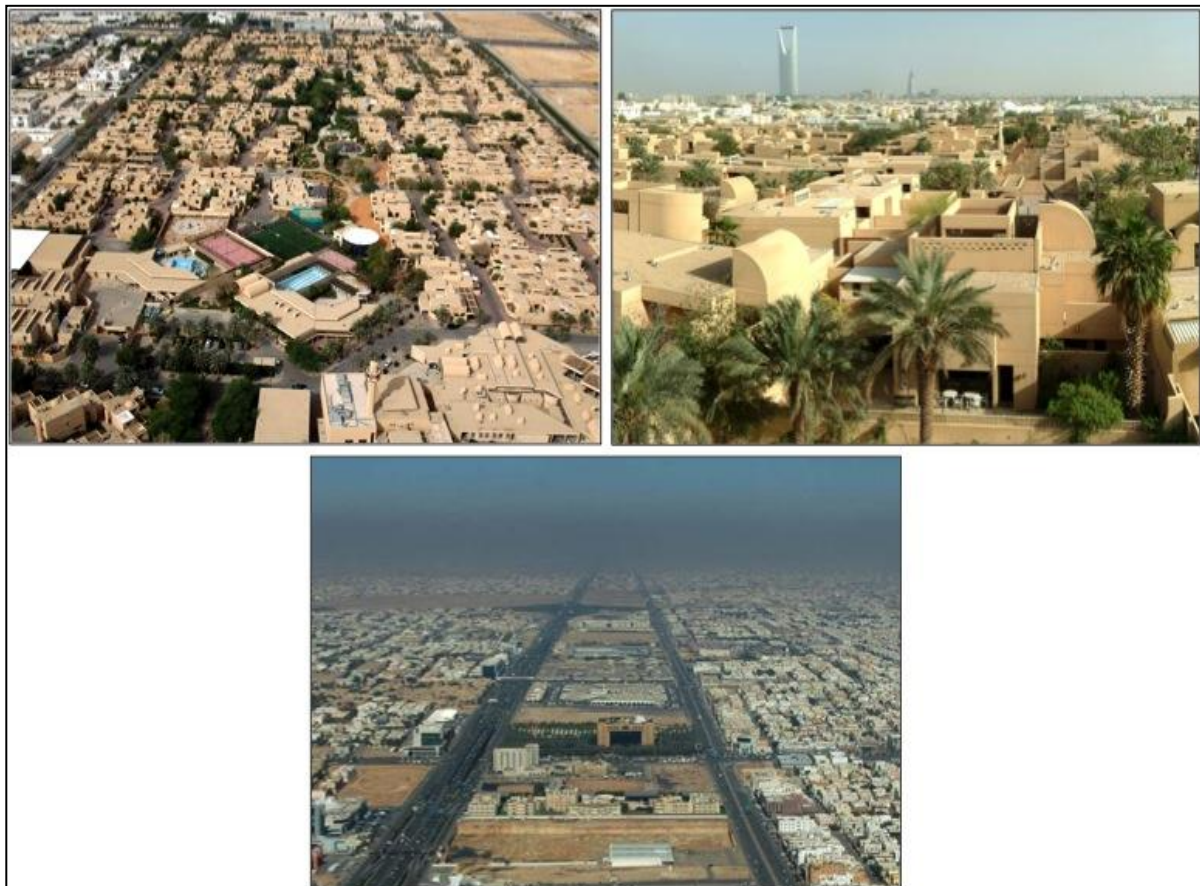


Figure 4.11. Comparison of the planning pattern of the Ministry of Foreign Affairs Staff Housing with other neighbourhoods in Riyadh (High Commission for the Development of Arriyadh, 2011).

Unquestionably, consideration of the key dimensions of the concept of sustainable urban planning and linking it with each other properly during the development process will

encourage the citizens to understand the cultural identity of place, the value and importance of urban areas and feel a sense of belonging. Eben Saleh (2001), indicates that the design of spaces reflects the ideal images and represents the congruence between the physical and social spaces. According to Mubarak (2004), although the governmental authorities have established several national and urban schemes, based on the oil wealth, these plans and strategies have been set without public contribution.

In the same context, the relevant authorities were attempting to manage the remarkable development of the city of Riyadh by using a number of master plans such as Doxiadis and SCET plans which were not suitable and compatible with the local context of the city. Undoubtedly, these imported urban planning plans have influenced negatively the development process and urbanisation of the city of Riyadh. The consequences of these negative influences have already appeared. One of the most obvious ones is the apparent variance between the proposed strategies of the urbanisation development and the current situation in the city. At the current time, in the city of Riyadh, the urbanisation process has created thousands of hectares of subdivisions that are inappropriate and unplanned and scattered around the periphery of the city (Mubarak, 2004).

In this study it is argued that past plans for the city of Riyadh have failed. The city is now ready for a new urban planning strategy in accordance with the principles of sustainable development; a process that could be greatly facilitated by the financial support of the state. The gridiron pattern with its associated negative effects, for instance, must be abandoned. Moreover, the local customs and traditions of the city in addition to the nature of the local climate have to be taken into consideration.

The process of urban development has been achieved with minimum understanding and recognition of social, economic and environmental issues which undoubtedly play a major role in shaping the city. Although the Ministry of Municipal and Rural Affairs developed urban boundaries (MEDSTAR) for the city of Riyadh in order to manage and control the growth of the city, subdivisions continue to expand because of the influence of landowners and the absence of required decisions from the relevant authorities. Furthermore, the MEDSTAR scheme notably does not provide a connected approach for the long-range possibility of future society developments (Middleton, 2009).

Obviously, the recent strategy for dealing with the urban planning of the city, based on central government decisions, will obstruct public participation, the achievement of the

fundamental concept of sustainable urban planning and will influence negatively on the city of Riyadh and its population. In the same context, one of the most important issues that has emerged during this research is the lack of an understandable explanation of the roles and functions of different stakeholders engaged within the urban development process (Garba, 2004). This issue without doubt is considered as one of the most critical problems that the structural framework for supervising and guiding the urban planning suffers from in the city of Riyadh. Logically, the city of Riyadh, as is the case in most capital cities with such size, will be subjected to a number of challenges regarding the urban planning in the near future, which include the increasing demand on urban areas and services. These challenges must be dealt with and managed properly in order to improve the quality of life for the city and its citizens.

Numerous significant changes in environmental, social and economic matters affected the formation of the traditional built environment in the city of Riyadh and the surrounding areas. These changes occurred as result of the remarkable growth of the population and spatial areas in the city during the development phases. There is no doubt that the absence of a comprehensive strategy for development to manage and control the current urbanisation will lead to a continuation of the incapacity to attain a sustainable urban planning for the city of Riyadh and its residents.

Creating effective approaches for evaluating various frameworks of urban planning concerning the potential challenges for the growth of the spatial areas and population is critical for relevant authorities including architects, planners and decision makers. At the current time, it is clear that there is a sort of lack of coordination between different service providers in the city. For instance, most road construction services are often uncoordinated with the housing, construction or residential services resulting in the creation of heavy traffic and other transportation problems within the city (Gamboa, 2008). These matters have arisen in the absence of a technological system such as ICT that provides different stakeholders and service providers with a perception of the functions that will be carried out. Thus, it is argued in this research that the development process of the city overlooked the importance of ICT system as an important tool in order to achieve sustainable urban planning.

Undoubtedly, the city of Riyadh, as is the case in many other cities in the Middle East, has some disputations with some concepts and differences regarding urbanisation such as the relationship between the concepts of the modern city and principles of Muslim society. Sustainable development issues have become increasingly important concerns that must be

considered in the urban planning process for 21st century cities such as the city of Riyadh. Consequently, in order to achieve an effective sustainable urban planning framework, there are a number of core issues that are critically important to understand, realise and take into account. These issues include historical development of the city, limitations of previous plans, society characteristics and local context.

Most of the results and findings reached through this historical background of the city of Riyadh, and factors affecting the urban planning, have emphasised the need for an effective strategy for sustainable urban planning due to fact that there are several issues, obstacles and challenges, which must be managed properly. Furthermore, as a result of the examination of the urban planning of Riyadh based on the core issues of the proposed framework, this study argues that the city has grown and developed in unsustainable manner. Therefore, the significance of the importance of having such an effective sustainable urban planning framework has emerged as a critical issue that it is very important to be taken into account by the relevant authorities and experts. By the same token, this study argues that the adoption of a sustainable framework would return substantial benefits to the communities and cities despite potential difficulties and obstacles.

4.5. Summary

The main purpose of the chapter was to present an inclusive picture of the current situation of sustainable urban planning within the capital city of Riyadh. The chapter reviewed the historical process of the urbanization since the start of the 20th century based on the core dimensions of the proposed framework that have been designed during this research work. Based on the information and facts contained in this part of the thesis, this research would argue that the city of Riyadh has expanded and grown in an unsustainable mode because of a number of serious matters.

These matters are linked to several social, environmental, planning and economic issues in addition to the lack of a technological system such as ICT. Moreover, one of the most important results to arise from this part of the research is that there is an insistent need for developing an inclusive and effective framework for sustainable urban planning for the city of Riyadh to address the different issues that resulted from the unsustainable development of the city during the last century. In the same context it is argued that all institutions and individuals related to this matter must coordinate with each other in order to reach the desired objectives.

CHAPTER FIVE: DELPHI CONSULTATION PROCESS: DATA ANALYSIS RESULTS

5.1. Introduction

In this research work, the Delphi technique is followed for two reasons. The first reason is to investigate expert opinions regarding the significance of the proposed framework for sustainable urban planning in the city of Riyadh. This investigation aims to work out the suitability and possibility of applying such a framework. In this sense, the Delphi technique could be considered a validation tool of the proposed framework, as it assesses the feasibility of this framework in terms of its clarity and adequacy in addition to ensuring that the framework is reasonably solid.

The second purpose of the Delphi technique is to investigate expert views regarding the nature of urban planning in the city of Riyadh at the current time. This chapter begins with an explanation of the main data collection and analysis methods and a report of the main Delphi-based validation results that are gathered in respect of the proposed framework. Then, the chapter will end with a general discussion of the main findings that have been obtained.

5.2. Delphi-based Validation Results

In this research, experts were asked to determine the level of the importance of each dimension of the proposed framework for sustainable urban planning based on the local context of the city of Riyadh. Of the 45 experts, 40 agreed to participate in this research, 37 experts have completed the first round of Delphi technique and 35 experts have completed the second and third round. The three rounds of Delphi technique have been carried out July through October 2012. Data analysis has been completed through the use of SurveyMonkey and SPSS software.

As presented in Figure 5.1, the majority of the experts stress the significance of all five dimensions of the proposed framework, and they rated the dimensions based on the level of the importance of each of these dimensions from their opinion. The environmental dimension is considered as the most important one whereas the ICT dimension is considered less important. However, all of the five dimensions are located within the range between very important and extremely important.

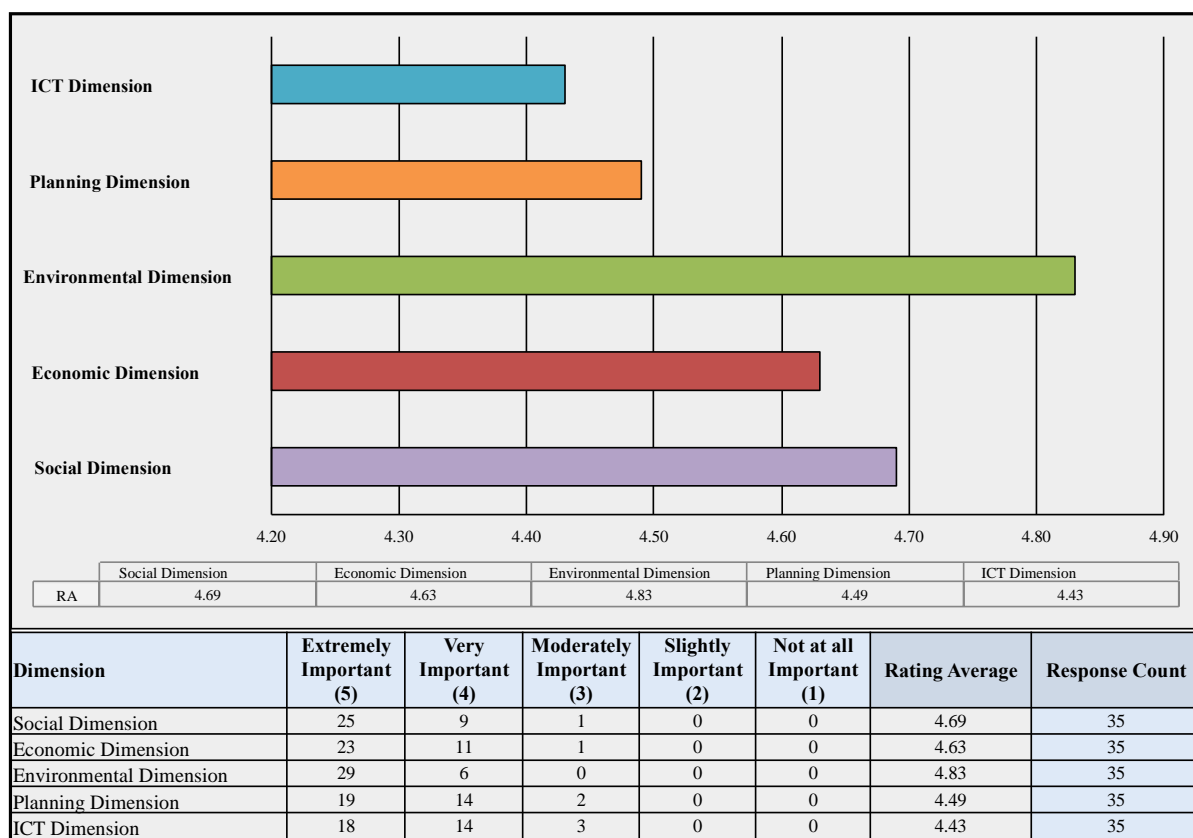


Figure 5.1. Rating average of the important level of the dimensions for the proposed framework based on the result from the final round.

Table 5.1 shows that the mean values for the dimensions of the proposed framework are in the range of 4.43 and 4.83 based on a five-point Likert scale, where 1 represented not at all important and 5 represented extremely important. Additionally, standard deviations for all the dimensions are less than 1 and in the range of 0.38 and 0.65, which means that there is a satisfying consensus. The decrease in the standard deviation means that the experts show a movement toward convergence and consensus (Bryant and Abkowitz, 2007, Vidal et al., 2011).

Table 5.1. Mean and standard deviations for the dimensions of the proposed framework.

Dimension	Mean	Standard Deviation
Social Dimension	4.6857	0.52979
Economic Dimension	4.6286	0.54695
Environmental Dimension	4.8286	0.38239
Planning Dimension	4.4857	0.61220
ICT Dimension	4.4286	0.65465

This section introduces the findings of the Delphi technique and the most important results that have been reached. Therefore, it has been divided into five subsections to deal with each one of these dimensions in detail. The main aim of this division is to obtain the opinion of experts regarding the proposed framework in order to answer the research question, which is how Riyadh can be guided towards more sustainable urban planning.

5.2.1. Social Dimension

Participants have emphasised on the significance of all the five categories of the social dimension. They rated these categories based on the priority of each of them from their individual point of view. The Health category is considered as the most important one whereas the Community category is considered less important. However, all of the five categories are located within the range between very important and extremely important. Figure 5.2 shows the responses and rating average of the important level of the categories for social dimension based on the result from the final round.

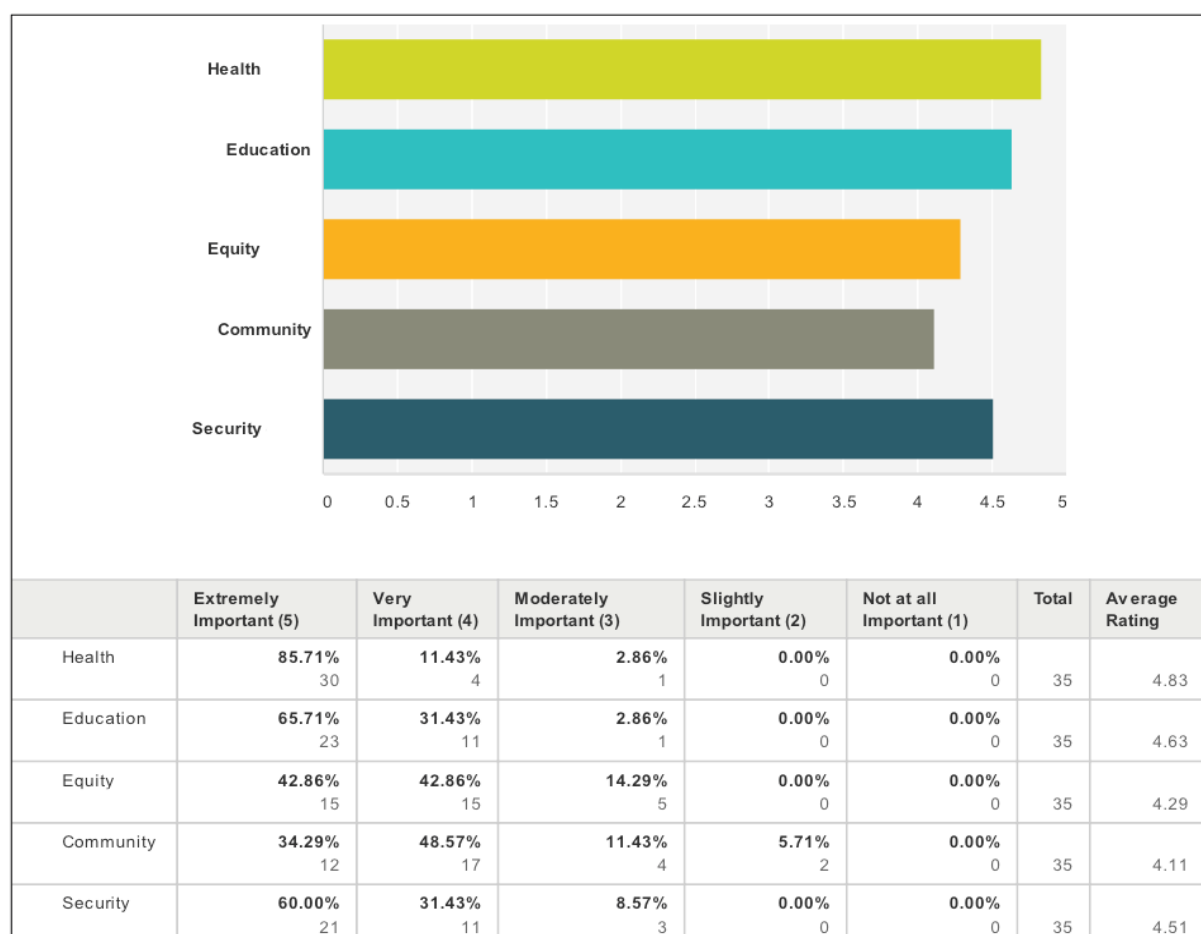


Figure 5.2 Responses and rating average of the important level of the categories for social dimension.

The mean values for the categories of social dimension are in the range of 4.11 and 4.83. The standard deviations for the categories are less than 1 and in the range of 0.45 and 0.83. Experts agreed on the importance of these categories and considered health as the most important category. Table 5.2 presents the mean values and standard deviations for all categories of social dimension as well as their criteria.

Table 5.2. Mean and standard deviations for categories and criteria of the social dimension.

Category	Criteria	Mean	Standard Deviation
Health		4.8286	0.45282
	Consideration of health and safety issues	4.7143	0.51856
	Providing medical facilities	4.6571	0.59125
	Easy access to health services	4.6286	0.59832
	Public awareness	4.4857	0.65849
Education		4.6286	0.54695
	Providing educational facilities	4.6571	0.53922
	Health and safety within educational environment	4.4857	0.56211
	Development of educational process	4.1714	0.61767
	Educational management	4.2000	0.63246
	Affordable access to standard educational services	4.5143	0.50709
Equity		4.2857	0.71007
	Equitable distribution of services	4.6857	0.47101
	Equitable distribution of income	4.2857	0.62174
	Public participation	4.3143	0.58266
	Heritage preservation	4.3143	0.63113
Community		4.1143	0.83213
	Community involvement in decision-making	4.5429	0.56061
	Characteristics of the population	4.2857	0.71007
	Enhancement of the community with essential services	4.2286	0.64561
	Promoting digital community	4.1176	0.68599
	Consideration of culture and background of the community	4.3143	0.58266
	Promoting community participation	4.4571	0.50543
	Governance framework	4.2857	0.57248
	Legislations and regulations	4.3714	0.59832
Security		4.5143	0.65849
	Natural hazards	4.4857	0.65849
	Man-made hazards	4.4857	0.65849
	Risk mitigation	4.6286	0.49024
	Risk management	4.5143	0.56211
	Crime prevention	4.7143	0.45835

5.2.2. Economic Dimension

Experts stressed the importance of all the five categories of the economic dimension. They rated these categories based on the priority of each of them from their individual point of view. The Sustainable Economy category is considered as the most important one whereas the Economic Growth and Productivity are considered less important. All of the five categories are located within the range between very important and extremely important.

Figure 5.3 shows the responses and rating average of the important level of the categories for economic dimension based on the result from the final round.

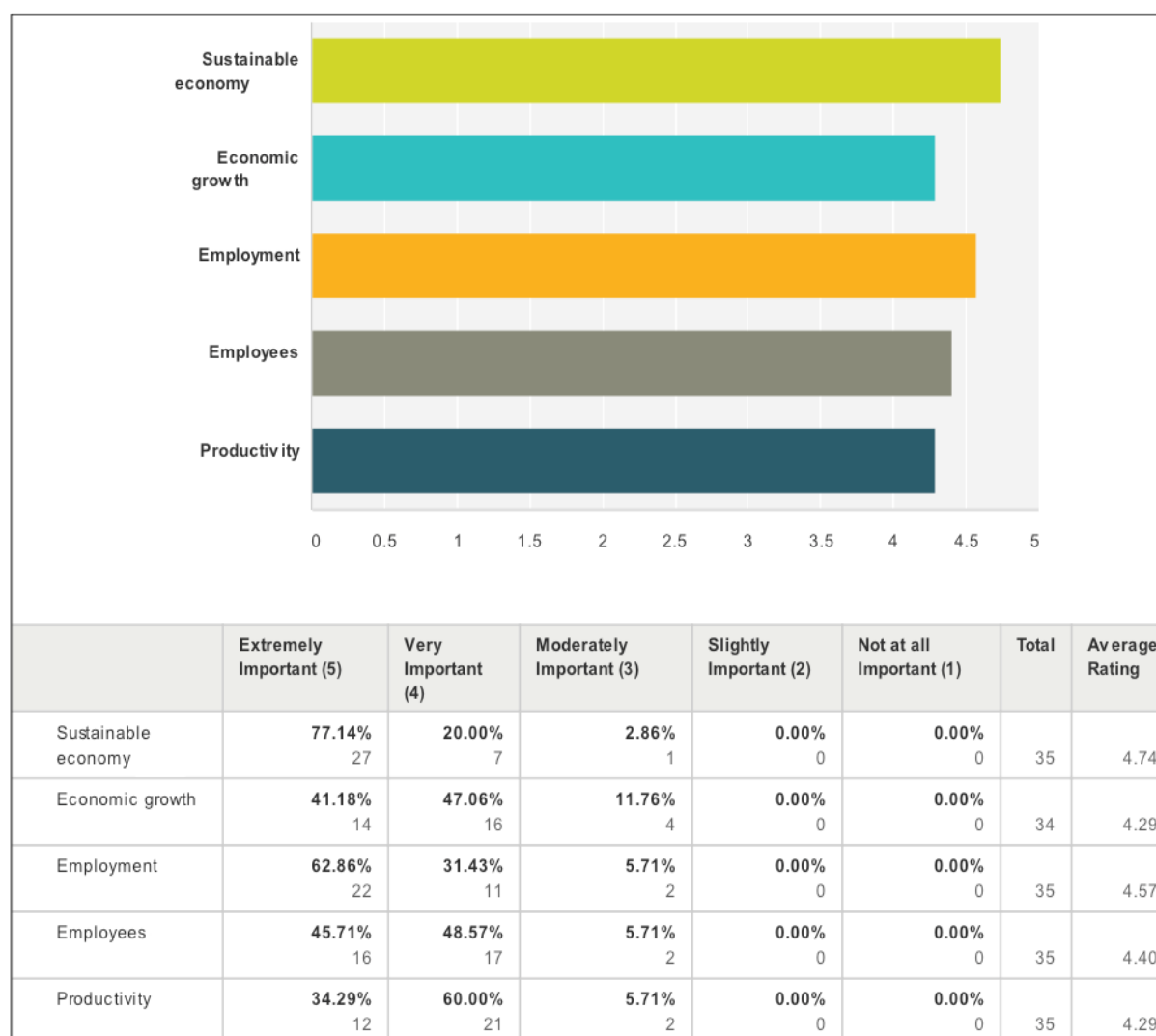


Figure 5.3 Responses and rating average of the important level of the categories for economic dimension.

The mean values for the categories of economic dimension are in the range of 4.29 and 4.74. The standard deviations for the categories and its criteria are less than 1 and in the range of 0.47 and 0.71. The category of sustainable economy is considered as the most important one whereas the category of productivity is considered less important, keeping in mind that all of the categories are located within the range between very important and extremely important. Table 5.3 shows the mean values and the standard deviations for the categories and criteria of economic dimension.

Table 5.3 Mean and standard deviations for categories and criteria of economic dimension.

Category	Criteria	Mean	Standard Deviation
Sustainable Economy		4.7429	0.50543
	Enhancement of local economy	4.6857	0.47101
	Diversity of economic activities	4.4000	0.60391
	Efficient use of resource	4.5143	0.50709
	Balance between income and spending	4.3714	0.64561
Economic Growth		4.2941	0.67552
	Developing new investment	4.3143	0.71831
	Promoting local industry	4.5714	0.50210
	Business facilities	4.2286	0.64561
	Economic capacity	4.2571	0.56061
	Providing healthy economic environment	4.6000	0.55307
	Facilitate procedures to attract investments	4.3714	0.54695
Employment		4.5714	0.60807
	Healthy employment	4.4000	0.60391
	Employment opportunities	4.6571	0.48159
	Employment prospect	4.1714	0.61767
	Work environment	4.4000	0.60391
Employees		4.4000	0.60391
	Skills and qualifications	4.6571	0.53922
	Effective training	4.6000	0.55307
	Vocational guidance	4.2857	0.62174
	Motivation	4.5000	0.50752
	Employees participation	4.1714	0.61767
	Working efficiency	4.5143	0.50709
Productivity		4.2857	0.57248
	Quality	4.6857	0.47101
	Cost efficiency	4.5714	0.60807
	Efficient pricing	4.3143	0.67612
	Delivery	4.1143	0.63113
	Accessibility	4.1714	0.70651

5.2.3. Environmental Dimension

Participants emphasised on the significance of all the five categories of the environmental dimension. They rated these categories based on the priority of each of them from their individual point of view. The Pollution category is considered as the most important one whereas the Ecology category is considered less important. However, all of the five categories are located within the range between very important and extremely important.

Figure 5.4 shows the responses and rating average of the important level of the categories for environmental dimension based on the result from the final round.

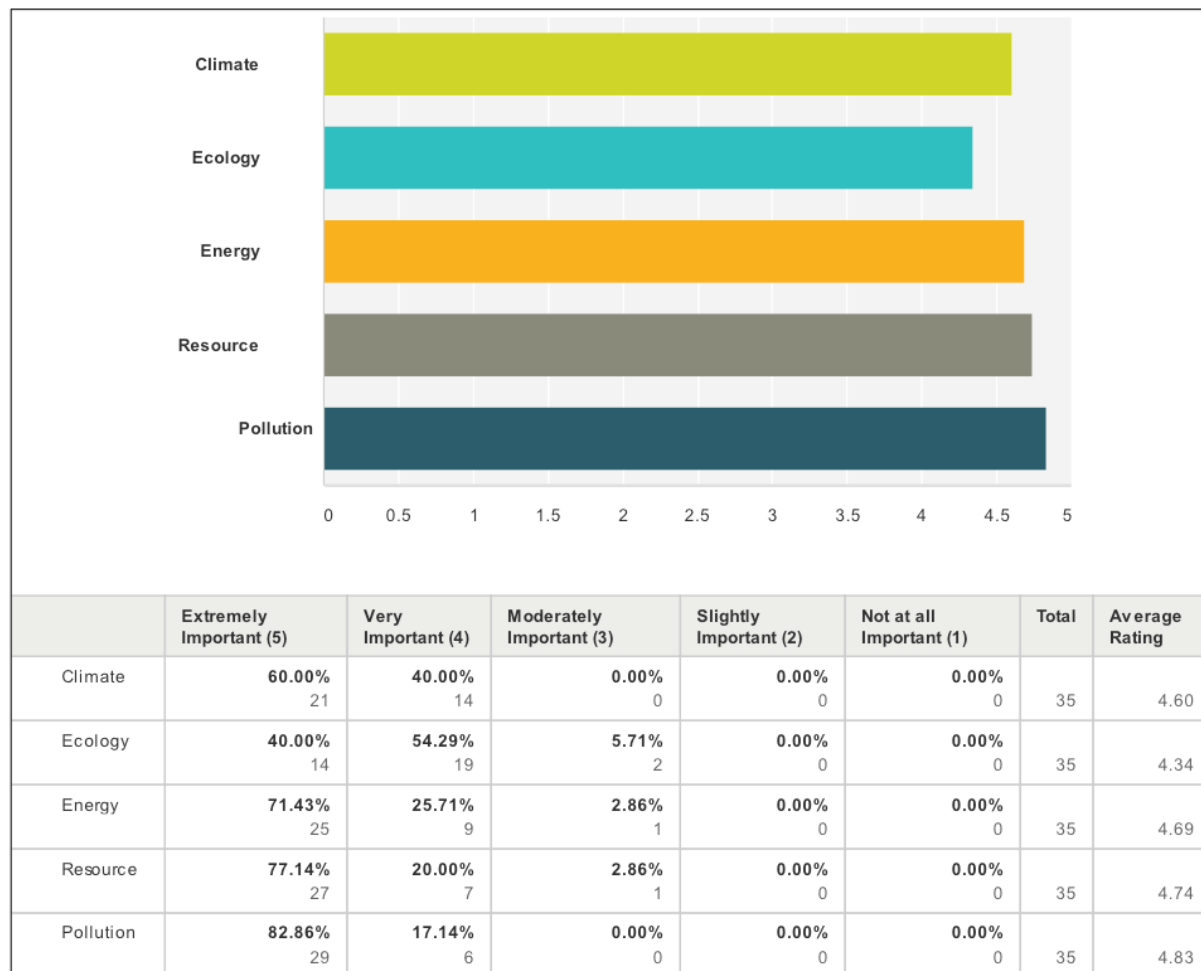


Figure 5.4 Responses and rating average of the important level of the categories for environmental dimension.

As is the case with previous dimensions, the standard deviations for all the categories of environmental dimension are less than 1 and in the range of 0.38 and 0.59. This means that a satisfactory consensus has been achieved. Furthermore, the mean values for the categories are in the range of 4.34 and 4.83. Table 5.4 displays the mean values and standard deviations for the categories of environmental dimension in addition to their criteria.

Table 5.4. Mean values and the standard deviations for the categories and criteria of the environmental dimension.

Category	Criteria	Mean	Standard Deviation
Climate		4.6000	0.49705
	Global warming	4.4571	0.61083
	Carbon emissions	4.7714	0.42604
	Solar radiation	4.3429	0.63906
	Flood risk issues	4.5429	0.61083
Ecology		4.3429	0.59125
	Ecological assessment	4.2857	0.62174
	Biodiversity	4.2857	0.51856
	Flora / Fauna	4.2857	0.57248
	Ecological appraisal	4.2000	0.67737
	Ecological survey	4.3429	0.63906
Energy		4.6857	0.52979
	Passive design	4.2286	0.68966
	Energy efficiency	4.5143	0.50709
	Energy consumption	4.6286	0.49024
	Energy management	4.6286	0.54695
Resource		4.7429	0.50543
	Resource recycling	4.4857	0.70174
	Resource efficiency	4.5714	0.55761
	Use of local resource	4.4857	0.70174
	Use of renewable resource	4.4857	0.65849
	Resource management	4.6286	0.54695
Pollution		4.8286	0.38239
	Pollution assessment	4.5429	0.74134
	Noise and waste	4.3429	0.63906
	Water pollution	4.6571	0.48159
	Pollution prevention	4.7143	0.45835
	Air quality	4.7429	0.44344

5.2.4. Planning Dimension

In this stage, experts have stressed the importance of all the five categories of the planning dimension. They rated these categories based on the priority of each of them from their individual point of view. The Land Use category is considered as the most important one whereas the Transport category is considered less important. However, all of the five categories are located within the range between very important and extremely important.

Figure 5.5 shows the responses and rating average of the important level of the categories for planning dimension based on the result from the final round.



Figure 5.5 Responses and rating average of the important level of the categories for planning dimension.

During the process of the Delphi Technique, experts have agreed on the importance of planning as an independent dimension. They confirm that it must be added to the pillars of sustainable development (social, economic and environmental) recognised since 1987 by the Brundtland Commission. The mean values of the categories of planning dimension are in the range of 4.51 and 4.77. The standard deviations are less than 1 and in the range of 0.42 and 0.65. The mean values and standard deviations for the categories of planning dimension and their criteria are illustrated in Table 5.5.

Table 5.5. Mean values and the standard deviations for the categories of the planning dimension and their criteria.

Category	Criteria	Mean	Standard Deviation
Land Use		4.7714	0.42604
	Distribution of land use	4.6857	0.52979
	Residential schemes	4.4000	0.60391
	Public services	4.4000	0.55307
	Open spaces / park	4.5143	0.65849
	Effective use of land	4.5429	0.56061
	Land ownership	4.4571	0.65722
Infrastructure		4.6571	0.48159
	Green infrastructure	4.3143	0.75815
	Infrastructure efficiency	4.6286	0.49024
	Infrastructure management	4.6286	0.59832
Transport		4.5143	0.65849
	Consideration of traffic issues	4.5714	0.55761
	Public transportation	4.6286	0.54695
	Transport facilities	4.4286	0.65465
	Transport policies	4.5714	0.65465
Management		4.6000	0.60391
	Monitoring	4.4857	0.61220
	Control	4.4571	0.65722
	Operation	4.4412	0.66017
	Maintenance	4.4118	0.65679
	Governmental rules and regulations	4.3143	0.63113
	Planning policies and legislations	4.3714	0.64561

5.2.5. ICT Dimension.

Last but not least, participants placed emphasis on the importance of all the five categories of the Information and Communication Technology (ICT) dimension. They rated these categories based on the priority of each of them from their individual point of view. The Access to Services and Resources 24/7 category is considered as the most important one whereas the Technological and Institutional Aspects category is considered less important. However, all of the five categories are located within the range between very important and extremely important. Figure 5.6 shows the responses and rating average of the important level of the categories for ICT dimension based on the result from the final round.

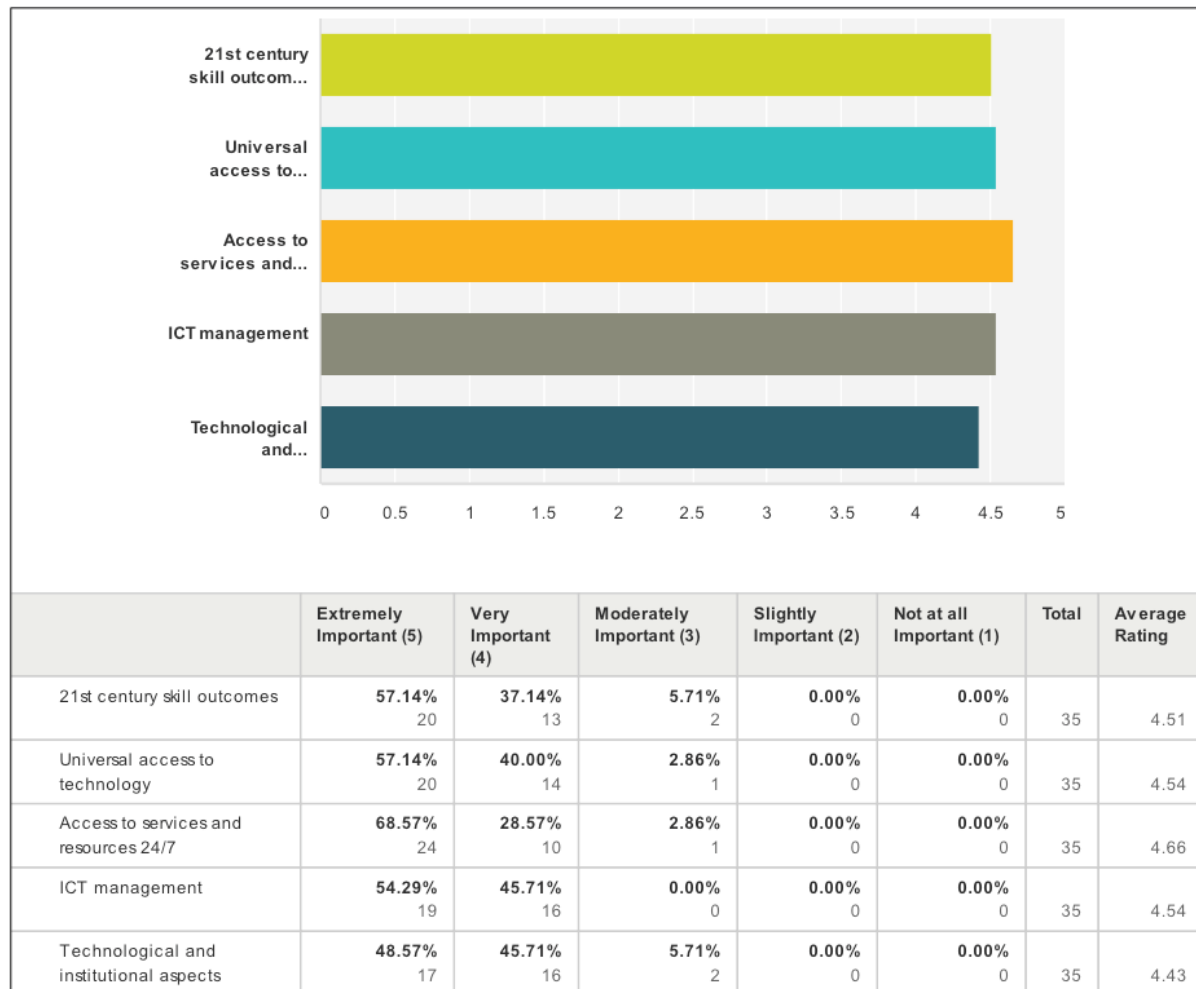


Figure 5.6 Responses and rating average of the important level of the categories for ICT dimension.

In this research, experts were asked to determine their opinion regarding the importance of ICT, and whether or not it should be added to the proposed framework. Experts have showed a movement towards a consensus and agreed that ICT should be considered within the framework. In this dimension, the focus was mainly on the categories rather than the criteria because of that fact the ICT approach has not been introduced clearly yet within Saudi Arabian cities including the City of Riyadh. However, as can be seen in Table 5.6 the mean values of the ICT categories are in the range of 4.43 and 4.66 with all of them located between very important and extremely important. The standard deviations for the categories are also less than 1 and in the range of 0.50 and 0.61.

Table 5.6. Mean values and the standard deviations for the categories of the ICT dimension.

Criteria	Mean	Standard Deviation
21st century skill outcomes	4.5143	0.61220
Universal access to technology	4.5429	0.56061
Access to services and resources 24/7	4.6571	0.53922
ICT management	4.5429	0.50543
Technological and institutional aspects	4.4286	0.60807

5.3. Discussion of the Main Findings

During the Delphi consultation process the experts indicated that the city of Riyadh has witnessed a significant growth in its urban development during the last few decades. There was a consensus among experts in regard to the fact that this growth was not built on traditional organic principles that reflected in the social and cultural values as well as the local identity of the city and its residents. For instance, regarding the heritage and cultural values, experts have confirmed that most of the structures and buildings that were constructed before 1950, and considered as important historical landmarks, have been abandoned and deserted as result of urbanisation. They indicated that the most indicative example of this deterioration was the demolition of the initial central area of the city of Riyadh in the mid 1970s.

The Delphi panel points out that local authorities have attempted to manage the remarkable development of Riyadh through schemes such as Doxiadis and SCET, which were not suitable and compatible within the local context of the city. Therefore, these imported urban planning schemes have negatively influenced the development process of the city of Riyadh. The consequences of these negative influences have already appeared, one of the most obvious examples being the apparent variance between the proposed strategies of the urban planning and the current situation in the city.

The panel argues that the process of urban development during the last few decades has been followed with minimal understanding and recognition of social, economic and environmental issues. Experts also point out that although the Ministry of Municipal and Rural Affairs (MEDSTAR) developed urban boundaries for the city of Riyadh to manage and control the growth of the city, subdivisions continue to expand under the influence of various factors, including landowners projects and ambitions and the absence of required decisions from the

relevant authorities. Furthermore, the MEDSTAR scheme does not provide a long-term integrated approach for sustainable growth.

During the Delphi process, experts emphasise that sustainable development issues have raised increasingly important concerns that must be considered in the urban planning process for modern cities such as the city of Riyadh. Consequently, in order to achieve an effective sustainable urban planning, there are a number of core issues that are critically important to understand, realise and take into account. These issues include the historical development of the city, limitations of previous plans, society characteristics and the local context. They point out that the understanding of these different issues will encourage the citizens to understand the cultural values of communities and cities in addition to the importance of the concept of “place”.

Most of the results and findings reached through the use of Delphi technique have emphasised the need for the proposed framework due to the existence of many issues, obstacles and challenges, which must be dealt with and managed in an informed and integrated way. Therefore, the significance of having such an effective sustainable urban planning framework has emerged as a critical issue. This research work argues that such a framework would deliver substantial benefits to communities despite potential difficulties and obstacles. Throughout the Delphi consultation process, experts were asked to express their opinions on the proposed framework and as a result a number of changes have been introduced. For instance, new criteria have been recommended by experts to be included within the proposed framework such as governmental rules, regulations and legislations. Furthermore, some of the categories and criteria were consolidated with each other.

Figure 5.7 illustrates the proposed framework after it has been updated based on the results obtained through the Delphi consultation process. At the end of this discussion, this study concludes that the experts have reached a consensus regarding the contents of the proposed framework of the sustainable urban planning for the city of Riyadh, and emphasised the significance of such a framework being implemented in the city. They confirm that the implementation of such framework will help to guide the growth of the city of Riyadh sustainably.



Figure 5.7. The proposed framework for sustainable urban planning based on the results of Delphi Technique.

5.4. Summary

The purpose of the chapter was to provide a comprehensive review of one of the most significant tools that is used in many academic works at the present time, the Delphi technique. The main aim of this technique was to obtain expert opinions regarding the applicability and usefulness of the proposed framework for sustainable urban planning designed for the city of Riyadh during this research. Also, it aimed to evaluate the feasibility of this framework in terms of clarity and adequacy in addition to ensuring that the framework was reasonably solid.

In this study, the Delphi technique was employed to obtain expert opinions in respect of the proposed framework in order to answer the main research question: can the urban planning of the city of Riyadh be managed sustainably through an adapted sustainable urban planning framework? The Delphi panel has reached a consensus on the applicability and suitability of

the proposed framework, as well as its categories and criteria, for developing a sustainable urban planning for the city of Riyadh. It is recommended by experts that the five dimensions should be taken into account equally on the same level of the importance in order to achieve sustainability for the city of Riyadh. The average ratings of the dimensions are located within the range between very important and extremely important, which means that there is a high level of consensus among experts.

CHAPTER SIX: APPLICATION OF ANALYTIC HIERARCHY PROCESS (AHP): DATA ANALYSIS RESULTS

6.1. Introduction

In this research, the Analytic Hierarchy Process (AHP) is followed in order to achieve a number of key objectives of this study. One of the most important ones is the establishment of a weighting system for the proposed framework of sustainable urban planning for the city of Riyadh, through the use of the AHP technique that involves a follow on consultation with the experts. This system aims to give weight to each dimension and category of the proposed framework by the use of analytical functions of Expert Choice software, which simplifies the implementation of the steps of AHP.

Therefore, the primary aim of this chapter is to illustrate how the AHP can be applied to the proposed framework. The chapter begins with applying AHP to the proposed framework of sustainable urban planning, which will be mainly built, based on the results that will be obtained from the Delphi technique stage. Then, this chapter will end with a general discussion of the main results that have been obtained during the AHP.

6.2. Applying the AHP to the Proposed Framework of SUP for Riyadh

In this research, Analytic Hierarchy Process (AHP) is employed to evaluate the different dimensions and categories that form the proposed framework of sustainable urban planning for the city of Riyadh. It aims to establish a weighting system for the proposed framework by giving a weight to each dimension and category based on a follow on consultation with the experts and use of the analytical functions of Expert Choice software, which simplifies the implementation of the steps of AHP.

Keeping in mind the four main steps of the AHP mentioned previously in Chapter Three, this research firstly has defined the decision problem and has identified the main goal, which is the evaluation of a new framework for sustainable urban planning for the city of Riyadh. This is followed by structuring the decision hierarchy into three main levels: the top level with the goal of the decision, the intermediate level with the dimensions of the proposed framework, and the lowest level with the list of the categories of each dimension. These levels are illustrated in Figure 6.1.

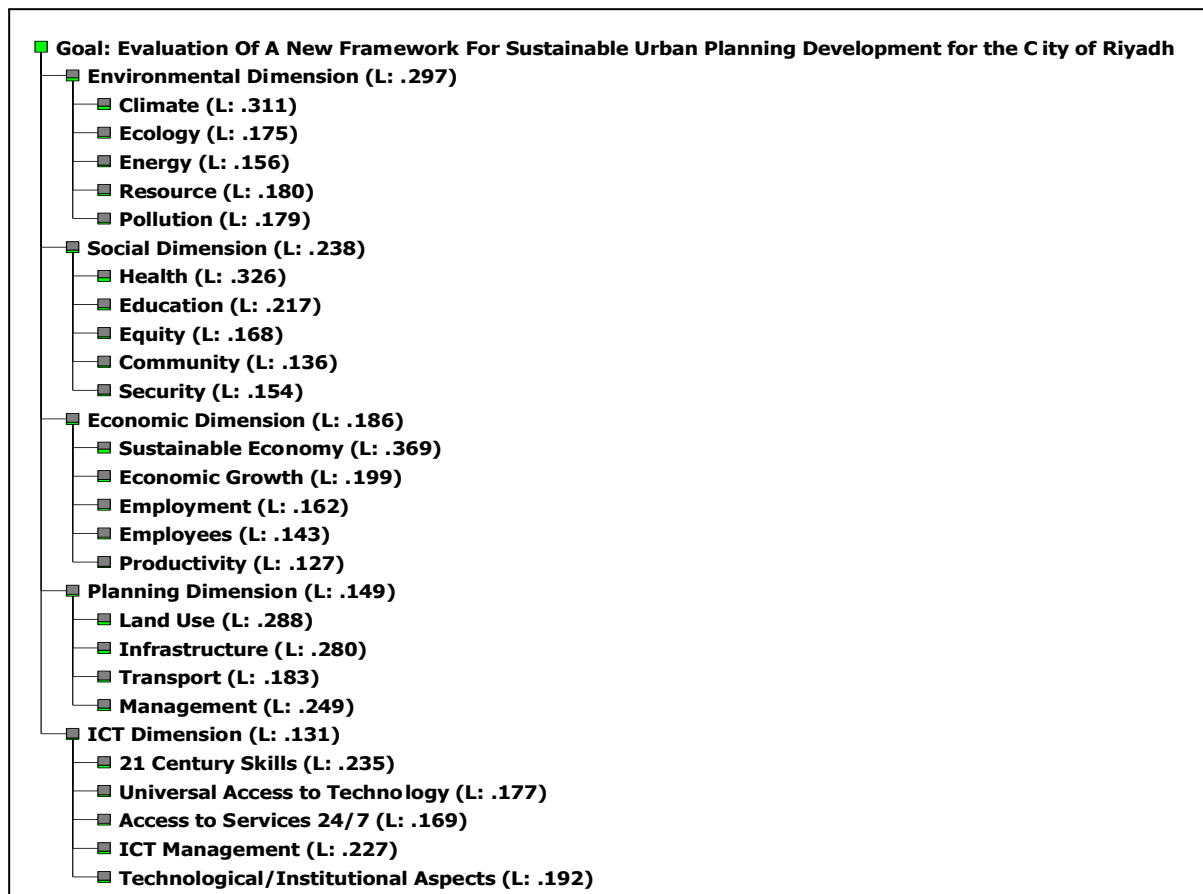


Figure 6. 1. Expert Choice hierarchy showing the three levels of the AHP process in this study.

Of the 20 experts initially involved in this study, 17 agreed to participate in the AHP process, but in the end 14 experts completed the questionnaire. A questionnaire technique is followed in this stage as it is considered as one of the most widely used techniques for collecting data that is easy to deliver and simple to use in addition to its wide acceptance by most experts. As part of this process, a pilot study has been conducted before sending the questionnaire to the experts in order to ensure that the questionnaire is appropriate for its aim. Furthermore, in this stage all the data analysis has been completed through the use of analytical functions of Expert Choice software.

The process of the AHP was divided into six main parts. The first part aims to compare the five dimensions of the proposed framework with each other, in order to determine the priority and the weight for each dimension. In this part, the experts were asked to compare and indicate the intensity of the importance of each dimension in respect to others based on the 9-point Saaty scale, as can be seen in Figure 6.2.

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)	Extremely More Important (9)	
Environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Society
Environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Economy
Environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Planning
Environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	ICT
Society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Economy
Society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Planning
Society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	ICT
Economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Planning
Economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	ICT
Planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	ICT

(2, 4, 6, 8 = Intermediate Values)

Figure 6. 2. Comparison of the five dimensions based on the 9-point Saaty scale.

The second part of the questionnaire compares the main categories of the social dimension based on the opinion of the selected experts. Experts were also asked to compare the main categories of the economic dimension with each other in the third part. The fourth part of the questionnaire aims to compare the main categories of the planning dimension. The fifth part compares the main categories of environmental dimension, and finally the sixth part will compare the main categories of the ICT dimension. All the six main comparisons will be based on the 9-point Saaty scale, as can be seen in examples in figure 6.3 and 6.4, and a copy of the questionnaire, which was followed in this research work, is shown in Appendix G.

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)	Extremely More Important (9)	
Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Education
Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Equity
Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Community
Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Security
Education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Equity
Education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Community
Education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Security
Equity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Community
Equity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Security
Community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Security

(2, 4, 6, 8 = Intermediate Values)

Figure 6.3. Comparison of the main categories of the social dimension based on the 9-point Saaty scale.

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)	Extremely More Important (9)	
Climate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Ecology
Climate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Energy
Climate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Resource
Climate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Pollution
Ecology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Energy
Ecology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Resource
Ecology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Pollution
Energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Resource
Energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Pollution
Resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Pollution

(2, 4, 6, 8 = Intermediate Values)

Figure 6.4. Comparison of the main categories of the environmental dimension based on the 9-point Saaty scale.

6.3. Discussion of the Main Findings of the AHP Process

In this practical stage, all the data and information obtained from the questionnaire have been analysed using the analytic functions of the Expert Choice software, which includes a combination of graphical tools that complement the numerical computations. According to Sloane et al., (2003), the different functions of the Expert Choice software are found very beneficial for presenting the proportional weight for different components in a research. Expert Choice software allows different sensitivity analysis in addition to using the consistency ratio (Ishizaka and Labib, 2009). It can be used for synthesising the pairwise comparison matrix; determining the priority for each element; calculating the consistency ratio; and evaluating the consistency of the pairwise comparison matrix to examine whether the decision-maker's comparisons were consistent or not (Al-Harbi, 2001).

As mentioned previously in Chapter Three, setting of the pairwise comparison matrices in this study aims to determine the relative importance of the components and preferences among the alternatives by making pairwise comparisons using Saaty a nine-point scale system, which has been used widely as a standard rating system used for the applications of the AHP (Saaty, 2000, Zhang et al., 2012). This scale ranging from 1, which means that the two selection options are equally important, to 9 which means that one selection option is extremely important over the other. According to Eakin and Tapia (2008) “the pairwise comparison matrices are reciprocal, so for matrix $A = [a_{ij}]$, each entry $a_{ij} = 1/a_{ji}$ and thus the number of necessary pairwise comparisons is $n(n-1)/2$ ” as shown in the following pairwise comparison matrices:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & & & \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$

Wong and Li (2008) point out that “to generate judgment matrix two elements need to be selected each time, and a_{ij} indicate the ratio of comparative importance, and all the comparison results are indicated by A , which is the judgment matrix”. In AHP application, the consistency ratio **CR** is usually used. Zhang et al. (2012) have described the relationship between the consistency ratio **CR**, the consistency index **CI**, and the correction freedom index **RI** in the following equation:

$$CR = CI/RI \quad CI = \frac{\varepsilon_{\max} - m}{m - 1}$$

CR = consistency ratio

CI = consistency index

RI = correction freedom index

m = judgment matrix order

ε_{\max} = maximum characteristic value of judgment matrix

“When **CR** increases, the matrix consistency decreases, and vice versa. When **$\varepsilon_{\max} = n$** , **CR** = **0**, the matrix is in complete consistency; usually when **$CR \leq 0.1$** , the matrix is qualified by consistency test, otherwise, comparison should be made once more, till a final qualified test is obtained” (Zhang et al., 2012).

The discussion of the main findings of the AHP process will be mainly built based on the experts responses with respect to the six main parts of the questionnaire that have been referenced previously. At the beginning of the questionnaire the experts were asked to compare the five dimensions of the proposed framework of sustainable urban planning for the city of Riyadh with each other, which are environmental, social, economic, planning and ICT dimension. This comparison has been carried out through establishing the pairwise comparison matrix that is provided by the Expert Choice software. Figure 6.5 presents the pairwise comparison matrix of the five dimensions of the proposed framework.

Environmental Dimension

98765432 | 23456789

Economic Dimension

Compare the relative importance with respect to: Goal: Evaluation Of A New Framework For Sustainable Urban Planning Development for the City of Riyadh

	Environmental Dimension	Social Dimension	Economic Dimension	Planning Dimension	ICT Dimension
Environmental Dimension		1.31853	1.66851	1.86468	2.18791
Social Dimension			1.3459	1.70315	1.70315
Economic Dimension				1.28089	1.54258
Planning Dimension					1.16013
ICT Dimension		Incon: 0.00			

Figure 6.5. Pairwise comparison matrix of the five dimensions of the proposed framework with respect to the goal.

In respect to the results of the pairwise comparison of the five dimensions and by using the Expert Choice software to calculate the weightings of the dimensions, the environmental dimension ranked as the most important dimension and represents about 29.7% of the total weight, followed by the social dimension with about 23.8%. Economic dimension represents 18.8%, and then planning dimension with 14.9%, and finally the ICT dimension with 13.1% of the total weight. The weightings of the five dimensions are illustrated in Figure 6.6.

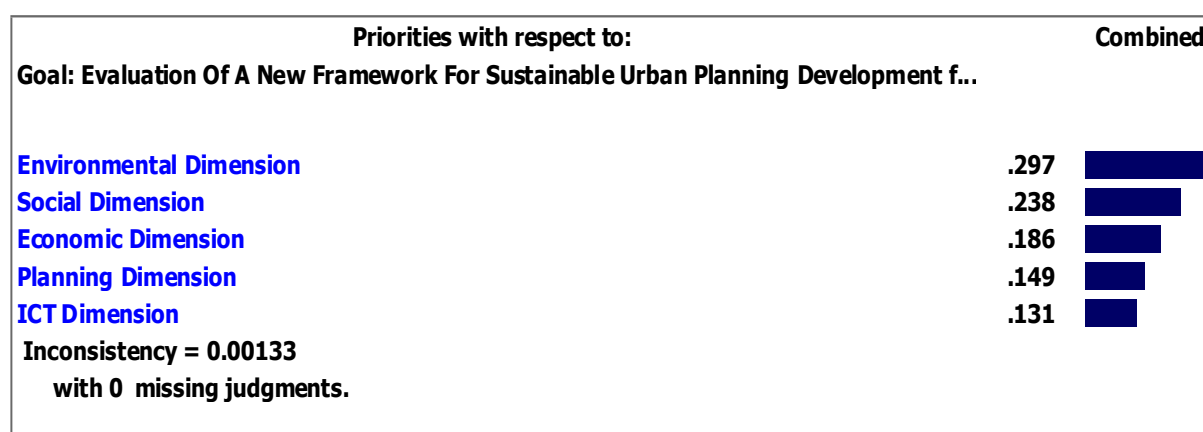


Figure 6.6. Priorities of the dimensions of the proposed framework with respect to the goal.

In the second part of the questionnaire, the experts were asked to compare the main categories of the environmental dimension with each other, which are climate, resource, pollution, ecology, and energy. Figure 6.7 presents the pairwise comparison matrix of these main categories of the environmental dimension. Results of the pairwise comparison of the categories of environmental dimension show that the climate category ranked as the most important category and represents about 31.1% of the total weight, followed by the resource and pollution with 18% and 17.9% respectively. However, the weightings of all the categories of environmental dimension are illustrated in Figure 6.8.

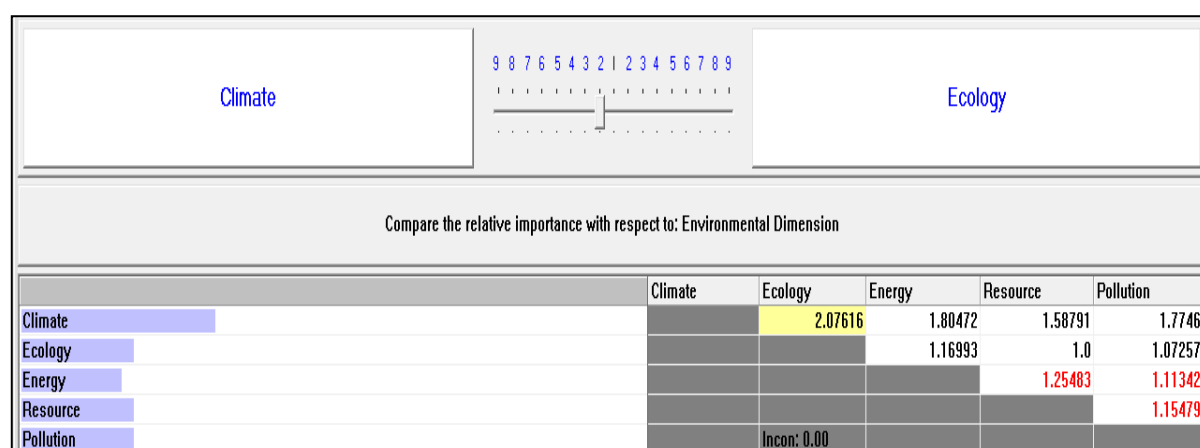


Figure 6.7. Pairwise comparison matrix of the main categories of the environmental dimension.

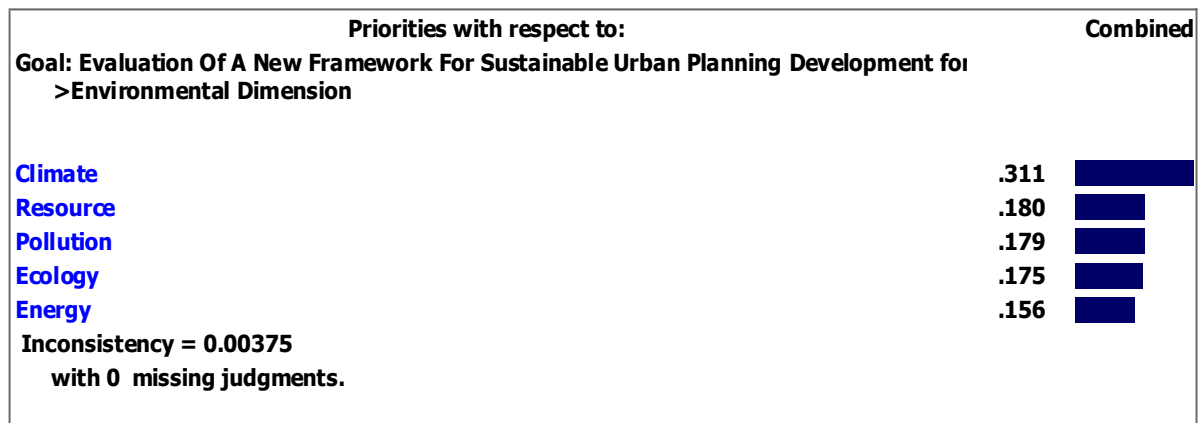


Figure 6.8. Priorities of the main categories of the environmental dimension.

In the third part of the questionnaire, the experts were asked to compare the categories of the social dimension with each other in order to determine the priorities of these categories, which are health, education, equity, security, and community. Figure 6.9 shows the pairwise comparison matrix of these categories. Regarding the results of this part, the health category ranked as the most important category and represents about 32.6% of the total weight. The weightings of the main categories of social dimension can be seen in Figure 6.10.

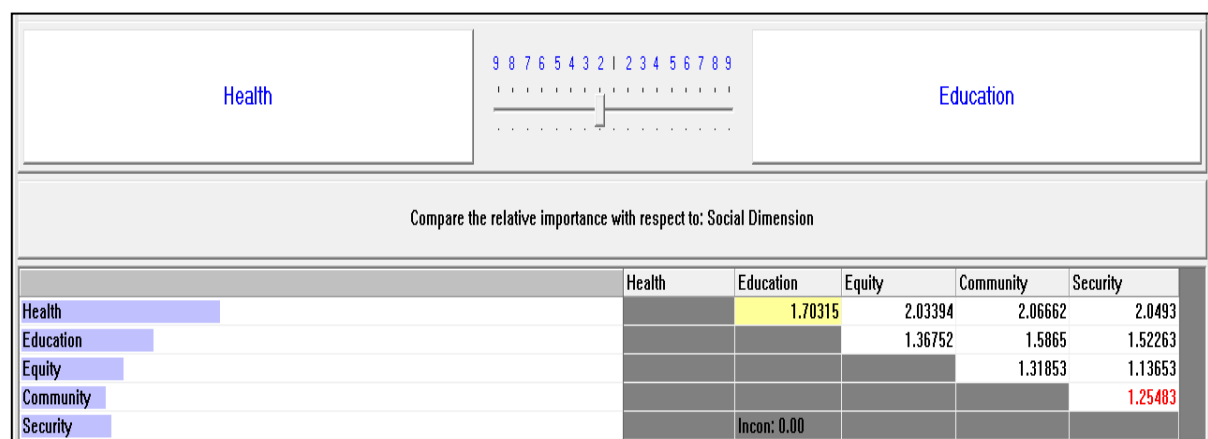


Figure 6.9. Pairwise comparison matrix of the main categories of the social dimension.

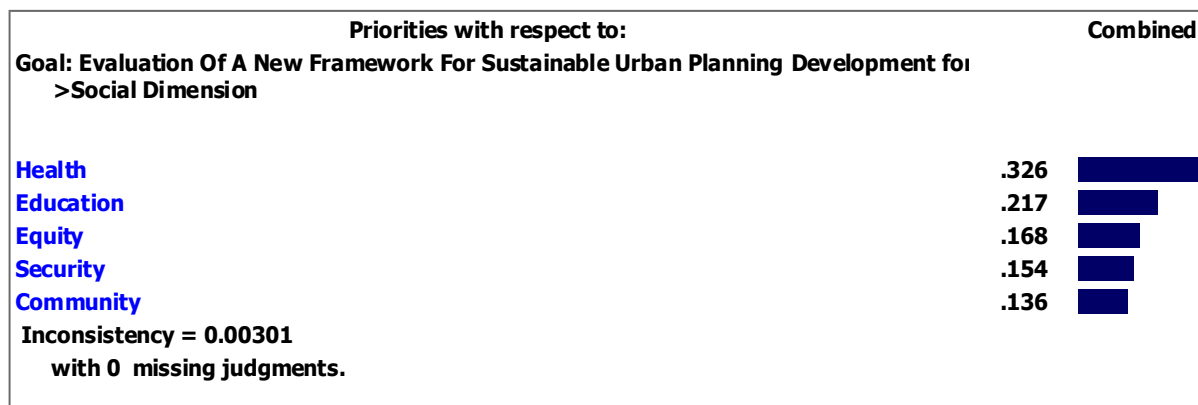


Figure 6.10. Priorities of the main categories of the social dimension.

During the fourth part of questionnaire the experts have been asked by the researcher to compare the main categories of the economic dimension with each other, which are sustainable economy, economic growth, employment, employees, and productivity. Figure 6.11 shows the pairwise comparison matrix of the main categories of the economic dimension.

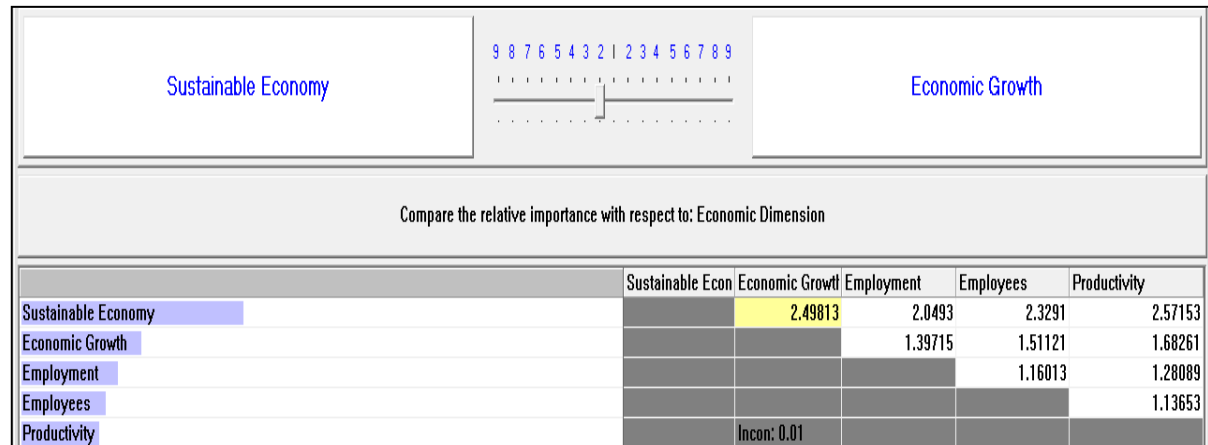


Figure 6.11. Pairwise comparison matrix of the main categories of the economic dimension.

In respect to the results of the pairwise comparison of the main categories of the economic dimension, and by employing the Expert Choice software to determine the weightings of these categories, sustainable economy category has been ranked as the most important category and represents about 36.9% of the total weight, followed by the economic growth category with 19.9%. Employment category represents 16.2%, and then employee's category with 14.3%, and finally the productivity category with 12.7% of the total weight. The weightings of these categories are illustrated in Figure 6.12.

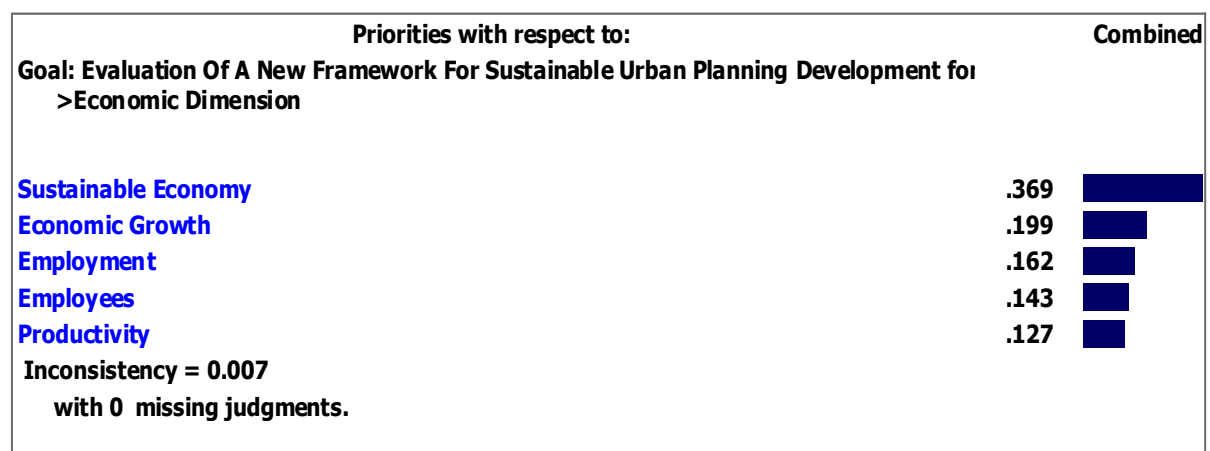


Figure 6. 12. Priorities of the main categories of the economic dimension.

The fifth part of the questionnaire aims to determine the priorities of the main categories of the planning dimensions. Therefore, experts were asked to compare these categories with each other, which are land use, infrastructure, management, and transport. The main aim of this comparison is to determine the weight for each category, which will be calculated based on the use of the pairwise comparison matrix that can be seen in Figure 6.13.

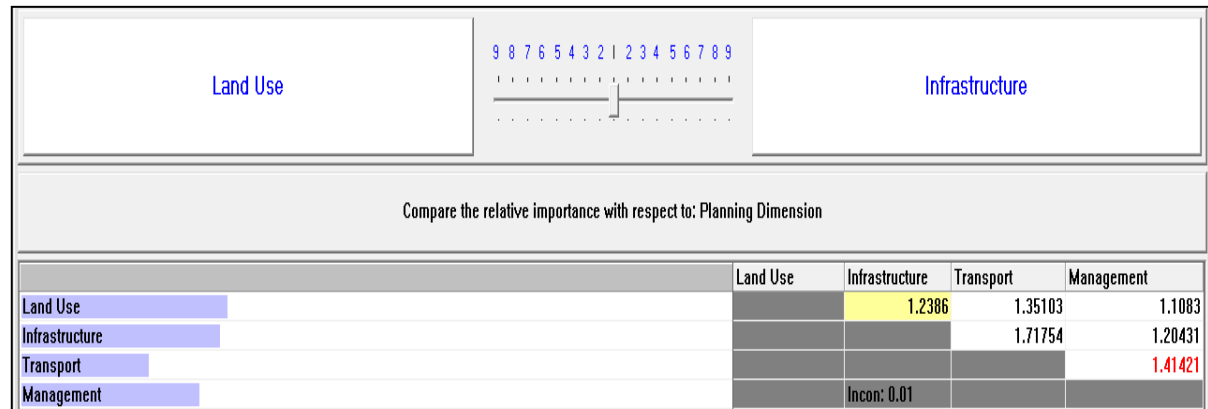


Figure 6.13. Pairwise comparison matrix of the main categories of the planning dimension.

Regarding the results of the pairwise comparison of the main categories of the planning dimension, land use category ranked as the most important category and represents about 28.8% of the total weight, and then it is followed immediately by the infrastructure category with 28%. Management category represents 24.9%, where the transport category represents with 18.3%, of the total weight of the planning dimension. The weightings of these categories are illustrated in Figure 6.14.

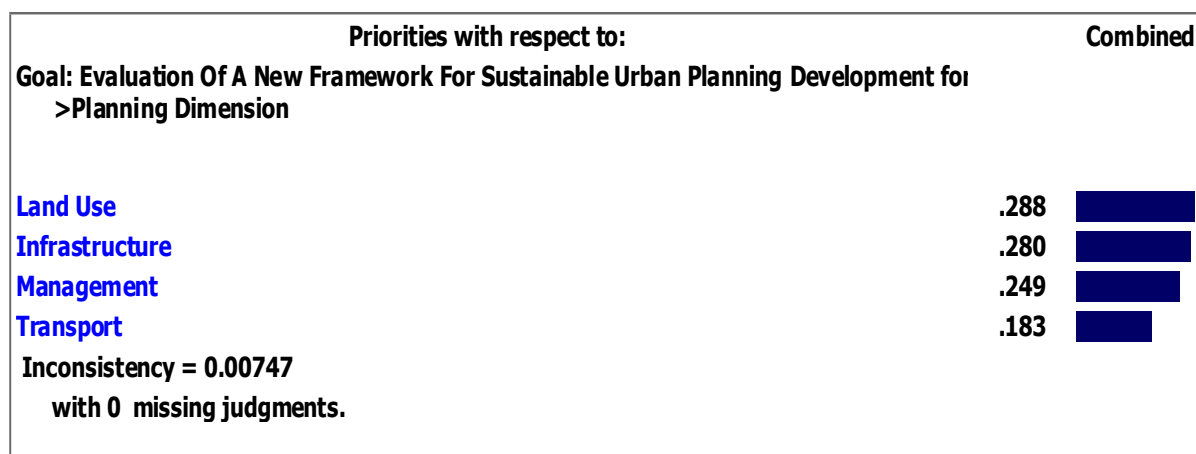


Figure 6. 14. Priorities of the main categories of the planning dimension.

Throughout the last part of the questionnaire, the sixth part, the experts were asked to compare the main categories of the ICT dimension with each other in order to determine the priority for each category. These main categories are the 21st century skills outcomes; ICT management, technological and institutional aspects; universal access to technology; and finally, the access to services and resources 24/7 category. This comparison has been done through the pairwise comparison matrix using the Expert Choice software, which is presented in Figure 6.15.

21 Century Skills	9 8 7 6 5 4 3 2 2 3 4 5 6 7 8 9	Universal Access to Technology			
Compare the relative importance with respect to: ICT Dimension					
	21 Century Skills	Universal Acces:	Access to Service	ICT Management	Technological/
21 Century Skills		1.33971	1.49855	1.12701	1.31853
Universal Access to Technology			1.05076	1.3459	1.02939
Access to Services 24/7				1.28089	1.08163
ICT Management					1.0
Technological/Institutional Aspects		Incon: 0.00			

Figure 6.15. Pairwise comparison matrix of the main categories of the ICT dimension.

In respect to the results of the pairwise comparison of the main categories of the ICT dimension, the category of the 21st century skills outcomes has been ranked by the experts as the most important category and represents about 23.5% of the total weight of ICT dimension. The weightings of the main categories are illustrated in Figure 6.16.

Priorities with respect to:		Combined
Goal: Evaluation Of A New Framework For Sustainable Urban Planning Development for >ICT Dimension		
21 Century Skills	.235	
ICT Management	.227	
Technological/Institutional Aspects	.192	
Universal Access to Technology	.177	
Access to Services 24/7	.169	
Inconsistency = 0.00328 with 0 missing judgments.		

Figure 6.16. Priorities of the main categories of the ICT dimension.

In addition to the pairwise comparison matrices aimed at determining the weightings and priorities of the main dimensions and categories, the analytical functions of the Expert Choice software has the ability to synthesise these matrices and determine the weighting and priority for each category with respect to the overall weighting of the proposed framework. Figure 6.17 presents the weightings of all the main categories forming the proposed framework of sustainable urban planning for the city of Riyadh.

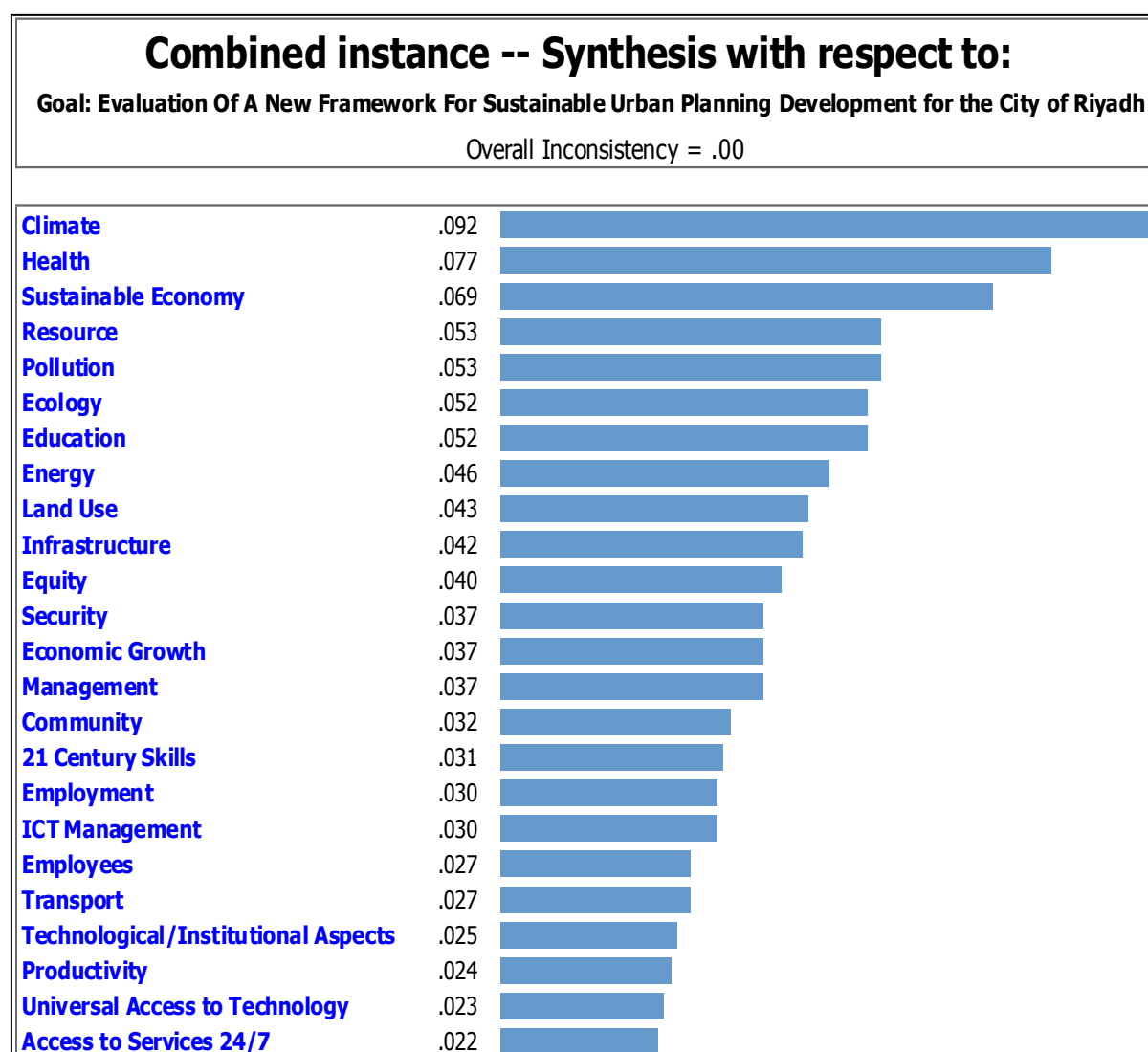


Figure 6.17. The overall weightings and priorities of all the main categories of the proposed framework for sustainable urban planning for the City of Riyadh.

Most of the results and findings reached through the use of the Analytic Hierarchy Process (AHP) approach and the application of Expert Choice software have emphasised the significance of the main dimensions and categories of the proposed framework. During this stage, experts were asked to express their opinions in respect to the importance of every

single component with respect to other components in order to determine the weightings and priorities of different dimensions and categories included within this framework. The findings of this process confirm that the experts show a movement toward convergence and consensus regarding the value of the proposed framework. This agreement can be justified based on the achievement of an acceptable value of the consistency ratio (CR) of the pairwise comparisons made by the experts. A number of studies (e.g. Saaty, 1994, Cheng and Li, 2002, Ishizaka and Labib, 2009) point out that the consistency ratio (CR) is used to calculate and determine the inconsistency in the pairwise comparison that is made by the respondents.

These studies have set the acceptable CR values for different matrices sizes, for instance, for a 3x3 matrix the CR value is 0.05, for a 4x4 matrix the CR value is 0.08, and finally for the larger matrices the CR value is 0.10. If the value of CR is lower than the acceptable value, this means that the weight results are consistent and valid. On the other hand, if the value of CR is larger than the acceptable value, the results are inconsistent and require further analysis. In this research work, the consistency ratio (CR) values of the pairwise comparison matrices are lower than the acceptable value, which is 0.10, and are in the range of 0.00133 and 0.00747. This means that the weight results, which have been obtained in this research, are consistent and valid.

Furthermore, in order to ensure that the use of AHP process and the application of Expert Choice software have been carried out in a proper and accurate manner, the results and finding have been sent to the assistance team in Expert Choice, Inc., who confirmed that the steps of the Expert Choice software have been followed appropriately by the researcher and the project has been built correctly. The overall weightings of the proposed framework of sustainable urban planning for the city of Riyadh are illustrated in Figure 6.18. This weighting system of different dimensions and categories of the proposed framework were mainly built based on the results obtained through the application of the Analytic Hierarchy Process (AHP) and the use of Expert Choice software.

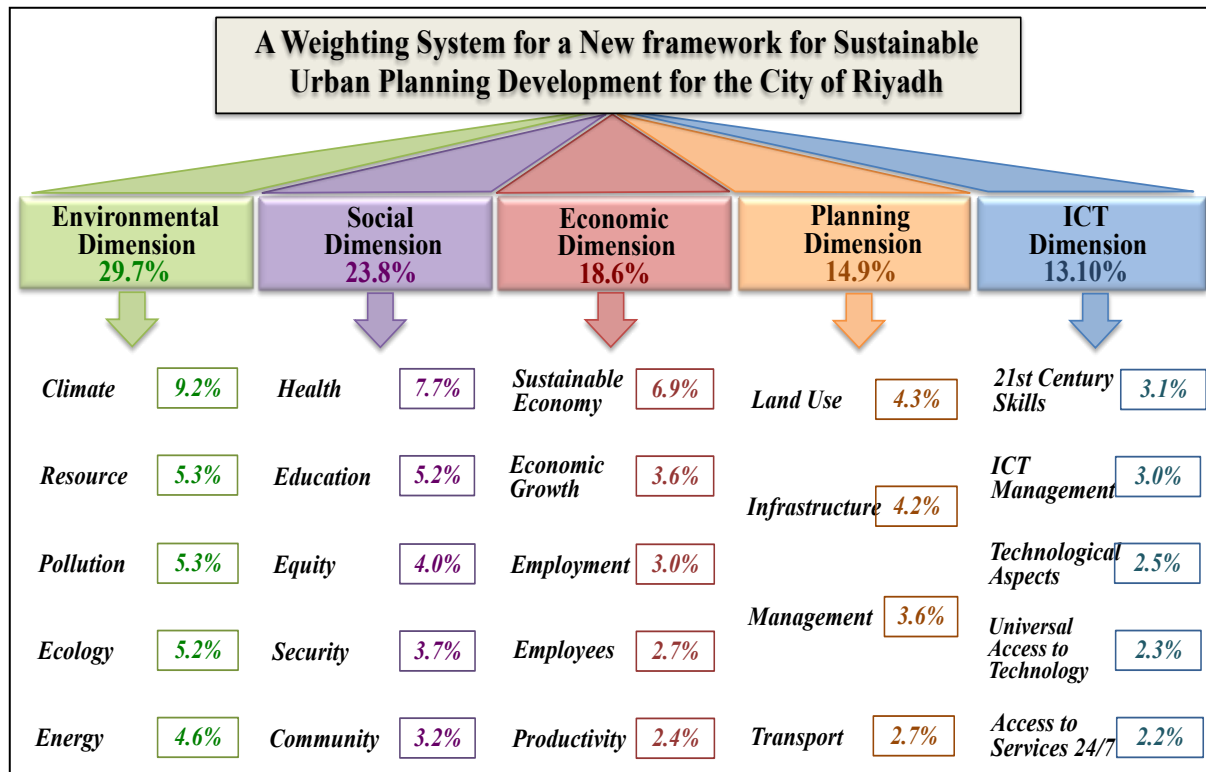


Figure 6.18. The weighting system of the proposed framework of sustainable urban planning for the City of Riyadh.

6.4. Summary

The fundamental aim of this chapter was to give a comprehensive picture about one of the most important tools that has been widely used in many research works for analysing complex alternative decision problems with multiple criteria, which is the Analytic Hierarchy Process (AHP). The application of this process aimed to establish a weighting system for the proposed framework of sustainable urban planning for the city of Riyadh, by the use of AHP technique that involves a follow on consultation with the experts and the Expert Choice software in order to give the weight to each dimension and category of the proposed framework.

During this chapter, the current concepts and main features of the AHP have been discussed. The justifications for the choice of the AHP application were also highlighted. One of the most important reasons behind the use of the AHP is the ability of such application to structure different judgements and insights into a clear hierarchic structure. The chapter has discussed the main four steps of the AHP process, which are: define the decision problem and the goal; structure the decision hierarchy; create a set of pairwise comparison matrices; and finally, the setting of the priorities based on the results.

In this part of the thesis, there have been several investigations made to reach the actual weights for the main dimensions and categories of the proposed framework through the use of the Expert Choice software, and based on the data that have been obtained from the experts. Most of the results and findings reached through the use of AHP process have emphasised the significance of the proposed framework for the city of Riyadh.

During the AHP process, experts were asked to compare the different dimensions and categories of the proposed framework with each other in order to determine the weight and priority for each one. In this chapter, the consistency and validity of the findings and results have been confirmed based on the consistency ratio (CR), provided by the Expert Choice software. The applicability of the proposed framework of sustainable urban planning for the city of Riyadh will be investigated within the next chapter.

CHAPTER SEVEN: TESTING THE FRAMEWORK FOR SUSTAINABLE URBAN PLANNING ON THREE NEIGHBOURHOODS IN CITY OF RIYADH

7.1. Introduction

As stated in Chapter One, the main research objective of this thesis is to develop an effective sustainable urban planning framework for the city of Riyadh. This has been covered and discussed in more detail during the previous chapters. Therefore, the purpose of this chapter is to demonstrate its practical application and to check the applicability of the proposed framework to the city of Riyadh. The chapter provides an explanation of the testing procedures that were followed during this research.

This includes the development of a new scoring and rating system to examine the current situation of the city of Riyadh based on the principles and contents of the proposed framework of sustainable urban planning. Moreover, this chapter will present some of the selected areas within the city of Riyadh that were assessed and examined based on the principles of the proposed framework in order to obtain the rating level of the urban planning compared to the contents of the framework. In other words, it aims to find out how much of these principles have been already achieved in the city of Riyadh.

7.2. Testing the Proposed Framework for SUP

The selection of the appropriate technique to be used for testing a framework mainly depends on the type of framework and the real world aspect being analysed (Gass, 1983). The constructed framework of this research work is tested through a number of phases in order to ensure that the proposed framework is reasonably solid and will be considered acceptable. Most of the results and findings reached through the use of Delphi technique have emphasised the need for such framework due to the existence of many issues, obstacles and challenges that need to be dealt with and managed in an informed and integrated way.

Therefore, the importance of having such an effective sustainable urban planning framework has emerged as a critical issue. During the Delphi process, experts were asked to express their opinions in respect to the proposed framework for the city of Riyadh and to what extent such framework can fit within the local context of the area. As can be seen in Figure 7.1, experts have reached a consensus regarding the contents of the proposed framework and emphasised

the significance of such a framework being realised in the city of Riyadh. They confirmed that the application and operation of such framework will help guide the city to a more sustainable future. This consensus without doubt has emphasised the validity of such framework.

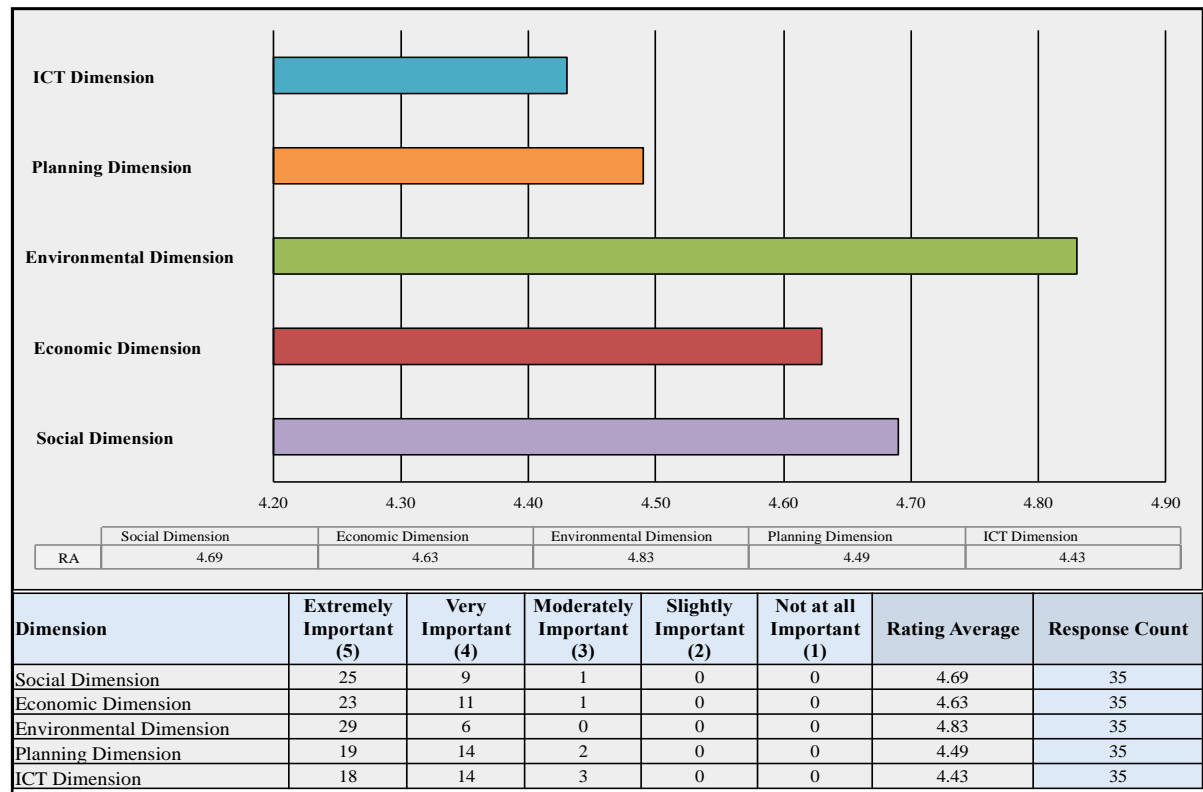


Figure 7.1. Experts opinions regarding the importance of the proposed framework dimensions based on the result from the final round of Delphi technique.

However, in order to build solid confidence regarding the applicability of the proposed framework, this research needs to carry out tests for the proposed framework. This was accomplished through evaluating the framework based on the real local context of the city of Riyadh. For this purpose, specific areas within the city of Riyadh were selected and then were evaluated and examined through the principles of the proposed framework.

In order to achieve that, this research has developed a new scoring and rating system, which was mainly based on the results and weighting system obtained through the application of the Analytic Hierarchy Process (AHP). After this new scoring and rating system was established, a full testing of the proposed framework was carried out on a part of the city. The following sections describe the detailed procedure of the testing process, which includes the development of scoring and rating system and the selection of specific areas within the city.

7.3. Scoring and Rating System of the Proposed Framework

This section of the thesis explains how the rating of the proposed framework of sustainable urban planning is calculated, in order to apply it to the city of Riyadh. There are a number of elements that determine the rating of this framework; these are as follows:

- Sustainable Urban Planning Framework (SUPF) rating benchmarks.
- SUPF weightings based on the results of AHP.
- SUPF available credits for each dimension, category and criterion.
- SUPF achieved credits for each dimension, category and criterion.

Each of these elements will be described in more details in the following sub-sections. This is followed by guidance describing how a SUPF rating is calculated. Moreover, there is a section explaining the conditions and requirements that need to be met in order to award the available credits.

7.3.1. SUPF Rating Benchmarks

The rating benchmarks for the SUPF are outlined in Table 7.1, which shows the rating and the score for each level that can be achieved based on the proposed framework for sustainable urban planning. This rating benchmarks system was based on the review of well-known frameworks for city sustainable development (BREEAM for Communities, CASBEE for Urban Development and LEED for Neighbourhood Development).

Table 7.1. Rating benchmark for the proposed framework for SUPF.

CLASSIFICATION (RATING)	% SCORE
UNCLASSIFIED	<30
PASS	≥30
GOOD	≥45
VERY GOOD	≥55
EXCELLENT	≥70
OUTSTANDING	≥85

In this research, it is argued that the communities and cities cannot achieve a sustainable level of development without addressing the minimum standard of the proposed framework of sustainable urban planning. In other words, cities and communities need to achieve more than 30% of the total score of the sustainable urban planning framework in order to achieve a Pass rating.

7.3.2. SUPF Weightings

The score of the proposed framework was determined based on the weightings of the dimensions and categories of the framework obtained through the application of the AHP. Table 7.2 outlines the weightings for each dimension and category of the sustainable urban planning framework based on the results of the AHP. It illustrates the most important dimension of these five dimensions, the environmental dimension, additionally referencing the least important, which is the ICT dimension.

Table 7.2. Weightings of dimensions and categories of SUPF based on the application of AHP.

Dimension	Dimension Weight (%)	Category	Category Weight (%)
Environmental Dimension	29.6%	Climate	9.2
		Resource	5.3
		Pollution	5.3
		Ecology	5.2
		Energy	4.6
Social Dimension	23.8%	Health	7.7
		Education	5.2
		Equity	4.0
		Security	3.7
		Community	3.2
Economic Dimension	18.6%	Sustainable Economy	6.9
		Economic Growth	3.7
		Employment	3.0
		Employees	2.7
		Productivity	2.4
Planning Dimension	14.9%	Land Use	4.3
		Infrastructure	4.2
		Management	3.6
		Transport	2.7
ICT Dimension	13.1%	21st Century skills Outcomes	3.1
		ICT management	3.0
		Technological & institutional aspects	2.5
		Universal Access to Technology	2.3
		Access to services and resources 24/7	2.2
Total	100%	Total	100%

7.3.3. SUPF Available Credits

As a result of the revision of sustainable cities frameworks, such as BREEAM for communities, this research has used a systematic approach for calculating the available credits. The available credits will be divided based on a number of criteria in each category that have been agreed by experts through the Delphi technique. Each criterion within the proposed framework will be equal to one credit due to the difficulty to assess every single criterion included within the proposed framework and because of the fact that not every criterion can be measured on the ground accurately. In other words, the number of available credits will be based on a number of criteria that compose the proposed framework. This means that the total number of available credits is 100 as can be seen in Table 7.3.

Table 7.3. The total number of the available credits for the SUPF.

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7.3.4. SUPF Achieved Credits

The process for calculating the achieved credits and the total SUPF rating depends on a number of key steps. These can be summarised in the following points:

- The available credits for each dimension will be calculated individually, the total number of credits awarded must be determined by the number of achieved credits in each category based on the number of criteria that have been achieved in accordance with the SUPF requirements.
- For each SUPF dimension the total score achieved will also be calculated separately. Firstly, the total score achieved for each category within the dimension will be calculated, and then the total scores for these categories will be added together to give the overall score achieved in the dimension.
- There are two methods of calculating the total category score achieved. The first is by dividing the credits achieved by the total credits available multiplied by the weighting, as shown by the following equation:

$$\frac{\text{Credits Achieved}}{\text{Credits Available}} \times \text{Weighting (\%)} = \text{The Total Category Score Achieved (\%)}$$

- The second method, which will be followed in this research, is to calculate the total category score achieved, by dividing the weighting by the number of criteria to determine the value of each criterion, and then adding the value of all the credits achieved (according to a number of criteria in a category) together to give the overall category score, as shown in the following equation:

$$\frac{\text{Category Weighting (\%)}}{\text{Number of Criteria}} = \text{Value of Each Criterion}$$

- Last but not least, the dimensions scores are added together to give the final SUPF score, and then the SUPF score can be compared with the benchmarks rating, which was highlighted previously in Table 7.1, in order to determine the SUPF rating, as is shown in Table 7.4.

Table 7.4. An example of SUPF score and rating calculation

SUPF Dimensions	Dimension Weight (%)	Dimension Score Achieved (%)
Environmental Dimension	29.6	15
Social Dimension	23.8	12.5
Economic Dimension	18.6	9.8
Planning Dimension	14.9	7.3
ICT Dimension	13.1	5.2
Final SUPF Score	49.8%	
SUPF Rating	GOOD	

However, in addition to these procedures and because of the difficulty of identifying the credits achieved, which resulted from the lack of availability of statistics and information on the current status of the neighbourhood, this research tended to use a five-point scale system for determining the credits achieved. This scaling system is divided as follows:

0.00 = No credit achieved

0.25 = Part of the credit is achieved with poor level of achievement

0.50 = Part of the credit is achieved with pass level of achievement

0.75 = Part of the credit is achieved with acceptable level of achievement

1.00 = One credit is achieved as result of implementing the criterion

7.4. Procedures of Testing Process for the Proposed Framework

The proposed framework of sustainable urban planning of the city of Riyadh is categorised into five dimensions: environmental, social, economic, planning and ICT. Therefore, this section is structured into five subsections in order to discuss each one of these identified dimensions in detail. It explains how the final score and rating of the proposed framework is calculated as can be seen in the following subsections.

7.4.1. Testing the Environmental Dimension

The environmental dimension focuses on a number of critical issues that are related to the environment such as the phenomenon of global warming, the importance of the reduction of emissions to the environment and the subjects of biodiversity and the ecosystem. It aims to reduce the impacts of the different aspects of a development on the environment, which have risen steadily as result of human activities and natural disasters as mentioned earlier in this research work.

In order to obtain the final score and rating of the environmental dimension, all the categories within the dimension need to be considered in terms of their credits achieved and the final scoring, as shown in Table 7.5. Therefore, these categories will be discussed in the following key points in order to explain the various steps of calculating the final score and rating of the environmental dimension of the proposed framework for sustainable urban planning.

Table 7.5. Calculation of the final score of the environmental dimension.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credits Achieved	Category Score Achieved (%)
Climate	9.2	Adapting to climate change	2.3		
		Reduce carbon emissions	2.3		
		Adapting to solar radiation	2.3		
		Flood risk assessment	2.3		
Resource	5.3	Resource recycling	1.06		
		Resource efficiency	1.06		
		Use of local resource	1.06		
		Use of renewable resource	1.06		
		Resource management	1.06		
Pollution	5.3	Pollution assessment	1.06		
		Reduce noise and waste pollution	1.06		
		Reduce water pollution	1.06		
		Pollution prevention	1.06		
		Air quality	1.06		
Ecology	5.2	Ecological assessment	1.04		
		Biodiversity and habitat protection	1.04		
		Flora and Fauna protection	1.04		
		Ecological appraisal	1.04		
		Ecological survey	1.04		
Energy	4.6	Passive design	1.15		
		Energy efficiency	1.15		
		Energy consumption	1.15		
		Energy management	1.15		
Total	29.6%		29.6%		
Final Score of the Environment Dimension					-

- **Climate**

The climate category aims to ensure that the development of the city has been planned and designed to reduce its impact on the microclimate and to be resilient to future climate changes (e.g. heavy rainfall and flooding). Also, the category aims to ensure that the development is appropriately adapted to the impacts of present and future climate change. This category includes four main criteria, each of which is equivalent to one credit, which are explained in the following key points:

- Credit for evidence provided demonstrating that the developers have taken into their account the different climate issues.
- Credit for evidence provided indicating that the development will contribute to

the reduction of carbon emissions (e.g. increase the number of green areas or the use of renewable energy).

- Credit for evidence provided showing that the development adapts with the solar radiation.
- Credit for evidence provided showing that the flood risk assessment has been carried out.

- **Resource**

The resource category aims to address the different concerns in regard to the sustainable use of resources. This includes the use of local resource and the renewable energy. It has five fundamental criteria, each of which is equivalent to one credit, explained in the following key points:

- Credit for the potential applications for the reuse and recycling of resources.
- Credit for evidence provided indicating that the developer has provided a written commitment to imbed resource efficiency within the overall scheme design.
- Credit for evidence provided demonstrating that the developer has a strategy, which includes the use of local resources in the proposed development (e.g. labourers, materials).
- Credit for the use of renewable resources (e.g. sustainable agriculture, water resources, solar energy, wind power, hydro-power).
- Credit for having a comprehensive resource management plan within the development scheme.

- **Pollution**

The main aim of the pollution category is to recognise and encourage the development to be managed in an environmentally sound manner. It covers a number of criteria that include pollution prevention and the reduction of different types of pollution (e.g. water pollution, air pollution). These criteria are explained in the following points:

- Credit for evidence provided that shows that the pollution assessment has been carried out.
- Credit for evidence provided to reduce the likelihood of noise and waste pollutants that could be caused by the development.
- Credit for evidence provided showing the reduction of any potential sources of

water pollution.

- Credit for evidence provided showing the reduction of air pollution and improvement of air quality.
- Credit for the applications of different mechanisms to prevent pollution, such as increases in green areas.

- **Ecology**

The category aims to address the protection of the ecological value of the development areas. Also, it is appointed to protect and conserve the ecological features of the development areas. The included criteria within this category and their available credits can be summarised in the following points:

- Credit for evidence provided indicating that the ecological assessment has been carried out.
- Credit for the implementation of different mechanisms to protect the biodiversity and habitats.
- Credit for the consideration of the native flora and plant species and those with a known attraction or benefit to local fauna for the purpose of increasing and enhancing the number of species in the area.
- Credit for evidence provided showing that the ecological appraisal has been carried out in the development area.
- Credit for a full ecological survey to examine habitats in and around the development area and migration routes across the area.

- **Energy**

Energy category focuses on the reduction of CO₂ emission on the surrounding environments of the development area. It aims to recognise and encourage the urban areas to be designed to minimise the CO₂ emissions associated with their operational energy consumption.

- Credit for minimising energy demand for the area through orientation and passive design.
- Credit for evidence provided showing increase to the overall efficiency of the development through energy efficient design and management.
- Credit for evidence provided demonstrating that there are a number of steps, which have been taken to prepare an energy strategy for the proposed development to optimise the consumption of the energy in the area.

- Credit for having a comprehensive energy management plan within the development scheme that controls and monitors the demand and consumption.

7.4.2. Testing the Social Dimension

As mentioned previously, the social dimension looks at the various needs of the residents in order to provide high citizen satisfaction. It aims to provide the society with essential services in order to reach citizen satisfaction. For example, human health includes welfare facilities and access to the medical service, and educational development. The dimension has five key categories that need to be taken into account; each one has a number of criteria that determine the number of available credits per category. These categories, criteria, and available credits can be seen in Table 7.6, and will be explained in more details through the following paragraphs.

Table 7.6. Calculation of the final score of the social dimension.

Category	Weighting (%)	Criteria	Value of Each criterion (%)	Credits Achieved	Category Score Achieved (%)
Health	7.7	Consideration of health and safety issues	1.925		
		Providing medical facilities	1.925		
		Easy access to health services	1.925		
		Public awareness of health issues	1.925		
Education	5.2	Providing educational facilities	1.04		
		Health and safety within educational environment	1.04		
		Development of educational process	1.04		
		Educational management	1.04		
		Affordable access to standard educational services	1.04		
Equity	4.0	Equitable distribution of services	1.00		
		Equitable distribution of income	1.00		
		Public participation	1.00		
		Heritage preservation	1.00		
Security	3.7	Natural hazards assessment	0.74		
		Man-made hazards assessment	0.74		
		Risk mitigation	0.74		
		Risk management	0.74		
		Crime prevention	0.74		
Community	3.2	Community involvement in decision-making	0.40		
		Characteristics of the population	0.40		
		Enhancement of community with essential services	0.40		
		Promoting digital community	0.40		
		Consideration of culture & background	0.40		
		Promoting community participation	0.40		
		Governance model	0.40		
		Legislations and regulations	0.40		
Total	23.8%		23.8%		
Final Score of the Social Dimension					-

- **Health**

Health category aims to help residents to stay and live healthy as well as protecting them from threats to their health. The proposed framework of sustainable urban planning has been designed to minimise the risk and impact of illness in addition to helping residents make better, healthier choices. The category includes four main criteria, each of which is equivalent to one credit, and are explained in the following key points:

- Credit for the consideration of different health and safety issues (e.g. disasters, diseases).
- Credit for providing standard medical and health services and facilities (e.g. health centres, hospitals).
- Credit for easy and affordable access to health services (distribution of health centres among the urban areas according to walking distances internationally recognised).
- Credit for public awareness about the different health issues through the media, aimed at informing them about the importance of healthy living style.

- **Education**

The education category aims to ensure that the each part of the city or urban area is provided with essential educational services. Also, it focuses on the importance of the development and improvement of the educational process within these areas. It covers several criteria, which are explained in the following points:

- Credit for providing the standard educational services and facilities (e.g. nurseries, primary and high schools, colleges, universities).
- Credit for easy and affordable access to educational services (distribution of schools among the neighbourhoods according to walking distances internationally recognised).
- Credit for evidence provided showing that considerations of the health and safety issues has been taken into account within the educational environment.
- Credit for having a comprehensive strategic plan to develop the educational process.
- Credit for having a comprehensive educational management plan to control and monitor the overall educational process.

- **Equity**

The equity category emphasises the significance of equity within the society, regardless of the classes of the residents. It aims to distribute the services and income equitably among the population. The included criteria within this category and their available credits can be seen in the key points below:

- Credit for evidence provided indicating that the services are distributed fairly within the communities and urban areas.
- Credit for evidence provided demonstrating that the income is distributed equally among the population.
- Credit for the public participation, including all the different society groups, in the decision-making process.
- Credit for the heritage preservation of previous generations for subsequent generations.

- **Security**

This category aims to ensure that the different neighbourhoods and communities within the city enjoy the highest levels of security and protection from various risks, both natural hazards and those that result from human activities. This category includes five main criteria, each of which is equivalent to one credit, and is explained in the following points:

- Credit for evidence provided demonstrating that the natural hazards assessment has been carried out.
- Credit for evidence provided indicating that the man-made hazards assessment has been carried out.
- Credit for evidence provided showing that a number of steps have been taken regarding the risk mitigation aimed at reducing the potential risks.
- Credit for having a comprehensive risk management plan to control and monitor the potential risks.
- Credit for the application of different crime prevention mechanisms (e.g. secure by design through the active frontages).

- **Community**

This category focuses on a number of issues that are concerned with the community's needs. This includes the promotion of the digital community and community participation. It has

eight fundamental criteria, each one is equivalent to one credit, and is illuminated in the following key points:

- Credit for community involvement in the decision-making process.
- Credit for promoting the community identity and the characteristics of the population.
- Credit for enhancement of community with essential services.
- Credit for creating and developing the concept of the digital community.
- Credit for the consideration of the culture and background of the community.
- Credit for promoting the community participation within the overall strategic plan of the community development.
- Credit for evidence provided demonstrating that there is a clear governance framework for the neighbourhoods and communities development.
- Credit for the implementation of the legislations and regulation.

7.4.3. Testing the Economic Dimension

This dimension deals with a number of aspects regarding the economy, including sustainable economy and employment. It focuses on the significance of the achievement of stable economic growth and work to organise the production and consumption processes and choosing forms of production that minimise the use of resources and reduce environmental pollution. The dimension has five key categories, each with a number of criteria as can be seen in Table 7.7. The full details of these categories and criteria will be discussed in more detail below.

Table 7.7. Calculation of the final score of the economic dimension.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credits Achieved	Category Score Achieved (%)
Sustainable Economy	6.9	Enhancement of local economy	1.725		
		Diversity of economic activities	1.725		
		Efficient use of resource	1.725		
		Balance between income and spending	1.725		
Economic Growth	3.6	Developing new investment	0.6		
		Promoting local industry	0.6		
		Business facilities	0.6		
		Economic capacity	0.6		
		Providing healthy economic environment	0.6		
		Facilitate procedures to attract investments	0.6		
Employment	3	Healthy employment	0.75		
		Employment opportunities	0.75		
		Employment prospect	0.75		
		Work environment	0.75		
Employees	2.7	Skills and qualifications	0.45		
		Effective training	0.45		
		Vocational guidance	0.45		
		Motivation	0.45		
		Employees participation	0.45		
		Working efficiency	0.45		
Productivity	2.4	Quality	0.48		
		Cost efficiency	0.48		
		Efficient pricing	0.48		
		Delivery	0.48		
		Accessibility	0.48		
Total	18.6%		18.6%		
Final Score of the Economic Dimension					-

- **Sustainable Economy**

The sustainable economy category aims to address the different issues that are related to the economy of the city or urban area in order to enhance the local economy and connect it with national and global economies. It has four main criteria, and each one is worth one credit, as explained in the following points:

- Credit for evidence provided demonstrating that there are a number of practical steps to enhance the local economy and connect it with both national and global economies.
- Credit for evidence provided indicating that there is diversity in economic activities within the city and its surrounding areas.
- One credit for the efficient use of resources, including petroleum products.
- One credit for the achievement of the balance between income and spending.

- **Economic Growth**

This category aims to ensure that the city economy is growing in a balanced and sustainable manner. It includes six main criteria, each of which is equivalent to one credit, and is clarified in the following points:

- Credit for developing new investments.
- Credit for promoting local industries.
- Credit for creating a suitable environment for investment and providing good business facilities.
- Credit for the consideration of the economic capacity of the city or urban area.
- Credit for providing a healthy economic environment (e.g. balancing supply and demand, preventing monopoly).
- Credit for facilitating the procedures to attract investments.

- **Employment**

This category is concerned with different issues that are related to the subject of employment. It has four essential criteria, each one is equivalent to one credit, and can be seen in the following points:

- Credit for creating healthy employment levels.
- Credit for providing reasonable employment opportunities that include all classes of the society.
- One credit for raising the possibility of employment prospects.
- Credit for providing a suitable work environment.

- **Employees**

The employees category aims to address the different concerns in regard to the rights and duties of employees, this includes qualifications and training opportunities. As can be seen through the following key points the category has six core criteria, where each one of them is equivalent to one credit and can be seen below:

- Credit for evidence provided indicating that the skills and qualification of employees have been taken into account during the employment process.
- Credit for providing reasonable and effective training opportunities for employees.
- Credit for providing the employees with effective and continuous vocational guidance.
- Credit for continuous motivation of employees.
- Credit for employee participation in the decision-making process, depending on the nature of the work and institution.
- Credit for the achievement of an acceptable level of working efficiency.

- **Productivity**

The productivity section emphasises the significant role of productivity within the city and urban area economies. It includes five principal criteria and each one of them is equivalent to one credit as illustrated in the following key points:

- Credit for the quality of the products.
- Credit for the cost efficiency of the products.
- Credit for the efficient pricing of the products.
- Credit for the possibility of the product delivery.
- Credit for the accessibility to the products.

7.4.4. Testing the Planning Dimension

This dimension places emphasis on several concerns in terms of planning features, including the proper use of land, addressing infrastructure issues and consideration of the importance of transportation matters. Moreover, it sheds light on the management side in terms of controlling and monitoring the overall process of sustainable urban planning. The dimension has four significant categories, and each one of them has a number of criteria as can be seen in Table 7.8. These categories and criteria will be discussed in the following paragraphs in more detail.

Table 7.8. Calculation of the final score of the planning dimension.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credits Achieved	Category Score Achieved (%)
Land Use	4.3	Distribution of land uses	0.72		
		Residential schemes	0.72		
		Public services	0.72		
		Open spaces / park	0.72		
		Effective use of land	0.72		
		Land ownership	0.72		
Infrastructure	4.2	Green infrastructure	1.40		
		Infrastructure efficiency	1.40		
		Infrastructure management	1.40		
Management	3.7	Monitoring	0.62		
		Control	0.62		
		Operation	0.62		
		Maintenance	0.62		
		Governmental rules and regulations	0.62		
		Planning policies and legislations	0.62		
Transport	2.7	Consideration of traffic issues	0.67		
		Public transportation	0.67		
		Transport facilities	0.67		
		Transport policies	0.67		
Total	14.9		14.9		
Final Score of the Planning Dimension					-

- **Land Use**

This category aims to ensure that the land in the city or urban area has been used in an appropriate manner according to the regulations of internationally recognised planning. It includes six primary criteria and each one of them is equivalent to one credit as demonstrated in the following key points:

- Credit for an appropriate distribution of the land use.
- Credit for residential schemes that are designed and developed sustainably.
- Credit for providing sufficient areas of land for public services.
- Credit for providing sufficient areas of land for open spaces and parks.
- Credit for the effective use of land.
- Credit for the control and organisation of the process of land ownership.

- **Infrastructure**

The infrastructure category aims to ensure that the infrastructure of the city and urban area is designed and managed properly. It includes three fundamental criteria and each one of them is equivalent to one credit as it is explained in the following points:

- Credit for promoting and encouraging the development of green infrastructure.
- Credit for achieving an acceptable level of infrastructure efficiency.
- Credit for having a comprehensive management plan to manage and control the infrastructure of the city or urban area.

- **Management**

In general, the management category is considered as the key for the success of the proposed framework. It aims to manage and control the overall process of the planning and development of urban areas in order to be more sustainable. There are six main criteria within this category and each one of them is equivalent to one credit as shown in the following points:

- Credit for effective monitoring of the urban planning process.
- Credit for the control of the process of urban planning.
- Credit for an efficient operation of the development process.
- Credit for the continuous maintenance.
- Credit for implementation of the governmental rules and regulations.
- Credit for the adoption of planning policies and legislations.

- **Transport**

The Transport category is concerned with several issues relating to transportation and movement within cities and urban areas, including public transport, roads, maintenance, and traffic management. It aims to provide cities and urban areas with sustainable and safe transportation systems in addition to the integrated facilities of the system. The category has four criteria, and each one is equivalent to one credit as can be seen in the following points:

- Credit for the consideration of traffic issues.
- Credit for the existence of an effective public transport system.
- Credit for providing essential transport facilities.
- Credit for the creation and implementation of effective transport policies and regulations.

7.4.5. Testing the ICT Dimension

The significance of the ICT dimension has emerged as one of the most important elements that must be taken into account at the present. It looks at a number of essential issues that touch the daily human life. For instance, it emphasises the 21st century skills outcomes and the ability of citizens to access the technologies, services and resources at any time and from anywhere. This dimension, with full list of the main categories and criteria, can be seen in Table 7.9, and will be described in more details through the following paragraphs.

Table 7.9. Calculation of the final score of the ICT dimension.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credits Achieved	Category Score Achieved (%)
21st century skill outcomes	3.10	Skills levels of the society	3.10		
ICT management	3.00	Consideration of ICT issues	1.50		
		Existence of an effective administration	1.50		
Technological and institutional aspects	2.50	Effective institutional framework	1.25		
		Cooperation with other institutions	1.25		
Universal access to technology	2.30	Available universal access to technology	2.30		
Access to services and resources 24/7	2.20	Access to services and resources 24/7	2.20		
Total	13.10%		13.10%		
Final Score of the ICT Dimension					-

- **21st Century Skill Outcomes**

The main aim of this category is to determine and assess the 21st century skill outcomes of society. It has one criterion that is equivalent to one credit as illustrated in Table 7.9.

- **ICT Management**

The category is about creating a comprehensive management plan to manage and control the information and communication technology. It has two main criteria, which are equivalent to two credits. The first one is the consideration of ICT issues, and the second one is the existence of an effective administration.

- **Technological and Institutional Aspects**

This category is concerned with different aspects that are related to the technological and institutional issues. It has two fundamental criteria, which are equivalent to two credits. The first criterion is the existence of an effective institutional framework to manage the different technological and institutional issues, and the second one is the cooperation with other institutions.

- **Universal Access to Technology**

The main aim of this category is to provide the society within the cities and urban areas with a good and suitable access to technology across the world. It has one criterion that is equivalent to one credit.

- **Access to Services and Resources 24/7**

This category aims to provide the communities with an easy and acceptable access to different services and resources at any time and from anywhere. It has one criterion that is equivalent to one credit, which is the access to services and resources 24/7.

7.5. Applying the Proposed Framework to the City of Riyadh

In order to test the proposed framework and apply it to the real-world case studies, three neighbourhoods have been selected from the city of Riyadh. These three neighbourhoods are Ad-Dirah, Al-Shifa, and An-Nafl. These areas present three different stories of how urban planning processes were carried out in the city of Riyadh in the past. Figure 7.2 indicates the locations of these three selected areas.

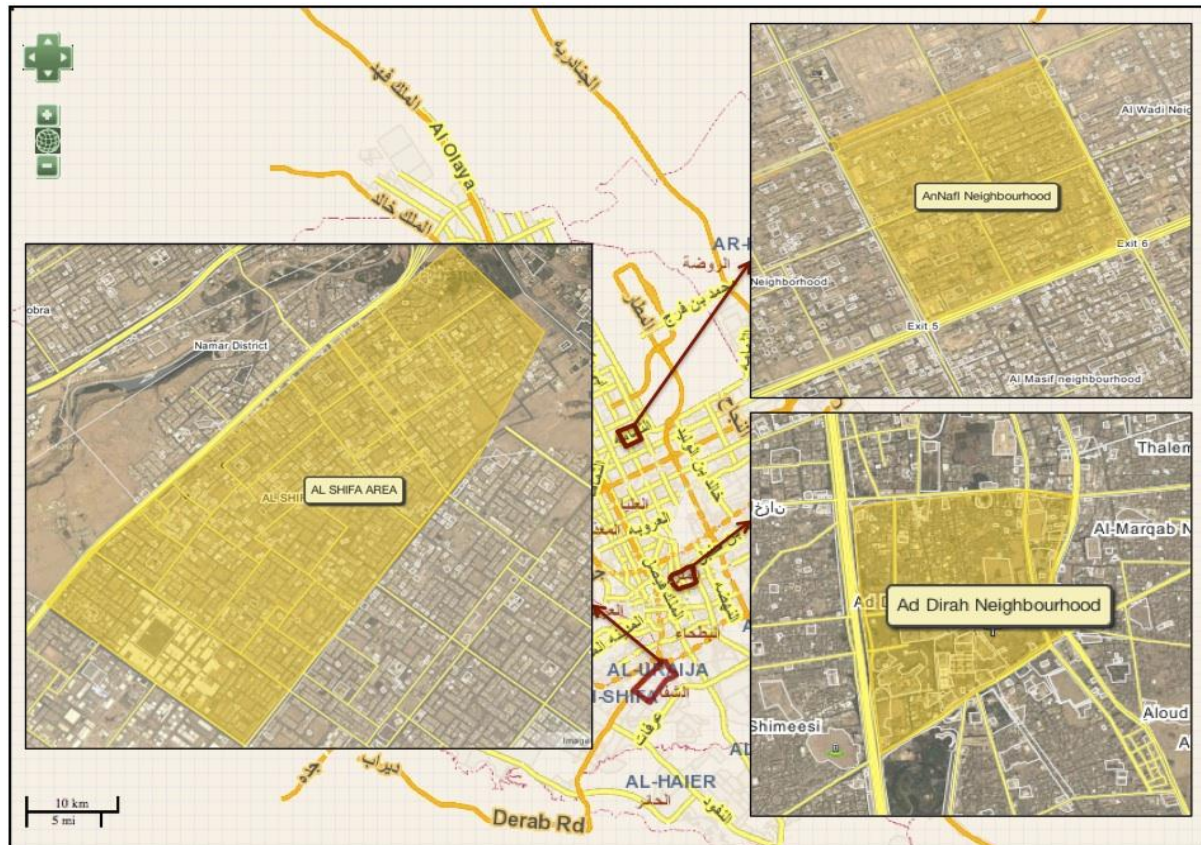


Figure 7.2. The main locations of the selected areas from the City of Riyadh.

These case studies have been selected based on the discussion of the historic development of Riyadh presented in Chapter Four. It comes from three different periods, which are considered turning points that have played an obvious role in the formation of the city. These periods are the foundation period (1930-1970), the oil boom period (1970-1990) and the post-oil boom from 1990 until the present. The main purpose behind the selection for these three case studies is to examine the patterns of urban planning that have been followed by the city during its growth based on the core dimensions of the proposed framework

Ad-Dirah neighbourhood is considered as the core of old city of Riyadh, which was created at the beginning of the 1930s (High Commission for the Development of Arriyadh, 2010).

Al-Shifa neighbourhood is considered as one of the middle-age neighbourhoods, developed in the 1970s as a result of the adoption of Doxiadis Associates and SCET International plans for the city of Riyadh as mentioned previously in Chapter Four. The third selected area is An-Nafl neighbourhood, which is seen as one of the most modern neighbourhoods, developed during 1990s. The proposed framework of sustainable urban planning will be evaluated based on the current situation of these three neighbourhoods in order to obtain the rating level of these areas.

The data for each neighbourhood has been collected from related organisation depends on the availability of the data. For example, High Commission for the Development of Arriyadh provided the researcher with a number of GIS maps that were helpful to identify the main locations of the three selected case studies that used in this study to determine the type of services that are available in these areas. Moreover, many of the data and information have been collected through the several site visits to the three neighbourhood which have been done in order to find out what is the current situation of the urban planning within these areas in addition to obtain the opinion of the residents of these areas and what they think about their surrounding environment. Therefore, the following subsections will discuss the current state of each neighbourhood individually in detail.

7.5.1. Urban Planning of Ad-Dirah Neighbourhood

Ad-Dirah Neighbourhood is considered as the main core of the city of Riyadh, and one of the oldest neighbourhoods in the city. It has a historical background, which can be traced back to the Pre-Foundation Period (1900-1930) of the city of Riyadh. However, during the last few decades and as a result of the abandonment of the core of the city and the traditional neighbourhoods with movement towards the north and west of the city, this area has started to lose its historical significance and national identity. At present, Ad-Dirah is a low-income neighbourhood providing low standard living conditions. Figure 7.3 shows the main location of the Ad-Dirah neighbourhood for the city of Riyadh in the past and present.

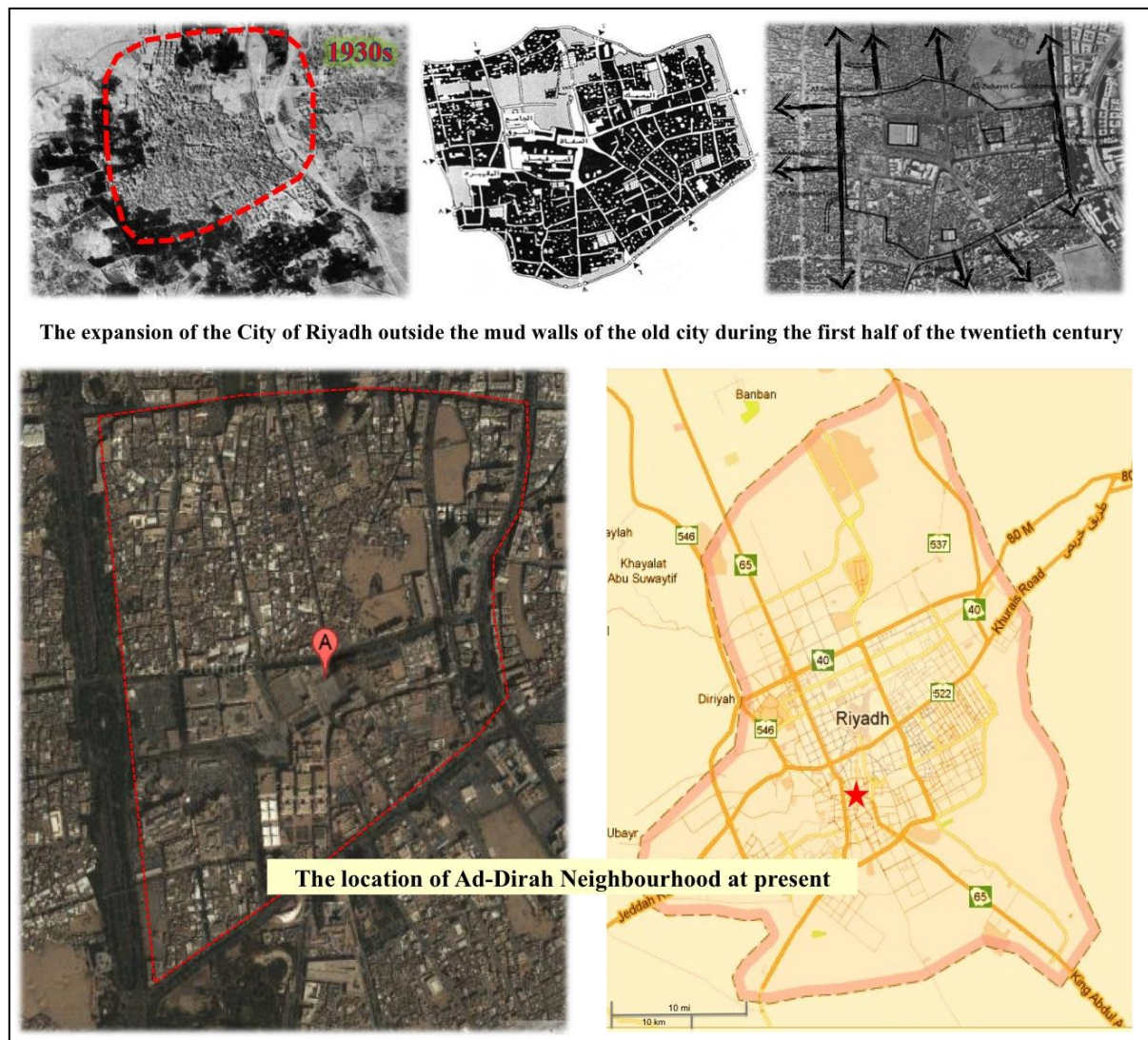


Figure 7.3. The main location of Ad-Dirah neighbourhood of the City of Riyadh in the past and present (Al-Hathloul, 2004, High Commission for the Development of Arriyadh, 2010).

Currently, Ad-Dirah neighbourhood suffers from a number of serious issues due to the change of the built environment and social life and its random development. The recent development of Riyadh consisted of a series of self-sustained communities along the edges of the city and the creation of many job opportunities, shopping centres, and leisure activities away from its historic core. This manner of development led to the disintegration of social connections between citizens in the central area of the city. Therefore, the aim of this part is to evaluate the current situation of the Ad-Dirah neighbourhood based on the five dimensions of the proposed framework of sustainable urban planning for the city of Riyadh in order to determine the quality of the urban planning of this area.

The final environmental dimension score has been calculated for Ad-Dirah neighbourhood based on the procedures that were highlighted previously. Ad-Dirah neighbourhood has achieved 6.055% out of 29.6%, which is the total score of the environmental dimension that was identified by the application of the AHP. The final score of the environmental dimension is presented in Table 7.10.

Unfortunately, the urban development of Ad-Dirah neighbourhood has overlooked a number of critical issues related to environment, including the significance of the climate change issue on the city and the kingdom in general. Assiri and Darfaoui (2012), point out that “Climate change is a serious challenge to the Kingdom of Saudi Arabia, which is under tremendous pressure as a result of the hyper aridity of the climate, severe shortage in water resources, rapidly growing population and reliance on fossil fuels”.

Table 7.10. Final score of the environmental dimension of Ad-Dirah neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
Climate	9.2	Adapting to climate change	2.3	✓					No evidence of adapting to climate change	1.725%
		Reduce carbon emissions	2.3		✓				Limited effort to reduce the carbon emission into the air in the neighbourhood	
		Adapting to solar radiation	2.3	✓					No evidence of adaptation to solar radiation	
		Flood risk assessment	2.3			✓			Limited evidences for carrying out the flood risk assessment within the area	
Resource	5.3	Resource recycling	1.06				✓		Recycle some resources in the area such as recycling the waste	1.855 %
		Resource efficiency	1.06		✓				Limited effort to increase the resource efficiency	
		Use of local resource	1.06		✓				Using some of local resources in limited quantities	
		Use of renewable resource	1.06	✓					No evidence of using renewable resource	
		Resource management	1.06			✓			Limited effort to manage the use of the resources in the neighbourhood	
		Pollution assessment	1.06		✓				No evidence for carrying out the pollution assessment	
Pollution	5.3	Reduce noise and waste pollution	1.06		✓				Limited measures are being installed in the area to reduce noise and waste pollution	1.325%
		Reduce water pollution	1.06		✓				No water pollution prevention systems have been found in the area	
		Pollution prevention	1.06		✓				No pollution prevention measures are being followed in the area	
		Air quality	1.06		✓				No clear evidence for implementing air quality improvement systems in the area	
		Ecological assessment	1.04	✓					No evidence for carrying out the ecological assessment for the area	
Ecology	5.2	Biodiversity and habitat protection	1.04	✓					Biodiversity and habitats were disappeared due to overlook the ecological assessment	0.00%
		Flora and Fauna protection	1.04	✓					No flora and fauna in the neighbourhood	
		Ecological appraisal	1.04	✓					No evidence for carrying out the ecological appraisal	
		Ecological survey	1.04	✓					No evidence for carrying out the ecological survey	
		Passive design	1.15		✓				Using some features of passive design resulted from traditional design of the city	
Energy	4.6	Energy efficiency	1.15		✓				Limited use of materials that increase energy efficiency	1.15 %
		Energy consumption	1.15		✓				Limited use of materials that reduce energy consumption	
		Energy management	1.15		✓				Limited effort to manage the energy within the area	
			1.15		✓					
Total	29.6%		29.6%							6.055%
Final Score of the Environment Dimension										6.055 %

This research argues that there is little attention to the importance of the resource and pollution categories. Although the related authorities encourage the use of local resources, there is a lack of awareness of the importance of recycling the resources and reusing them, for example the different applications of harvesting system to recycling the water. In this study, local resources are defined as products and materials, which come from a local source (e.g. either manufactured or processed within 50 miles of the area) as it is highlighted by BREEAM for Communities (BRE, 2011).

Ad-Dirah neighbourhood is experiencing various types of pollution. For example the area suffers from air pollution resulting from the huge number of cars that the absence of a public transport system has made necessary. The situation is further exacerbated by the noise that is produced by these cars. The area experiences other types of pollution as well some examples of which can be seen in Figure 7.4. Moreover, as is the case with the climate category, the urban planning of Ad-Dirah neighbourhood was carried out in the absence of clear mechanisms used to address different issues in regard to the ecology and energy categories.



Figure 7.4. Different types of pollution in Ad-Dirah neighbourhood (Rashid, 2011, Salem, 2012).

In this study, the social aspects have been investigated in Ad-Dirah neighbourhood based on the findings resulted from the several site visits to the area and comparing the current situation of the area with the information and data provided by related authorities including the Housing Ministry and High Commission for the Development of ArRiyadh. This investigation was mainly built based on the categories and criteria of social dimension. The final score of social dimension is presented in Table 7.11, where this neighbourhood has obtained 10.38 % out of 23.8%, which is the total score of the social dimension.

Table 7.11. Final score of the social dimension of Ad-Dirah neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
Health	7.7	Consideration of health and safety issues and problems	1.925	0.00	0.25	0.50	0.75	1.00	Emphasis on the significance of health and safety issues is limited in the area	3.85%
		Providing medical facilities	1.925			✓			Not enough medical centres (only one in the Neighbourhood)	
		Easy access to health services	1.925			✓			The level of access to services is acceptable to some extent	
		Public awareness of health issues	1.925			✓			Weak public awareness of health issues	
Education	5.2	Providing educational facilities	1.04				✓		Providing the district with educational facilities, except the high schools for the girls	3.12%
		Health and safety within educational environment	1.04		✓				Absence of health and safety within the educational environment	
		Development of educational process	1.04			✓			The weakness of the development process of the education	
		Educational management	1.04			✓			The weakness of the educational management in the area	
Equity	4.0	Affordable access to standard educational services	1.04					✓	Basic educational services are affordable to everyone in the area	1.50%
		Equitable distribution of services	1.00				✓		Acceptable distribution of services within the area, except health services	
		Equitable distribution of income	1.00		✓				Weak distribution of income	
		Public participation	1.00		✓				Absence of public participation	
Security	3.7	Heritage preservation	1.00		✓				The weakness of efforts to preserve the heritage of the old city of Riyadh	1.11%
		Natural hazards assessment	0.74		✓				No evidences for carrying out the natural hazards assessment	
		Man-made hazards assessment	0.74		✓				No evidences for carrying out the man-made hazards assessment	
		Risk mitigation	0.74		✓				No evidences for carrying out the risk mitigation	
Community	3.2	Risk management	0.74		✓				No evidences for carrying out the risk management	0.80%
		Crime prevention	0.74			✓			There are some efforts to prevent crime in the neighbourhood by related authorities	
		Community involvement in decision-making	0.40		✓				The weakness of community participation in the decision-making process	
		Characteristics of the population	0.40		✓				Population characteristics are not clear due to multiplicity of ethnicities and nationalities	
Community	3.2	Enhancement of community with essential services	0.40			✓			Providing the community with services to an acceptable level to some extent	0.80%
		Promoting digital community	0.40	✓					No evidence for promoting the digital community approach in the area	
		Consideration of culture & background	0.40		✓				The weakness of efforts to preserve the culture & background of the area	
		Promoting community participation	0.40		✓				Weakness of promoting community participation	
Total	23.8%	Governance model	0.40		✓				No evidence for following a governance model within the area	10.38%
		Legislations and regulations	0.40		✓				Weak of the legislations and regulations in the area	
Final Score of the Social Dimension										

In general, it is fair to point out that considerations of health and safety issues and providing standard medical facilities have been taken into account by related authorities. However, there are a number of key areas that need to be improved. For instance, despite the fact that primary health services are available in the neighbourhood, they are not easily accessible since there is only one health care centre in the area. This means that the health planning standards have not been followed in Ad-Dirah neighbourhood.

Health standards and regulations state that each area with population of 4,000 to 15,000 needs to be provided with one primary healthcare centre with a service range of 900 meters (Housing Ministry, 2013). However, this is not applied in reality. For example, the population of Ad-Dirah neighbourhood was estimated at 24,144 in 2005, and there is only one primary health care centre as can be seen in Figure 7.5 (High Commission for the Development of ArRiyadh, 2010).

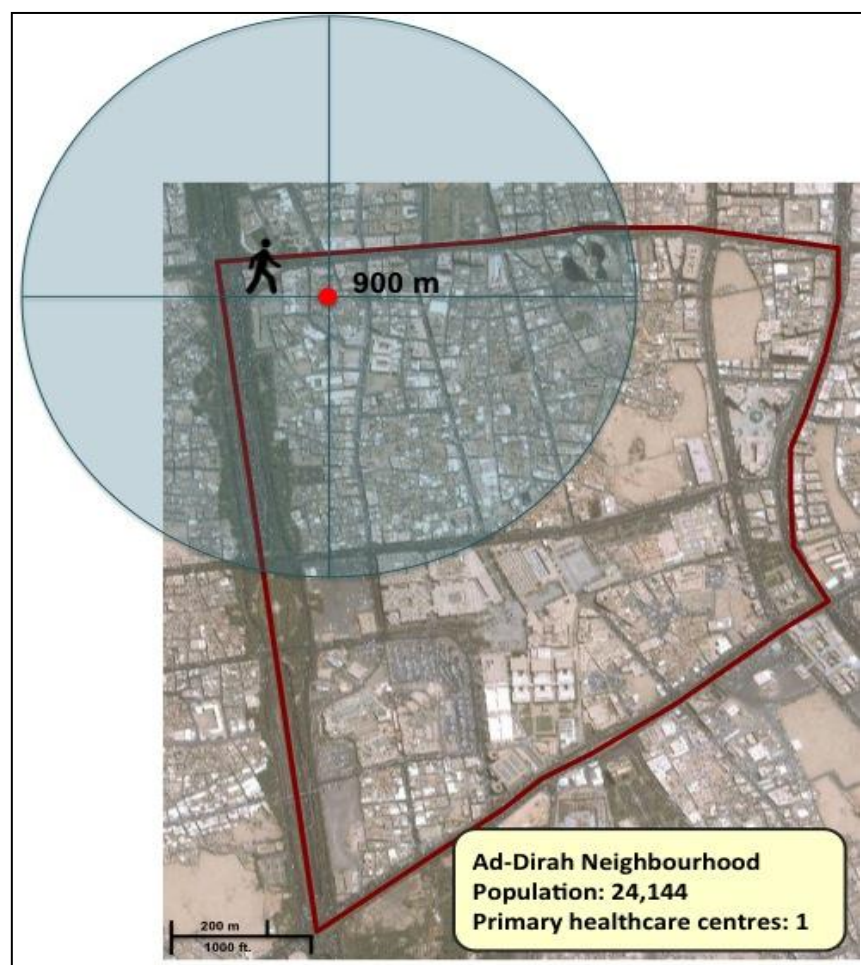


Figure 7.5. Location of the primary health care centre in Ad-Dirah neighbourhood.

The related authorities have to some extent made acceptable efforts to provide the citizens with standard educational services. However, these services are not easily accessible in some parts of the neighbourhood. Planning regulations indicate that each neighbourhood with population of 3,000 to 6,000 needs to be offered one primary school with a service range of 550 meters. Areas with population of 6,000 to 10,000 need to be provided with one secondary school with service range of 750 meters, in addition to two primary schools. Moreover, areas with population of 10,000 to 20,000 need to be provided with one high school with a service range of 2000 meters, in addition to two secondary schools and four primary schools (Housing Ministry, 2013). However, the situation on the ground has not followed these regulations. Distribution of educational services in Ad-Dirah neighbourhood can be seen in Figure 7.6.

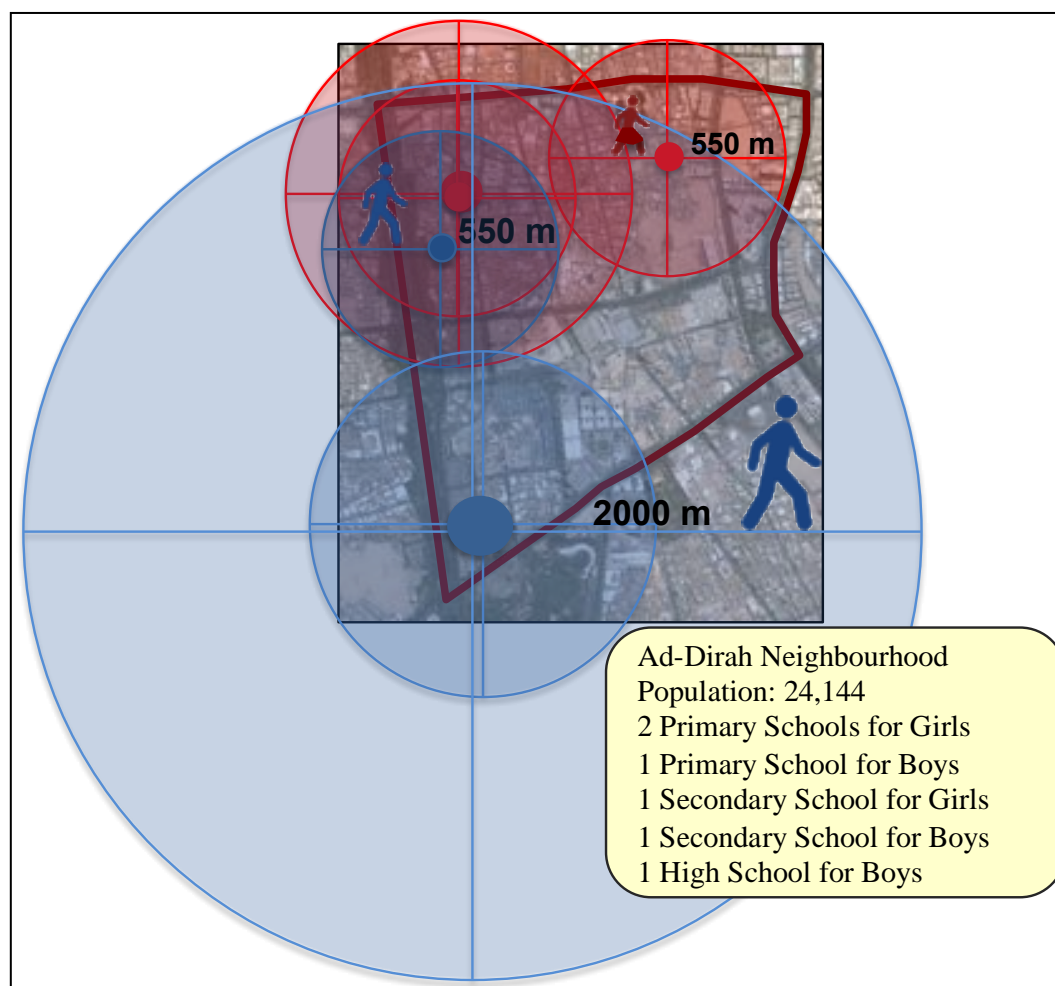


Figure 7.6. Distribution of the educational services in Ad-Dirah neighbourhood.

Furthermore, most of the educational services in Ad-Dirah neighbourhood are currently suffering from the poor conditions of the educational environment in the absence of many of the health and safety standards as can be seen in Figure 7.7.



Figure 7.7. The current situation of a number of educational institutions in Ad-Dirah neighbourhood (Bandar, 2008, Nayef, 2009).

Regarding the heritage preservation, this research has found that most of the historical features of the old city of Riyadh have been obliterated as a result of the boom that has been witnessed by the city. For instance, although Ad-Dirah neighbourhood was the essence of the old city of Riyadh and the starting point for the development of the city, it has been neglected by current development that overlooked the heritage value of this area, which is considered as one of the most important sights for current and future generations. Figure 7.8 shows how the Ad-Dirah neighbourhood was in the past, and what it has become today.

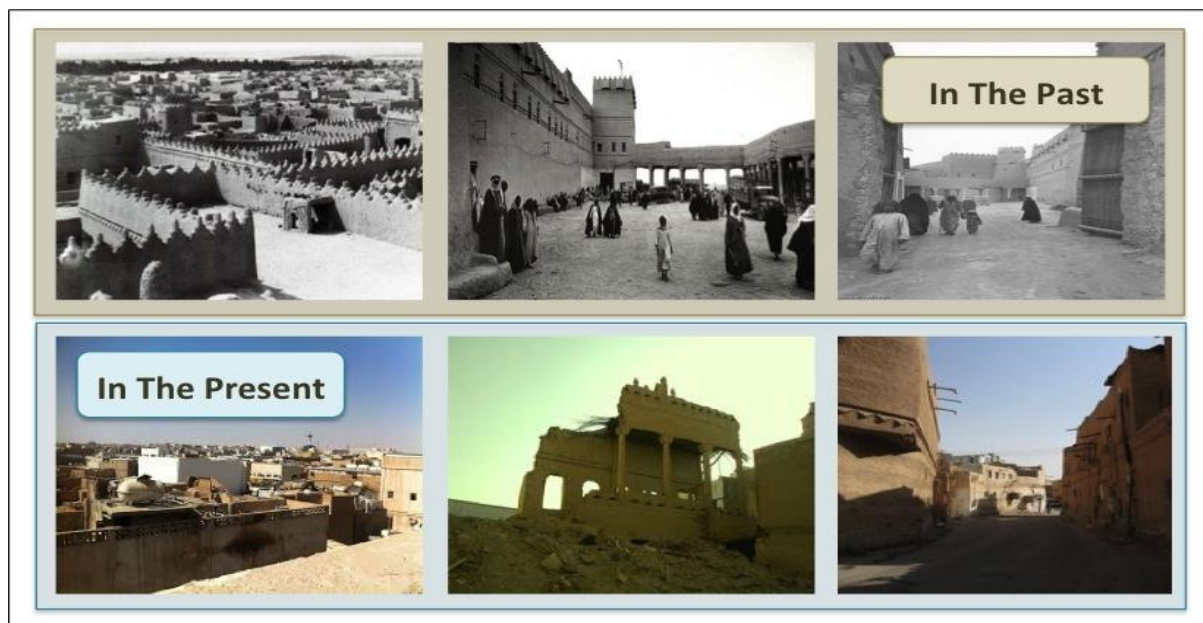


Figure 7.8. Some of the differences in Ad-Dirah neighbourhood in the past and the present (High Commission for the Development of Arriyadh, 2010).

Regarding the economic aspects, the final score of economic dimension that has been achieved by Ad-Dirah neighbourhood is 4.007 % out of 18.6% the total score of the economic dimension, as is presented in Table 7.12. High Commission for the Development of Arriyadh (2003), points out that there are a number of economic challenges facing the development of the old city of Riyadh (Ad-Dirah neighbourhood) and one of the most important ones is the increase of the proportion of people with low incomes and the reduction of people with middle incomes.

Another interesting issue related to the economic dimension is productivity. Al-Dosari (2013), points out that the most important element in the product is its quality, which determines its price. However, this idea is almost absent in Ad-Dirah neighbourhood due to the low level of the income of the residents as well as the limited awareness within the area. Moreover, in Ad-Dirah market there is not consisted monitoring and control of prices for various types of goods. The situation becomes worse because of a lack of transparency between producers and consumers (Alqbai, 2012, Jasser, 2013).

As is the case with the previous dimensions, Ad-Dirah neighbourhood has achieved a very low score with respect to the planning dimension. During the fieldwork, the planning aspects have been examined in Ad-Dirah neighbourhood based on the categories and criteria of the planning dimension. This selected area has achieved 2.05% out of 14.9%, which is the total score of planning dimension. The final score of the planning dimension of Ad-Dirah neighbourhood is presented in Table 7.13. This study argues that there are a number of questions about the distribution of land use within Ad-Dirah in particular and in the City of Riyadh in general.

One of these questions is in reference to the conflicts that exist between land uses within residential schemes and overlapping for different uses. This issue was a result of the absence of rules and regulations that govern such issues (El-Saleh, 2013). In Ad-Dirah neighbourhood, for example, there is a clear overlap between residential areas and some business activities, which include the use of residential houses to store commercial goods or to run other business away from the original use for the land that was adopted by the planning master plan. This issue without doubt has many negative environmental and health influences on the daily lives of the citizens, whilst at the same time affecting the urban image and surrounding environment of the area in general, as can be seen clearly in Figure 7.9.

Table 7.12. Final score of the economic dimension of Ad-Dirah neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
Sustainable Economy	6.9	Enhancement of local economy	1.725		✓				Weakness of the local economy	1.293%
		Diversity of economic activities	1.725		✓				Limited diversity of the economic activities	
		Efficient use of resource	1.725		✓				No evidence of efficient use of economic resource in Ad-Dirah Neighbourhood	
		Balance between income & spending	1.725	✓					Absence of a balance between income and spending	
Economic Growth	3.6	Developing new investment	0.60		✓				No evidence for developing new investments in the area	0.75%
		Promoting local industry	0.60		✓				Weakness of the local industry due to the poor condition of local economy	
		Business facilities	0.60	✓					Poor conditions of business facilities	
		Economic capacity	0.60		✓				Economic capacity is not known in the area	
		Providing healthy economic environment	0.60	✓					General economic environment is not attractive for new investments	
		Facilitate procedures to attract investments	0.60			✓			Procedures to attract investments in the district are acceptable to some extent	
Employment	3.0	Healthy employment	0.75		✓				No evidence for healthy employment in the area due to the absence of relative data	0.562%
		Employment opportunities	0.75		✓				Limited job opportunities	
		Employment prospect	0.75		✓				Limited employment prospect	
		Work environment	0.75	✓					Poor condition of work environment because of the absence of efficient management	
Employees	2.7	Skills and qualifications	0.45		✓				Skill level of neighborhood residents is low because of the general environment	0.562%
		Effective training	0.45		✓				No evidence for effective training of employees	
		Vocational guidance	0.45		✓				Absence of vocational guidance	
		Motivation	0.45		✓				Absence of motivation mechanisms for employees	
		Employees participation	0.45	✓					Weakness of employees participation	
		Working efficiency	0.45		✓				The level of work efficiency in the neighbourhood unsatisfactory	
Productivity	2.4	Quality	0.48		✓				Product quality is low because of the low-income for the residents	0.84%
		Cost efficiency	0.48		✓				Low of the cost efficiency	
		Efficient pricing	0.48		✓				Low of the efficient pricing	
		Delivery	0.48			✓			Acceptable level of delivery based on the quality, cost, and pricing of the product	
		Accessibility	0.48			✓			Acceptable level of Accessibility based on the quality, cost, and pricing of the product	
Total	18.6%		18.6%							4.007%
Final Score of the Economic Dimension										4.007%

Table 7.13. Final score of the planning dimension of Ad-Dirah neighbourhood

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)		
				0.00	0.25	0.50	0.75	1.00				
Land Use	4.3	Distribution of land uses	0.72		✓				Poor distribution of land uses in the district	0.54%		
		Residential schemes	0.72	✓					Random residential schemes in the area			
		Public services	0.72		✓				Low level of public services			
		Open spaces / park	0.72		✓				Poor condition of the open spaces and park in the neighbourhood			
		Effective use of land	0.72	✓					No evidence for effective use of land			
		Land ownership	0.72	✓					Presence of many problems related to land ownership			
Infrastructure	4.2	Green infrastructure	1.40	✓					No evidence for using a green infrastructure	0.70%		
		Infrastructure efficiency	1.40		✓				Low level of infrastructure efficiency			
		Infrastructure management	1.40		✓				Low level of infrastructure management			
Management	3.7	Monitoring	0.62	✓					Absence of an effective monitoring on the planning process	0.31%		
		Control	0.62	✓					Weak control over the planning process			
		Operation	0.62	✓					Low level of sufficient planning operational processes			
		Maintenance	0.62	✓					Lack of maintenance operations in the neighbourhood			
		Governmental rules and regulations	0.62		✓				Failure to follow the governmental rules and regulations			
		Planning policies and legislations	0.62		✓				Failure to follow the planning policies and legislations			
Transport	2.7	Consideration of traffic issues	0.67		✓				Low level of the consideration of traffic issues, including the traffic congestion	0.50 %		
		Public transportation	0.67	✓					Absence of public transport system in the neighbourhood, and in the city in general			
		Transport facilities	0.67		✓				Poor condition of the transport facilities			
		Transport policies	0.67		✓				Failure to follow the transport policies			
Total	14.9		14.9%						2.05 %			
Final Score of the Planning Dimension												2.05%



Figure 7.9. Overlapping for different land uses in Ad-Dirah neighbourhood (Shaibani, 2007, Al-Sudairy, 2011).

Regarding the significance of ICT dimension this research has found that in the last few years there has been an increasing interest in the field of information and communication technology in the City of Riyadh in particular and it is in constant mutation across the Kingdom of Saudi Arabia. However, because of the general environment of Ad-Dirah neighbourhood as well as the low level of the income of the residents the consideration of the ICT issues is limited in the area. Therefore, in order to assess the current situation of Ad-Dirah the score of ICT dimension is determined by looking at the level of the cooperation among the different institutions within the area as well as the types of institutional frameworks of these bodies.

Ad-Dirah neighbourhood has achieved 1.35% out of 13.10%, which is the total score of the ICT dimension, and this is presented in Table 7.14. Based on the results presented in Table 7.14, this research work would argue that the significance of ICT has been overlooked in the area, where there are no practical steps to be implemented on the ground to enhance the importance of ICT in the area. For instance, in Ad-Dirah neighbourhood the effective administrations and institutional frameworks are almost absent because of the weakness of the cooperation between different institutions in the city (Al-Mayoof, 2003, Al-Sulaimani, 2010). Also, although the universal access to different technologies is available in the City of Riyadh, it is hard to access the services and resources due to the non-activation of ICT in most of the institutions and departments within the city, including Ad-Dirah neighbourhood.

Table 7.14. Final score of the ICT dimension of Ad-Dirah neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
21st century skill outcomes	3.10	Skills levels of the society	3.10		✓				Low level of the skills of the neighbourhood residents due to the general environment of the area	0.775%
ICT management	3.00	Consideration of ICT issues	1.50	✓					Lack of consideration of the issues that are related to ICT	0.00%
		Existence of an effective administration	1.50	✓					Absence of an effective administration in the neighbourhood	
Technological and institutional aspects	2.50	Effective institutional framework	1.25	✓					Absence of effective institutional framework	0.00%
		Cooperation with other institutions	1.25	✓					Lack of cooperation with other institutions	
Universal access to technology	2.30	Available universal access to technology	2.30		✓				Low level of accessing to the universal technology	0.575%
Access to services and resources 24/7	2.20	Access to services and resources 24/7	2.20	✓					Access to services and resources are limited	0.00%
Total	13.10%		13.10%							1.35%
Final Score of the ICT Dimension										1.35%

The final score of the current situation of Ad-Dirah neighbourhood, based on the proposed framework for sustainable urban planning, has been determined as a total of the final scores of the five dimensions discussed above. As can be seen in Table 7.15 the current urban planning situation of Ad-Dirah neighbourhood has achieved 23.842% of the total score of the proposed framework for sustainable urban planning of the city of Riyadh. This score has been obtained after the comprehensive analysis of the area in regard to the five main dimensions, categories, and criteria of the proposed framework.

Based on the scoring and rating system that was developed within this research as well as the rating benchmarks presented previously in this chapter, this final obtained score means that the urban development of Ad-Dirah neighbourhood is rated as “UNCLASSIFIED” where the final score of the urban planning is <30. This means that the urban planning of Ad-Dirah neighbourhood needs to be given more attention from various relevant authorities in order to manage the current growth of the area properly and reach an acceptable level of sustainable urban planning.

Table 7.15. Final Score of the proposed framework for sustainable urban planning of Ad-Dirah neighbourhood.

SUPF Dimensions	Dimension Weight (%)	Dimension Achieved Score (%)
Environmental Dimension	29.6	6.005%
Social Dimension	23.8	10.38%
Economic Dimension	18.6	4.007%
Planning Dimension	14.9	2.05%
ICT Dimension	13.1	1.35%
Total	100%	23.842%
Final SUPF Score of Ad-Dirah neighbourhood	23.842%	
SUPF Rating	UNCLASSIFIED	

7.5.2. Urban Planning of Al-Shifa Neighbourhood

Al-Shifa neighbourhood is one of the neighbourhoods, which developed in the 1970s as a result of the adoption of the first and second master plans for the city of Riyadh prepared by both Doxiadis Associates and SCET International. It has developed during the Oil Boom Period (1970 - 1990) of the city of Riyadh that was highlighted previously within Chapter Four. Figure 7.10 presents the main location of Al-Shifa neighbourhood.

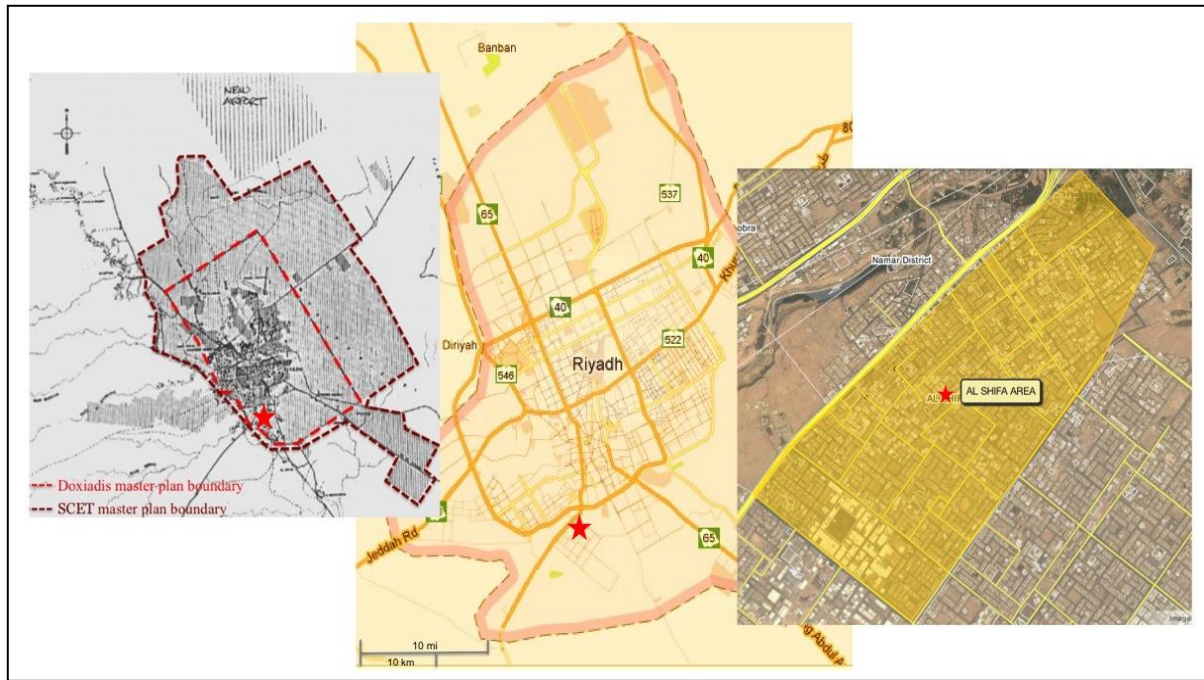


Figure 7.10. The main location of Al-Shifa neighbourhood of the City of Riyadh.

As a result of a dramatic increase of its area and population, Al-Shifa neighbourhood has witnessed many social, economic, environmental, and urban changes. Therefore, the fundamental aim of this part is to evaluate the current state of Al-Shifa neighbourhood based on the five dimensions of the proposed framework for the city of Riyadh in order to determine the quality of the urban planning of this area.

The final score has been calculated for Al-Shifa neighbourhood based on the procedures that were highlighted previously and followed in the evaluation of Ad-Dirah neighbourhood. Al-Shifa neighbourhood has achieved 5.722 % out of 29.6%, which is the total score of the environmental dimension that was identified by the application of the AHP. The final score of the environmental dimension is presented in Table 7.16. Unfortunately, as is the case with Ad-Dirah neighbourhood, the urban planning of Al-Shifa neighbourhood has overlooked the significance of the environmental issues, including the climate change, pollution, and energy matters.

Moreover, the random urban planning of Al-Shifa neighbourhood led to loss of biodiversity and natural habitats, which were located in the area in the past. For instance, Mubarak (2004), points out that the land was seen as homogeneous in most of the parts of the city of Riyadh without taking into the considerations the value of the biodiversity, natural habitat or topographical characteristics of these areas.

Table 7.16. Final score of the environmental dimension of Al-Shifa neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
Climate	9.2	Adapting to climate change	2.3	✓					No evidence of adapting to climate change	0.575%
		Reduce carbon emissions	2.3		✓				Limited effort to reduce the carbon emission into the air in the neighbourhood	
		Adapting to solar radiation	2.3	✓					No evidence of adaptation to solar radiation	
		Flood risk assessment	2.3	✓					Limited assessment for flood risks in Al-Shifa neighbourhood	
Resource	5.3	Resource recycling	1.06				✓		Recycle some resources in the area such as recycling the waste	1.855 %
		Resource efficiency	1.06		✓				Limited effort to increase the resource efficiency	
		Use of local resource	1.06		✓				Using some of local resources in limited quantities	
		Use of renewable resource	1.06	✓					No evidence of using renewable resource	
		Resource management	1.06			✓			Limited effort to manage the use of the resources in the neighbourhood	
Pollution	5.3	Pollution assessment	1.06		✓				No evidence for carrying out the pollution assessment	1.855%
		Reduce noise and waste pollution	1.06			✓			Limited measures are being installed in the area to reduce noise and waste pollution	
		Reduce water pollution	1.06			✓			Limited evidences have been found in the area to reduce water pollution	
		Pollution prevention	1.06		✓				No pollution prevention measures are being followed in the area	
		Air quality	1.06		✓				No clear evidence for implementing air quality improvement systems in the area	
Ecology	5.2	Ecological assessment	1.04	✓					No evidence for carrying out the ecological assessment for the area	0.00%
		Biodiversity and habitat protection	1.04	✓					Biodiversity and habitats were disappeared due to overlook the ecological assessment	
		Flora and Fauna protection	1.04	✓					No flora and fauna in the neighbourhood	
		Ecological appraisal	1.04	✓					No evidence for carrying out the ecological appraisal	
		Ecological survey	1.04	✓					No evidence for carrying out the ecological survey	
Energy	4.6	Passive design	1.15			✓			Using some features of passive design in some building in the area	1.437 %
		Energy efficiency	1.15		✓				Limited use of materials that increase energy efficiency	
		Energy consumption	1.15		✓				Limited use of materials that reduce energy consumption	
		Energy management	1.15		✓				Limited effort to manage the energy within the area	
Total	29.6%		29.6%							5.722%
Final Score of the Environment Dimension										5.722 %

The social dimension for Al-Shifa neighbourhood has been investigated as well through an examination of such issues as health and education. This investigation was mainly built based on the categories and criteria of the dimension included within the proposed framework. The final score of the social dimension is presented in Table 7.17, where the neighbourhood has obtained 11.375 % out of 23.8%, which is the total score of the social dimension.

Generally, the considerations of health and safety issues as well as providing standard medical facilities for the residents have been taken into account by related authorities. In Al-Shifa neighbourhood, there are three health care centres, which are acceptable to some extent, but need to be increased in order to meet the needs of 64,128 people. In the same context, the related authorities have made acceptable efforts to provide the neighbourhood with standard educational services. In Al-Shifa neighbourhood, there are five primary schools for boys and five primary schools for girls in addition to four secondary schools for boys and three secondary schools for girls. Furthermore, the neighbourhood is provided with two high schools for boys and two high schools for girls. Figure 7.11 presents the main location of the health and educational services in Al-Shifa neighbourhood.

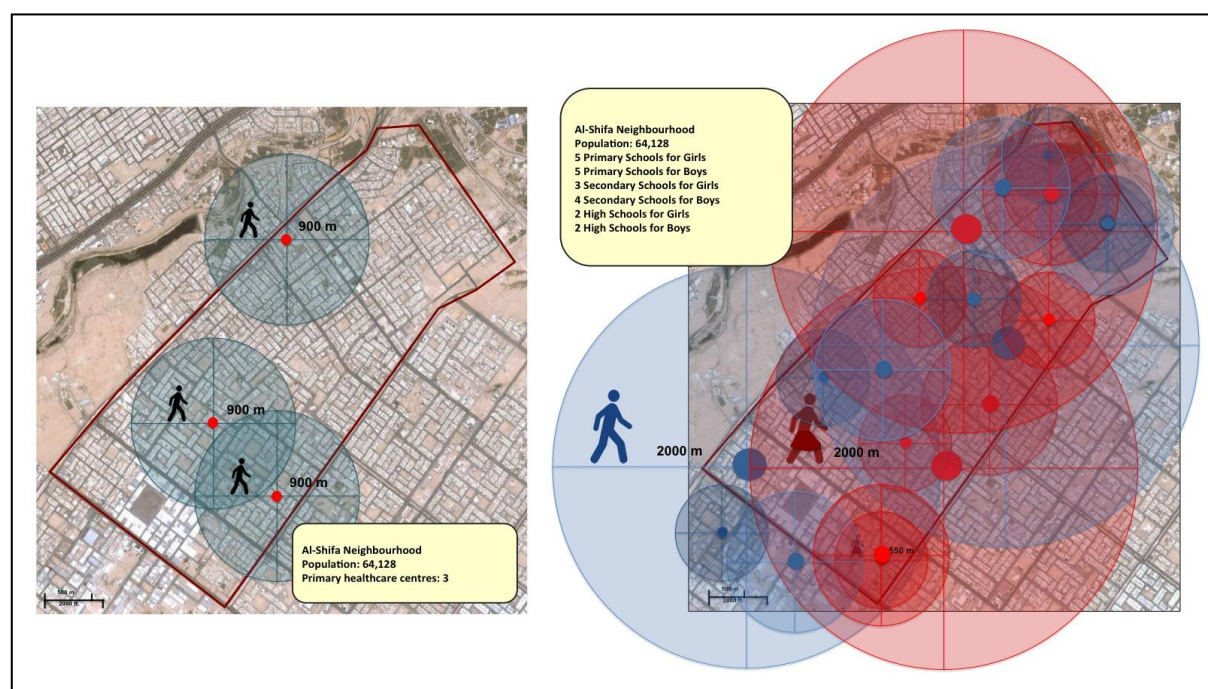


Figure 7.11. Distribution of the health and educational services in Al-Shifa neighbourhood.

Table 7.17. Final score of the social dimension of Al-Shifa neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
Health	7.7	Consideration of health and safety issues and problems	1.925			✓			Emphasis on the significance of health and safety issues is limited in the area	4.33%
		Providing medical facilities	1.925			✓			Not enough medical centres (only three in the Neighbourhood)	
		Easy access to health services	1.925				✓		The level of access to services is acceptable to some extent	
		Public awareness of health issues	1.925			✓			Weak public awareness of health issues	
Education	5.2	Providing educational facilities	1.04			✓			Providing the district with acceptable educational facilities	2.6%
		Health and safety within educational environment	1.04			✓			Absence of health and safety within the educational environment to some extent	
		Development of educational process	1.04			✓			The weakness of the development process of the education	
		Educational management	1.04			✓			The weakness of the educational management in the area	
Equity	4.0	Affordable access to standard educational services	1.04			✓			Basic educational services are affordable to everyone in the area	1.75%
		Equitable distribution of services	1.00				✓		Acceptable distribution of services within the area, except health services	
		Equitable distribution of income	1.00			✓			Weak distribution of income	
		Public participation	1.00		✓				Public participation is limited	
Security	3.7	Heritage preservation	1.00		✓				The heritage preservation is weak	1.295%
		Natural hazards assessment	0.74		✓				No evidences for carrying out the natural hazards assessment	
		Man-made hazards assessment	0.74			✓			Evidences for carrying out the man-made hazards assessment are limited	
		Risk mitigation	0.74		✓				Evidences for carrying out the risk mitigation are limited	
Community	3.2	Risk management	0.74		✓				Evidences for carrying out the risk management are limited	1.40%
		Crime prevention	0.74			✓			There are some efforts to prevent crime in the neighbourhood by related authorities	
		Community involvement in decision-making	0.40			✓			Weakness of community participation in the decision-making process	
		Characteristics of the population	0.40			✓			Residents of the area are classified under the category of middle-income people	
Community	3.2	Enhancement of community with essential services	0.40			✓			Providing the community with services to an acceptable level to some extent	1.40%
		Promoting digital community	0.40		✓				No evidence for promoting the digital community approach in the area	
		Consideration of culture & background	0.40			✓			Weakness of efforts to preserve the culture & background of the area	
		Promoting community participation	0.40			✓			Weakness of promoting community participation	
Total	23.8%	Governance model	0.40			✓			Following a governance model within the area is limited	11.375%
		Legislations and regulations	0.40			✓			Weak of the legislations and regulations in the area	
Final Score of the Social Dimension		11.375%								

This research has found that there are a number of key issues, which need to be improved within the security and community categories based on the current situation of Al-Shifa neighbourhood. For example, more attention must be given to the subjects of natural and man-made hazards assessment to avoid the future risks such as the events of 2010 and 2013 when heavy rain fell on the city of Riyadh, revealing the weakness of the risk management and poor infrastructure as can be seen in Figure 7.12.



Figure 7.12. Some of the destruction that resulted from the heavy rain fell on Al-Shifa neighbourhood in November 2013 (Sabq, 2013).

Concerning the economic features of the area, the final score of economic dimension achieved by Al-Shifa neighbourhood is 5.515% out of 18.6%, which is the total score of the economic dimension. This score is illustrated in Table 7.18. During the 1970s and 1980s the oil wealth allowed the Saudi government to start many projects in the city, including Al-Shifa neighbourhood, which were established to improve the living conditions and improving the built environment. However, this study has found that these projects have led to expansion of the spatial area in an unsustainable manner and increase in the cost of infrastructure and transportation. As is the case with previous case study, the urban planning of Al-Shifa has been overlooked the significance of the elements of sustainable economy including the importance of the diversification of the economic activities.

Table 7.18. Final score of the economic dimension of Al-Shifa neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
Sustainable Economy	6.9	Enhancement of local economy	1.725		✓				Weakness of the local economy	1.725%
		Diversity of economic activities	1.725		✓				Limited diversity of the economic activities	
		Efficient use of resource	1.725		✓				Evidence of efficient use of economic resource is limited in the neighbourhood	
		Balance between income & spending	1.725		✓				Deficiency of a balance between income and spending	
Economic Growth	3.6	Developing new investment	0.60		✓				No evidence for developing new investments in the area	1.05%
		Promoting local industry	0.60		✓				Lack of the local industry due to the limited of the economic diversity	
		Business facilities	0.60		✓				Poor conditions of business facilities	
		Economic capacity	0.60		✓				Economic capacity is not known in the area	
		Providing healthy economic environment	0.60		✓				General economic environment is not attractive for new investments	
		Facilitate procedures to attract investments	0.60			✓			Procedures to attract investments in the district are acceptable to some extent	
Employment	3.0	Healthy employment	0.75		✓				Evidence for healthy employment in the area are limited	0.75 %
		Employment opportunities	0.75		✓				Limited job opportunities	
		Employment prospect	0.75		✓				Limited employment prospect	
		Work environment	0.75		✓				Work environment is acceptable to some extent in the area	
Employees	2.7	Skills and qualifications	0.45			✓			Skill level of neighborhood residents is fair	0.79%
		Effective training	0.45		✓				Evidence for effective training of employees is limited	
		Vocational guidance	0.45		✓				Lack of vocational guidance	
		Motivation	0.45		✓				Deficiency of motivation mechanisms for employees	
		Employees participation	0.45		✓				Weakness of employees participation	
		Working efficiency	0.45		✓				Low level of work efficiency in the neighbourhood	
Productivity	2.4	Quality	0.48			✓			Product quality is fair because of the income of the residents	1.20%
		Cost efficiency	0.48			✓			Cost efficiency is fair	
		Efficient pricing	0.48			✓			Efficient pricing is fair	
		Delivery	0.48			✓			Acceptable level of delivery based on the quality, cost, and pricing of the product	
		Accessibility	0.48			✓			Acceptable level of Accessibility based on the quality, cost, and pricing of the product	
Total	18.6%		18.6%							5.515%
Final Score of the Economic Dimension										5.515%

During this research, the planning aspects of Al-Shifa neighbourhood have been examined based on the categories and criteria of the planning dimension of the proposed framework. Al-Shifa neighbourhood has achieved a very low score with respect to the planning dimension, where it only achieved 2.07% out of 14.9%, which is the total score of planning dimension. The detail of this final score can be seen in Table 7.19.

This study argues that there are a number of critical questions in regard to the distribution of the land uses within Al-Shifa neighbourhood. One of these questions is in reference to the conflicts that exist between land uses within residential schemes in the neighbourhood and overlapping for different uses, which was a result of the absence of rules and regulations that govern such developments (El-Saleh, 2013). In this selected area, for instance, there is a clear overlap between residential areas and some industrial activities such as industrial exhibitions and car repair workshops in addition to the large warehouses that are used for different purposes, as shown in Figure 7.13. This matter has several negative environmental and health influences that affect the daily lives of the citizens (e.g. the air and noise pollution) in addition to its effect on the urban image and surrounding environment of the city in general as illustrated below.



Figure 7.13. Overlap among land uses in Al-Shifa neighbourhood (Aleqt, 2008, Alriyadh, 2011).

Table 7.19. Final score of the planning dimension of Al-Shifa neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)	
				0.00	0.25	0.50	0.75	1.00			
Land Use	4.3	Distribution of land uses	0.72		✓				Poor distribution of land uses in the area	1.08%	
		Residential schemes	0.72		✓				Random residential schemes in the area		
		Public services	0.72		✓				Low level of public services		
		Open spaces / park	0.72		✓				Poor condition of the open spaces and park in the neighbourhood		
		Effective use of land	0.72		✓				No evidence for effective use of land		
		Land ownership	0.72		✓				Presence of many problems related to land ownership		
Infrastructure	4.2	Green infrastructure	1.40	✓					No evidence for using a green infrastructure	0.70%	
		Infrastructure efficiency	1.40		✓				Low level of infrastructure efficiency		
		Infrastructure management	1.40		✓				Low level of infrastructure management		
Management	3.7	Monitoring	0.62		✓				Absence of an effective monitoring on the planning process	0.93%	
		Control	0.62		✓				Weak control over the planning process		
		Operation	0.62		✓				Low level of sufficient planning operational processes		
		Maintenance	0.62		✓				Lack of maintenance operations in the neighbourhood		
		Governmental rules and regulations	0.62		✓				Failure to follow the governmental rules and regulations		
		Planning policies and legislations	0.62		✓				Failure to follow the planning policies and legislations		
		Consideration of traffic issues	0.67		✓				Low level of the consideration of traffic issues, including the traffic congestion		
Transport	2.7	Public transportation	0.67	✓					Absence of public transport system in the neighbourhood, and in the city in general	0.50 %	
		Transport facilities	0.67		✓				Low level of the transport facilities		
		Transport policies	0.67		✓				Failure to follow the transport policies		
Total	14.9		14.9%							3.21 %	
Final Score of the Planning Dimension											3.21%

Regarding the ICT dimension, Al-Shifa neighbourhood has achieved 3.26% out of 13.10%, which is the total score of the ICT dimension. The research has found that although the ICT dimension emphasises the 21st century skill outcomes and the ability of people to access different technologies, services and resources, the consideration of the importance of such an idea in Al-Shifa neighbourhood is limited.

In reality, there is a lack of cooperation between different institutions in the area, which resulted from the deficiency and ineffectiveness of the existing administration as well as the absence of an effective institutional framework responsible for the ICT issues. The final score of the ICT dimension is presented in Table 7.20. Based on the results of the current situation of the area, this study argues that during the last two decades the urban planning of Al-Shifa neighbourhood has overlooked the significance of ICT, whilst the efforts made by different authorities to enhance such approach are inadequate.

Table 7.20. Final score of the ICT dimension of Al-Shifa neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
21st century skill outcomes	3.10	Skills levels of the society	3.10		✓				Low level of the skills of the neighbourhood residents	0.77%
ICT management	3.00	Consideration of ICT issues	1.50		✓				Lack of consideration of the issues that are related to ICT	0.75%
		Existence of an effective administration	1.50		✓				Absence of an effective administration in the neighbourhood	
Technological and institutional aspects	2.50	Effective institutional framework	1.25		✓				Absence of effective institutional framework	0.62%
		Cooperation with other institutions	1.25		✓				Lack of cooperation with other institutions	
Universal access to technology	2.30	Available universal access to technology	2.30		✓				Low level of accessing to the universal technology	0.57%
Access to services and resources 24/7	2.20	Access to services and resources 24/7	2.20		✓				Access to services and resources are limited	0.55%
Total	13.10%		13.10%							3.26%
Final Score of the ICT Dimension										3.26%

The final score of the current situation of Al-Shifa neighbourhood has been determined based on the total of the final scores of the five dimensions discussed above. As can be seen in Table 7.21 the current situation of urban planning of Al-Shifa has achieved a low score with respect to the overall score of the proposed framework, where it achieved 29.07% out of 100%, which is the total score of the proposed framework for the city of Riyadh. This score has been obtained after the comprehensive analysis of the neighbourhood state in regard to the five main dimensions, categories, and criteria of the proposed framework.

Based on the rating benchmarks presented previously in this chapter, this final score means that the urban planning of Al-Shifa neighbourhood is rated as “UNCLASSIFIED” where the final score of the urban planning is <30. This means that the urban planning of Al-Shifa neighbourhood needs to be given more attention in order to manage the current and future growth of the area sustainably and obtain an acceptable level of sustainable urban planning.

Table 7.21. Final Score of the proposed framework for sustainable urban planning of Al-Shifa neighbourhood.

SUPF Dimensions	Dimension Weight (%)	Dimension Achieved Score (%)
Environmental Dimension	29.6	5.72 %
Social Dimension	23.8	11.37%
Economic Dimension	18.6	5.51%
Planning Dimension	14.9	3.21%
ICT Dimension	13.1	3.26%
Total	100%	29.07%
Final SUPF Score of Al-Shifa neighbourhood	29.07%	
SUPF Rating	UNCLASSIFIED	

7.5.3. Urban Planning of An-Nafl Neighbourhood

An-Nafl neighbourhood is considered as one of the modern neighbourhoods that were developed during the 1990s in the north part of the city of Riyadh. It has been developed during the Post-Oil Boom Period (1990 – until the present) as a result of the rapid growth in the field of urban planning and construction development that extended to all the parts of the city due the increase in oil prices and production quantities. Figure 7.14 illustrates the main location of An-Nafl neighbourhood within the city of Riyadh.

In this research work it is argued that although An-Nafl neighbourhood has been developed relatively recently, it experiences a number of critical matters that rose from the random urban planning of the area in the absence of an effective administration to manage the urban planning sustainably. Therefore, the main purpose of this part is to evaluate the current situation of An-Nafl neighbourhood based on the five dimensions of the proposed framework for the city of Riyadh in order to determine the level of the urban planning of this area.



Figure 7.14. The main location of An-Nafl neighbourhood of the City of Riyadh.

The final environmental dimension score has been calculated for An-Nafl neighbourhood based on the procedures that were highlighted earlier and followed in the analysis of both previous case studies: Ad-Dirah neighbourhood and Al-Shifa neighbourhood. An-Nafl has achieved 6.31% out of 29.6%, which is the total score of the environmental dimension that was determined by the application of the AHP.

As is the case with both Ad-Dirah and Al-Shifa neighbourhoods, most of the issues regarding the environment have been ignored during the urban planning process of An-Nafl neighbourhood. This was a result of the concentration of the governmental authorities on the accommodation of the growth of population and spatial area rather than focusing on the sustainability aspects. The final score of the environmental dimension of An-Nafl neighbourhood is presented in Table 7.22.

Table 7.22. Final score of the environmental dimension of An-Nafl neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
Climate	9.2	Adapting to climate change	2.3	✓					No evidence of adapting to climate change	0.57%
		Reduce carbon emissions	2.3		✓			Limited effort to reduce the carbon emission into the air in the neighbourhood		
		Adapting to solar radiation	2.3	✓				No evidence of adaptation to solar radiation		
		Flood risk assessment	2.3	✓				Limited assessment for flood risks in An-Nafl neighbourhood		
Resource	5.3	Resource recycling	1.06			✓			Recycle some resources in the area such as recycling the waste	1.59 %
		Resource efficiency	1.06		✓			Limited effort to increase the resource efficiency		
		Use of local resource	1.06		✓			Using some of local resources in limited quantities		
		Use of renewable resource	1.06	✓				No evidence of using renewable resource		
Pollution	5.3	Resource management	1.06				✓		Limited effort to manage the use of the resources in the neighbourhood	1.85%
		Pollution assessment	1.06		✓			No evidence for carrying out the pollution assessment		
		Reduce noise and waste pollution	1.06				✓	Limited measures are being installed in the area to reduce noise and waste pollution		
		Reduce water pollution	1.06				✓	Limited evidences have been found in the area to reduce water pollution		
Ecology	5.2	Pollution prevention	1.06		✓				No pollution prevention measures are being followed in the area	0.00%
		Air quality	1.06		✓			No clear evidence for implementing air quality improvement systems in the area		
		Ecological assessment	1.04	✓				No evidence for carrying out the ecological assessment for the area		
		Biodiversity and habitat protection	1.04	✓				Biodiversity and habitats were disappeared due to overlook the ecological assessment		
Energy	4.6	Flora and Fauna protection	1.04	✓					No flora and fauna in the neighbourhood	2.30 %
		Ecological appraisal	1.04	✓				No evidence for carrying out the ecological appraisal		
		Ecological survey	1.04	✓				No evidence for carrying out the ecological survey		
		Passive design	1.15				✓	Using some features of passive design in some building in the area		
Total	29.6%	Energy efficiency	1.15				✓		Limited use of materials that increase energy efficiency	6.31 %
		Energy consumption	1.15				✓	Limited use of materials that reduce energy consumption		
		Energy management	1.15				✓		Limited effort to manage the energy within the area	
			29.6%							
Final Score of the Environment Dimension										
6.31 %										

During this research, the various sides of social dimension have been examined in An-Nafl neighbourhood. This examination was based on the categories and criteria of the social dimension included within the proposed framework. The final score of social dimension is presented in Table 7.23, where this neighbourhood has obtained 4.67 % out of 23.8%, which is the total score of the social dimension.

Based on the results of the current situation of An-Nafl neighbourhood, the research would argue that the efforts made by the related authorities regarding the health issues are limited. For instance, although there are about 11,877 people living in the area, there is not any primary health care centre. Moreover, the same thing can be said for the education in the area, where related authorities have not taken the considerations of the educational issues into account properly. Generally speaking, An-Nafl neighbourhood suffers from the absence of the educational services since there is only one secondary school for boys. Figure 7.15 illustrates the availability of the health and educational services in An-Nafl neighbourhood.

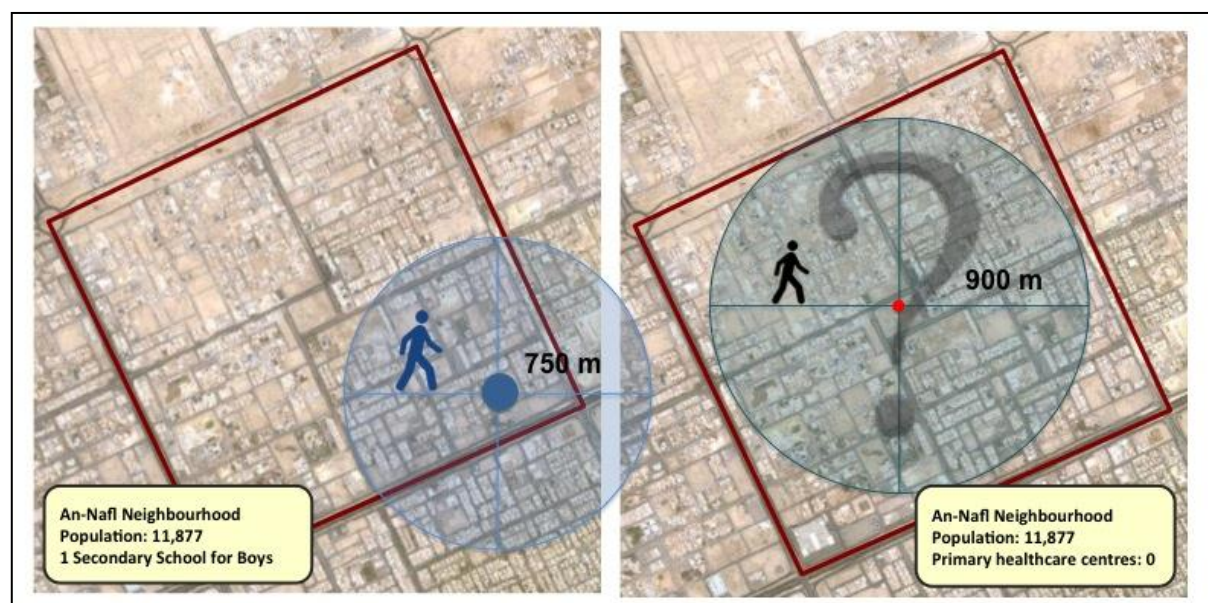


Figure 7.15. The availability of the health and educational services in An-Nafl neighbourhood.

Regarding the economic aspects of the area, the final score of economic dimension achieved by An-Nafl neighbourhood is 6.59 % out of 18.6%, which is the total score of the economic dimension as can be seen in Table 7.24. As is the case with previous case studies, this research has found that the urban planning of An-Nafl has been adopted with very little awareness of the key elements for providing a sustainable economy. For example, although An-Nafl has a number of strengths as well as an acceptable level for developing new investments with great business facilities and services, the area suffers from issues regarding the enhancement and promotion of the local economy and the lack of economic diversity.

Table 7.23. Final score of the social dimension of An-Nafl neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
Health	7.7	Consideration of health and safety issues and problems	1.925	0.00	0.25	0.50	0.75	1.00	Emphasis on the significance of health and safety issues is limited in the area	0.96%
		Providing medical facilities	1.925	✓					Not enough medical centres (only three in the Neighbourhood)	
		Easy access to health services	1.925	✓					The level of access to services is acceptable to some extent	
		Public awareness of health issues	1.925		✓				Weak public awareness of health issues	
Education	5.2	Providing educational facilities	1.04		✓				Providing the district with acceptable educational facilities	1.30%
		Health and safety within educational environment	1.04		✓				Absence of health and safety within the educational environment to some extent	
		Development of educational process	1.04		✓				The weakness of the development process of the education	
		Educational management	1.04		✓				The weakness of the educational management in the area	
Equity	4.0	Affordable access to standard educational services	1.04		✓				Basic educational services are affordable to everyone in the area	0.50%
		Equitable distribution of services	1.00	✓					Acceptable distribution of services within the area, except health services	
		Equitable distribution of income	1.00		✓				Weak distribution of income	
		Public participation	1.00		✓				Public participation is limited	
Security	3.7	Heritage preservation	1.00	✓					The heritage preservation is weak	1.11%
		Natural hazards assessment	0.74		✓				No evidences for carrying out the natural hazards assessment	
		Man-made hazards assessment	0.74		✓				Evidences for carrying out the man-made hazards assessment are limited	
		Risk mitigation	0.74		✓				Evidences for carrying out the risk mitigation are limited	
Community	3.2	Risk management	0.74		✓				Evidences for carrying out the risk management are limited	0.80%
		Crime prevention	0.74			✓			There are some efforts to prevent crime in the neighbourhood by related authorities	
		Community involvement in decision-making	0.40		✓				Weakness of community participation in the decision-making process	
		Characteristics of the population	0.40			✓			Residents of the area are classified under the category of middle-income people	
Community	3.2	Enhancement of community with essential services	0.40		✓				Providing the community with services to an acceptable level to some extent	0.80%
		Promoting digital community	0.40	✓					No evidence for promoting the digital community approach in the area	
		Consideration of culture & background	0.40		✓				Weakness of efforts to preserve the culture & background of the area	
		Promoting community participation	0.40		✓				Weakness of promoting community participation	
Community	3.2	Governance model	0.40		✓				Following a governance model within the area is limited	0.80%
		Legislations and regulations	0.40		✓				Weak of the legislations and regulations in the area	
			23.8%							
			23.8%							
Total	23.8%									4.67%
Final Score of the Social Dimension										4.67%

Table 7.24. Final score of the economic dimension of An-Nafl neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
Sustainable Economy	6.9	Enhancement of local economy	1.725		✓				Weakness of the local economy	2.16%
		Diversity of economic activities	1.725			✓			Limited diversity of the economic activities	
		Efficient use of resource	1.725		✓				Evidence of efficient use of economic resource is limited in the neighbourhood	
		Balance between income & spending	1.725		✓				Deficiency of a balance between income and spending	
Economic Growth	3.6	Developing new investment	0.60			✓			Evidence for developing new investments in the area is limited	1.50%
		Promoting local industry	0.60		✓				Lack of the local industry due to the limited of the economic diversity	
		Business facilities	0.60			✓			Fair conditions of business facilities	
		Economic capacity	0.60			✓			Fair economic capacity in the area	
		Providing healthy economic environment	0.60			✓			Attractive environment for new investments	
		Facilitate procedures to attract investments	0.60			✓			Procedures to attract investments in the district are acceptable to some extent	
Employment	3.0	Healthy employment	0.75		✓				Evidence for healthy employment in the area are limited	0.94 %
		Employment opportunities	0.75		✓				Limited job opportunities	
		Employment prospect	0.75		✓				Limited employment prospect	
		Work environment	0.75			✓			Work environment is acceptable to some extent in the area	
Employees	2.7	Skills and qualifications	0.45			✓			Skill level of neighborhood residents is fair	0.79%
		Effective training	0.45		✓				Evidence for effective training of employees is limited	
		Vocational guidance	0.45		✓				Lack of vocational guidance	
		Motivation	0.45		✓				Deficiency of motivation mechanisms for employees	
		Employees participation	0.45		✓				Weakness of employees participation	
		Working efficiency	0.45		✓				Low level of work efficiency in the neighbourhood	
Productivity	2.4	Quality	0.48			✓			Product quality is fair because of the income of the residents	1.20%
		Cost efficiency	0.48			✓			Cost efficiency is fair	
		Efficient pricing	0.48			✓			Efficient pricing is fair	
		Delivery	0.48			✓			Acceptable level of delivery based on the quality, cost, and pricing of the product	
		Accessibility	0.48			✓			Acceptable level of Accessibility based on the quality, cost, and pricing of the product	
			18.6%							
Total	18.6%									6.59%
Final Score of the Economic Dimension										
6.59%										

This research has found that there are a number of key issues that need to be considered and improved in regard to the planning dimension. For instance, the overall urban planning of the area has ignored the significance of the connection between citizens and the natural environment. The idea of providing green areas and open spaces unfortunately was not taken into account, this is considered as one of the most critical issues. Although the green areas are vital to enhancing the natural environment and obtaining citizens satisfaction by reducing temperature and noise, it has been overlooked in several parts of the city including An-Nafl neighbourhood as it is illustrated in Figure 7.16.

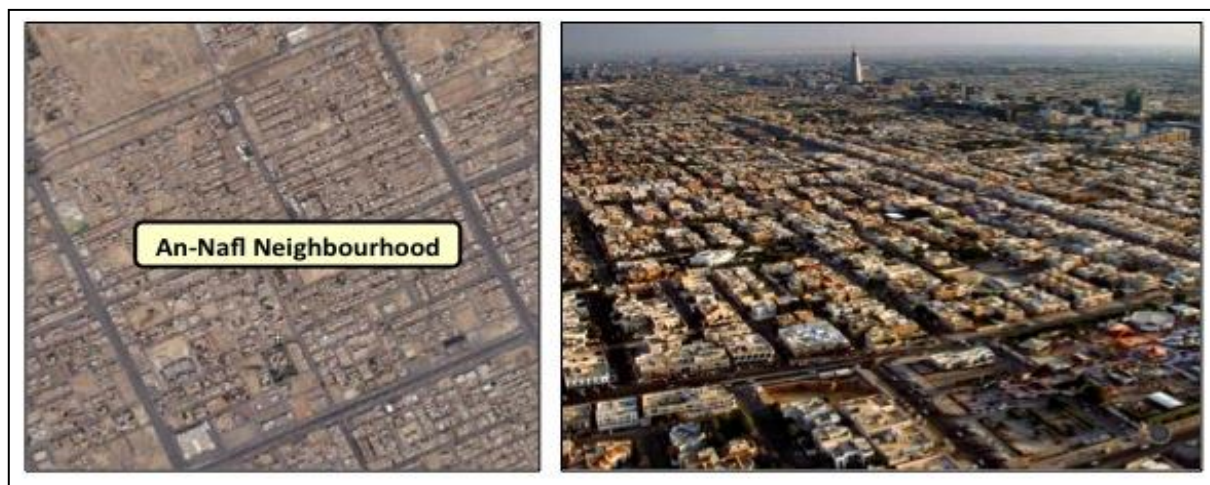


Figure 7.16. The absence of the green areas and open spaces in An-Nafl neighbourhood.

Furthermore, to avoid future risks, more attention must be given to creating a sustainable transport system and an efficient infrastructure system. The effects of the heavy rainfalls in 2010 and 2013 revealed both the poor conditions and inefficiency of the city infrastructure, as can be seen in Figure 7.17.



Figure 7.17. Damage caused by the heavy rains that fell on the city in 2010 (Alriyadh, 2010).

This study argues that there are a number of questions about the urban planning of An-Nafl neighbourhood in particular and in the city of Riyadh in general. For instance the absence of a public transport system and the corresponding reliance on the use of private cars constitute a major planning shortcoming for the city of Riyadh and affects An-Nafl as well. In short, An-Nafl neighbourhood has achieved a low score with respect to the planning dimension. It has achieved 3.91 % out of 14.9%, which is the total score of planning dimension. The final score of the planning dimension of An-Nafl neighbourhood is presented in Table 7.25.

As is the case with the previous dimensions, An-Nafl neighbourhood has achieved a low score with respect to the ICT. In this study, the score of ICT dimension is determined by looking at a number of fundamental issues in the neighbourhood (e.g. skills levels of the residents and consideration of ICT issues) and comparing them with the main categories and criteria of ICT dimension included within the proposed framework.

An-Nafl neighbourhood has achieved 4.99% out of 13.10%, which is the total score of the ICT dimension. This score can be seen in Table 7.26. Based on the results obtained from the investigation of the current situation of the ICT dimension within the area, the research has found that the level of the skills of the society is fair and acceptable to some extent compared with the previous cases studies. This can be attributed to the fact that most of the neighbourhood areas are occupied by medium and higher income families.

However, the study also has found that although the consideration of the significance of ICT has been taken into account by the related authorities in the neighbourhood, there are no obvious and practical steps to enhance the importance of ICT on the ground in the area. For example, in An-Nafl neighbourhood the ideas of having an effective institutional framework and an efficient administration are almost absent due to the weakness of the cooperation between different institutions in the area and in the city in general.

Table 7.25. Final score of the planning dimension of An-Nafl neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)	
				0.00	0.25	0.50	0.75	1.00			
Land Use	4.3	Distribution of land uses	0.72		✓				Poor distribution of land uses in the area	1.44%	
		Residential schemes	0.72			✓			Residential schemes have been designed reasonably		
		Public services	0.72				✓		Acceptable level of public services		
		Open spaces / park	0.72		✓				Poor condition of the open spaces and park in the neighbourhood		
		Effective use of land	0.72		✓				No evidence for effective use of land		
Infrastructure	4.2	Land ownership	0.72		✓				Presence of many problems related to land ownership	0.70%	
		Green infrastructure	1.40	✓					No evidence for using a green infrastructure		
		Infrastructure efficiency	1.40		✓				Low level of infrastructure efficiency		
Management	3.7	Infrastructure management	1.40		✓				Low level of infrastructure management	0.93%	
		Monitoring	0.62		✓				Absence of an effective monitoring on the planning process		
		Control	0.62		✓				Weak control over the planning process		
		Operation	0.62		✓				Low level of sufficient planning operational processes		
		Maintenance	0.62		✓				Lack of maintenance operations in the neighbourhood		
		Governmental rules and regulations	0.62			✓			Failure to follow the governmental rules and regulations		
Transport	2.7	Planning policies and legislations	0.62			✓			Failure to follow the planning policies and legislations	0.84 %	
		Consideration of traffic issues	0.67				✓		Acceptable level of the consideration of traffic issues, including the traffic congestion		
		Public transportation	0.67		✓				Absence of public transport system in the neighbourhood, and in the city in general		
		Transport facilities	0.67				✓		Acceptable level of the transport facilities		
Total	14.9	Transport policies	0.67			✓			Failure to follow the transport policies	3.91 %	
			14.9%								
Final Score of the Planning Dimension											3.91%

Table 7.26. Final score of the ICT dimension of An-Nafl neighbourhood.

Category	Weighting (%)	Criteria	Value of Each Criterion (%)	Credit Achieved					Justification for the Credit Granted	Category Score Achieved (%)
				0.00	0.25	0.50	0.75	1.00		
21st century skill outcomes	3.10	Skills levels of the society	3.10			✓			Acceptable level of the skills of the neighbourhood residents	1.55%
ICT management	3.00	Consideration of ICT issues	1.50			✓			Acceptable level of the consideration of the issues that are related to ICT	1.12%
		Existence of an effective administration	1.50		✓				Absence of an effective administration in the neighbourhood	
Technological and institutional aspects	2.50	Effective institutional framework	1.25		✓				Absence of effective institutional framework	0.62%
		Cooperation with other institutions	1.25		✓				Lack of cooperation with other institutions	
Universal access to technology	2.30	Available universal access to technology	2.30			✓			Acceptable level of accessing to the universal technology	1.15%
Access to services and resources 24/7	2.20	Access to services and resources 24/7	2.20		✓				Access to services and resources is limited	0.55%
Total	13.10%		13.10%							4.99%
Final Score of the ICT Dimension										
4.99%										

The final score of the present state of An-Nafl neighbourhood, based on the proposed framework for sustainable urban planning, has been determined based on the total of the final scores of the five dimensions discussed above. As can be seen in Table 7.27 the current situation of urban planning of An-Nafl neighbourhood has achieved 26.47% of the total score of the proposed framework for sustainable urban planning of the city of Riyadh. This score has been obtained after a comprehensive investigation of the area in light of the reality of the five main dimensions, categories, and criteria of the proposed framework.

This final obtained score means that the overall urban planning of An-Nafl neighbourhood is rated as “UNCLASSIFIED” where the final score of the urban planning is <30 based on the scoring and rating system that was developed within this research as well as the rating benchmarks presented previously in this chapter. This without doubt means that the urban planning of An-Nafl neighbourhood needs to be given more attention from various authorities in order to manage the current growth of the area sustainably, and achieve an acceptable level of sustainable urban planning.

Table 7.27. Final Score of the proposed framework for sustainable urban planning of An-Nafl neighbourhood.

SUPF Dimensions	Dimension Weight (%)	Dimension Achieved Score (%)
Environmental Dimension	29.6	6.31 %
Social Dimension	23.8	4.67%
Economic Dimension	18.6	6.59%
Planning Dimension	14.9	3.91%
ICT Dimension	13.1	4.99%
Total	100%	26.47%
Final SUPF Score of An-Nafl neighbourhood	26.47 %	
SUPF Rating	UNCLASSIFIED	

7.6. Discussion of the Main Results

These three case studies, Ad-Dirah, Al-Shifa, and An-Nafl neighbourhoods, have presented three different stories of how urban planning has been carried out in the city of Riyadh in the last few decades. Most of the results obtained from the previous investigations point out that the three selected areas in particular and the city of Riyadh in general have witnessed a

remarkable growth in the urban development field. This growth was not built on the traditional principles of urban planning but on a number of imported plans and regulations that have been adopted in the city by a number of foreign experts.

The results have confirmed that the urban planning of Ad-Dirah, Al-Shifa, and An-Nafl has been carried out with a minimum understanding and recognition of the five main dimensions of the proposed framework that include different aspects of environmental, social, economic, planning and ICT issues. Different changes occurred as result of the incredible growth of the population and spatial areas in the city during the development phases in the absence of a comprehensive strategy for development to manage and control such urbanisation.

Regarding the climate and energy aspects of the environment, the findings indicate that in the City of Riyadh the high cost of living has discouraged the residents from implementing sustainable housing and other building projects. The public perception of the new concept of passive design, for example, is that it is complex and expensive, and some residents are still not aware of the benefits of this new concept in regard to energy efficiency and consumption. Furthermore, although there are some concerns that are voiced about the initial cost of green projects, the financial benefits are still remarkable in the long term (Cityscape, 2010). These are the benefits that the residents of the city of Riyadh should begin to appreciate.

As a result of reviewing the social dimension, the research would argue that public services such as health and education have been distributed unfairly within the selected case studies and within the city of Riyadh in general. This matter without doubt has occurred due to the absence of public participation in the decision-making process. Furthermore, the public awareness of the importance of health care and disease prevention is weak and is limited to educated people, therefore, efforts need to be made by the concerned authorities to enhance public awareness by using different tools of the press, media and lectures (Al-Zawad and Aksakai, 2010, Alaamer, 2012).

In general, and as a result of reviewing the current economic situation of the three selected neighbourhoods, this research work debates that there are a number of issues that need to be improved by the relevant authorities. Unfortunately, alternative economic activities (e.g. tourism, industry and the use of solar energy instead of petroleum products) are limited in the city of Riyadh. Presently, there are many critical economic issues that are facing the sustainable urban planning of the city of Riyadh. One of the most significant matters is the emergence of so-called social and economic deprivation among some strata of society as well

as the increase in the proportion of people with low incomes and the reduction of people with middle incomes. This matter undoubtedly occurred due to the unequal distribution of the services and income on the different parts of the city, which can be attributed to short sighted local decisions.

The three selected areas have witnessed a number of different urban schemes and strategies such as Doxiadis and SCET plans during the 1970s and 1980s. However, these plans were not established on the traditional principles of the urban planning which have been pursued for a long time. The previous strategies have not taken into consideration the need for a public transport system. Moreover, the adoption of the gridiron pattern has led to a phenomenal expansion.

Finally, most of the results obtained through this testing process have emphasised the urgent need for having an effective sustainable urban planning framework due to fact that there are several issues, obstacles and challenges, which must be managed properly. The investigation of the current situation of the urban planning of Ad-Dirah, Al-Shifa, and An-Nafl neighbourhoods, based on the core dimensions of the proposed framework, points out that these three areas have grown and developed in an unsustainable manner. Therefore, the significance of having an effective sustainable urban planning framework has emerged as a critical subject that it is very important to take into account by the relevant authorities and experts. By the same token, this chapter argues that the presence of such a framework would return substantial benefits not only to the three selected case studies but also to the different areas within the city of Riyadh.

7.7. Summary

The overall aim of this chapter was to illustrate the testing process of the proposed framework for sustainable urban planning for the city of Riyadh. The processes were conducted to confirm the applicability of this proposed framework to the local context of the city. The testing process was mainly built based on the result of both Delphi technique and AHP technique in addition to the scoring and rating system that was designed during this research. The first part of this chapter gave ideas about the procedure of the testing process and presented different techniques to carry it out. The second part of this chapter discussed the testing process of the proposed framework based on the current situation of the city of Riyadh by applying this framework into three selected areas, which were the Ad-Dirah, Al-Shifa, and An-Nafl neighbourhoods.

In summary, it should be acknowledged that the testing results showed that the three case studies and the City of Riyadh in general suffer from a real problem caused by designing and planning the city unsustainably during the last few decades. This problem affects the daily lives of the population as well as the city in many ways including the environmental, social and economic aspects, for instance, the existence of different types of pollution arising from the huge number of cars and the amount of exhausts that arise from factories in the city. Furthermore, these issues include the weakness of the city planning that resulted in the inequitable distribution of services, including the health and educational services, in different parts of the city. Therefore, this research would argue that the implementation of such framework for sustainable urban planning would help the development and growth of Riyadh to be managed sustainably.

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATIONS

8.1. Introduction

The purpose of this chapter is to conclude the thesis with a summary of the main findings obtained during this research. It seeks to deliver an answer to the research questions that were raised and highlighted previously in Chapter One. The answer will be primarily based on the findings from the research as a whole. The chapter aims to give general recommendations for the implementation of the developed proposal of a sustainable urban planning for the city of Riyadh and some suggestions to improve the current situation in the city. Additionally, the chapter outlines the main research limitations that faced the researcher and highlights some recommendations for further research.

Therefore, this chapter has been divided into four main parts. The first part provides the answers to the overarching research questions based on the results of this study. The second part of this chapter presents general recommendations for the application of the proposed framework designed in this research for the city of Riyadh. The main limitations of this research work will be discussed in the third part. Last but not least, the fourth part of this chapter proposes and highlights some recommendations for future research.

8.2. Research Conclusion

The purpose of this research study was to investigate and examine the current condition of the urban planning, in terms of sustainability, within Saudi Arabian cities in general and particularly within the capital city of Riyadh. The research involved a number of fundamental stages to achieve this purpose. A review of the notion of a sustainable urban planning concept was carried out at the beginning of this research (Chapter Two) to establish a theoretical background, and identify the limitations in the existing frameworks for city sustainable development. A background of the urbanisation process of the city of Riyadh was provided (Chapter Four), starting from the beginning of the 20th century, in order to discuss the different strategies and schemes that have been adopted and impacted the urban planning in the city.

As described in the first chapter, this thesis seeks to address the following research question: can the urban planning of the city of Riyadh be managed sustainably through an adapted sustainable urban planning framework? Additionally, this main research question has a number of sub-questions that are branched from it, which can be stated as follows:

- What are the gaps in the current frameworks for sustainable urban planning and how can they be improved?
- What are the current practices of urban planning in the city of Riyadh and what are their limitations and barriers?
- What are the main environmental, social, economic, planning, and ICT factors affecting the urban planning process in the city of Riyadh?

The main research question, as well as the sub-questions, has been answered throughout four main stages over the course of this study. One stage is considered as a theoretical stage, while the other three stages are considered as practical stages. The first stage, the theoretical stage, focused on the literature review to establish a comprehensive picture of the sustainable urban planning approach and review the different existing frameworks for sustainable city development. The second stage is a practical study, which employed the Delphi technique to evaluate the proposed framework based on the opinion of a number of experts.

The third stage focused on the application of the AHP to give weight to each dimension, category and criterion of the proposed framework. The fourth stage is the testing process stage, conducted to confirm the applicability of the proposed framework of sustainable urban planning to the local context of the city of Riyadh. The following paragraphs will discuss and answer each of the previous research questions individually.

Research Question 1 (The Main Research Question):

“Can the urban planning of the city of Riyadh be managed sustainably through an adapted sustainable urban planning framework?”

The main research question was answered by the results from the three practical stages: the Delphi technique, the Analytic Hierarchy Process (AHP), and the testing process stage. Throughout the Delphi consultation process the 35 experts, who have completed the three rounds, point out that the city of Riyadh has witnessed a considerable growth in its urban development during the last few decades. There was a consensus among those experts in regard to the fact that this growth was not built on the fundamental principles of sustainable urban planning.

Moreover, the panel argues that the urban planning of the city of Riyadh has been followed with minimal understanding and recognition of environmental, social, economic, and planning issues in addition to the ICT concerns during the last few decades. Experts

emphasise that sustainable development matters have raised increasingly important concerns that must be considered in the urban planning process for modern cities such as the city of Riyadh.

Findings reached through the Delphi process have emphasised the need for the proposed framework due to the existence of several issues, obstacles and challenges, which need to be dealt with and managed in an informed and integrated way. Moreover, the significance of having such an effective sustainable urban planning framework has emerged as a critical issue. Therefore, experts are of the opinion that the adoption of the proposed framework of sustainable urban planning for the city of Riyadh that has been designed in this study will help to manage the current and future growth of the city in a sustainable manner.

Indeed, they confirm that such a framework would deliver substantial benefits to residents and built environment as well as the city as a whole. Experts stress that there are a number of core issues included within this proposed framework that are critically significant to understand, realise and take into account. These issues include the understanding of the historical development of the city, limitations of previous plans, environmental issues, society characteristics, sustainable economy, and a proper planning process as well as the importance of the ICT network.

In this research, the experts were pleased to participate in further investigation, which aimed to develop a rigorous framework that could be readily applicable. They were asked to compare the different dimensions and categories of the proposed framework with each other in order to determine the weight and priority for each one by the use of the AHP. In this comparison, the consistency and validity of the findings and results have been confirmed based on the consistency ratio (CR), provided by the Expert Choice software.

In this study, the proposed framework is tested through real-world case studies. Three areas from the city of Riyadh have been chosen as case studies: Ad-Dirah, Al-Shifa, and An-Nafl neighbourhoods. The areas were selected to examine the applicability of the proposed framework in the local context of the city of Riyadh. The results have confirmed that the urban planning of Ad-Dirah, Al-Shifa, and An-Nafl particularly and the city of Riyadh in general has been carried out with a minimum consideration of the main dimensions of the proposed framework, which undoubtedly played a major role in shaping the city.

Results obtained through the testing process have stressed the urgent need for having an effective sustainable urban planning framework for the city of Riyadh due to fact that the

selected areas have achieved a low and unclassified level of the sustainable urban planning. As indicated in Chapter Seven, the three areas that were investigated achieved between 23.84% and 29.07% of the total score of the proposed framework.

Research Question 2:

“What are the gaps in the current frameworks for sustainable urban planning and how can it be improved?”

This question was answered through the literature review in Chapter Two. In this study, three of most common and internationally well-known frameworks, BREEAM Communities, CASBEE-UD and LEED-ND, were discussed. These three frameworks present different approaches of the creation of sustainable city development and the selection of the categories and criteria. It was discussed how despite the fact that these frameworks were established in different countries, under different circumstances and for different goals, all of them aim to achieve sustainable urban planning. However, as can be seen through the critique of these three frameworks, the research found that these frameworks have a number of strengths and weaknesses.

One of their most important strengths is their adoption of the major issues of the sustainable urban planning. For instance, they are more aware of the environmental matters, which are connected to urban areas including climate change, ecosystems and green infrastructure. Furthermore, there are common concerns between these three frameworks in terms of highlighting the significance of the issues of energy, resources and transportation. On the other hand, there are a number of weaknesses that have been identified as well. One of the most evident weaknesses is that these frameworks offer no explanation on how to be implemented outside the countries in which they were developed. For instance, how these frameworks deal with the variations of the regional and local context of different cities and different social background.

The research has found that these frameworks have overlooked a number of key issues such as addressing the financial issue, which is considered as one of the principles of a sustainable urban planning and one of the most important factors that would determine either success or failure of the development. Additionally, these frameworks failed to address how they deal with the management issue as an important factor in the development process. These issues without doubt also have emphasised the pressing need for adopting the proposed framework for sustainable urban planning of the city of Riyadh.

Research Question 3:

“What are the past and current situations of the urban planning of the city of Riyadh?”

This question has been answered by the findings obtained through Chapter Four that was concentrated on the review of the past and current situation of the city of Riyadh. As mentioned previously, in the last few decades the city of Riyadh has witnessed a significant change in the urban development field that was not built on the traditional principles of urban planning that have been pursued in the city for a long time. A number of imported schemes and regulations for urban planning have been adopted in the city by a number of foreign experts. Therefore, these schemes failed to deal with the urban planning of the city of Riyadh, which was beyond the scope of these plans each time they were applied.

Results reached through this study have emphasised that the urban planning of the city experiences a number of limitations and barriers at the current time that prevent the development of the city from being carried out in a sustainable manner. These issues have emerged from neglecting many aspects that are linked to the social, environmental, economic, planning and ICT aspects. Therefore, and based on the findings from studying the present condition of the city of Riyadh, this research argues that in order to improve the current situation of the city and manage its future urban planning, the city needs to have an effective framework for sustainable urban planning.

Research Question 4:

“What are the main environmental, social, economic, planning, and ICT factors affecting the urban planning process in the City of Riyadh?”

Results obtained over the course of this study have answered this question. The research has investigated the most important factors that play a major role in the development of the city. This study indicated a number of fundamental factors that are connected to the environment, society, economy, planning, and ICT, which need to be considered to manage the urban planning of the city. The issues classified within five main dimensions that are forming the proposed framework which are environmental, social, economic, planning, and ICT dimension as can be seen in the final version of the proposed framework for sustainable urban planning of the city of Riyadh in Figure 8.1. Each one of these five dimensions has then been divided into categories, which are represented with their corresponding criteria.

These dimensions, categories, and criteria have been identified through a literature review and a comparative analysis and evaluation of existing frameworks for sustainable city development.



Figure 8.1. The proposed framework for sustainable urban planning of the City of Riyadh.

As a result of the discussion and analysis included within this research work there is no doubt in concluding that the main hypothesis of this research has been proved. The hypothesis indicates that a comprehensive consensus-based framework for sustainable urban planning, supported by an understanding the key issues of sustainability and supported by clear and comprehensive guidelines, can manage the urban planning of the city of Riyadh sustainably.

Most of the findings obtained through this research work have confirmed that the role and importance of ICT has emerged as one of the critical issues that must currently be taken into account by the related authorities responsible for the urban planning of the city. As indicated during this study the city of Riyadh was beyond the scope of the previous plans and schemes

each time they were applied due to the absence of the technological system such as ICT network for decision-makers containing a clear mental picture for the growth of the city and all the required data and information.

Therefore, this research argues that the adoption of ICT in the city of Riyadh will help to improve the current situation of the city by providing an obvious picture of the current state of the city and giving scenarios of the future growth in order to manage the growth of the whole city sustainably. Experts who have participated in this study have showed a movement towards a consensus and agreed that ICT needs to be considered within the proposed framework, because it has the ability to connect the different dimensions within the framework together and exchange the different information and data between different institutions in order to achieved the desired objectives.

8.3. General Recommendations

The planned outline of viable expansion of town planning for the city of Riyadh must be ensured so that the desirable milestones would effectively be accomplished. So there are many common suggestions for this study, and for which the planned framework, specifically, holds great significance in successful execution; and generally the existing scenario in Saudi Capital, Riyadh may be enhanced considerably by the dynamic role of this outline. The given below fundamental points illustrate the most significant suggestions:

- Although urban planning is a geographical and cultural depended research topic, still there is room for beneficial added value in considering frameworks established in other domains. For instance, western urban planning experience can help and form an effective element when considering urban planning in eastern premises such as the city of Riyadh. Hence, the researcher suggests future comprehensive consideration of such experiences in related studies.
- Integrating skills and teamwork from all concerning organizations and inhabitants' representatives in the city of Riyadh for planning and expansion of the city will enrich the planning process. Moreover, participants from other Saudi cities so that the wider civic awareness of the Kingdom planning can be accomplished.

- The native traditions of the society must be highly regarded, for example, during the development of a new feasible public transport system, the privacy of Saudi families must be prioritized and the use of private vehicles across the city must be curtailed. For instance, special places need to be considered for families in this new transport system to achieve the desired privacy.
- Significance of sustainable community including economical, environmental and public aspects along with health benefits should be demonstrated by launching of educational awareness and learning based programs in the media for the general public.
- Weather transformation issues and utilization of sustainable resources must be extensively focused to enhance the quality of the atmosphere along with the effective control of the ecological risks such as pollution and also by preserving the land views and unique biodiversity.
- All the major stakeholders should be involved in the provision of projected and structural milestones to emphasise general benefits to the authority to avoid conflict of interests among parties in advance.
- For Saudi Arabian provinces, it is vital to consider a method to incorporate both genders in the panel size for Delphi study to reflect in the outcome for proper experts' opinions for future urban planning studies in the country.

8.4. Limitation of the Research

During this particular research work, the researcher faced various barriers and restrictions that were similar to many previous research studies. Outcomes of the research are likely to derive these limits through the utilization of diverse techniques such as the Delphi technique and AHP, where many frequent despatches of questionnaires to the experts and several face-to-face interviews are involved. Several limitations faced the research and played an important role in forming the addressed scope of the study. The key points listed below encapsulate these limitations:

- There is limited data available about reality of the town planning and expansion of the city of Riyadh with respect to sustainability. The desire to incorporate the original data has certainly been compromised and affected the size of the questionnaire so that the research questions could be addressed in a significant manner.
- Regarding the discussion of the existing frameworks for sustainable city development, this study would like to point that, because the technical articles dealing with these frameworks are recently published, the number of scientific papers analysing them is limited, which made the comparison of these frameworks some how compromised in this study.
- In this specific study, the researcher would like to highlight the fact that due to the nature of the urban planning field in Saudi cities as well as the cultural context of the society the majority of experts who were participated in this research were male. This limitation to the study may have resulted in gender-biased outcome.
- Regarding the testing of the proposed framework, the researcher would like to acknowledge that it was difficult to assess every single criterion included within the proposed framework and therefore the credit achieved has been divided into five points as described in Chapter Seven because of the fact that not every criterion can be measured on the ground accurately.
- Also, the researcher would like to clarify that during this research three different areas of the city of Riyadh have been selected to examine the applicability of the proposed framework due to the difficulty of applying this framework to the whole city, which needs to have teams to carry that out in addition to taking a long time to achieve. This limitation affected the outcomes of the study, so that it is not considering the whole city of Riyadh as one domain of study.
- As stated in many Delphi related studies, the recommended sample size of a single Delphi panel is between ten and eighteen members. However, due to the large number of experts involved in the study, the consensus and conformity impact the outcome of the study in increasing the number of categories and criteria of the proposed framework. Hence, this complicated the analysis process to deduce a trustful outcome.

8.5. Recommendations for Further Research

As discussed in the previous section, there are a number of limitations that shaped the scope of this research study. Undoubtedly, these limitations can provide guidelines for further research to be conducted. This thesis has focused on the city of Riyadh and it provides a platform for developing a sustainable urban planning framework to manage the growth of the city in a sustainable manner. However, as mentioned previously, this study has applied the proposed framework to three selected areas in the city of Riyadh due to the difficulty of applying the framework to the entire city. Therefore, future research would benefit from the knowledge gained from conducting this research work with its associated techniques to different parts of the city of Riyadh. Additionally, further research could concentrate on other cities, whether in Saudi Arabia or internationally.

Research can be further developed and expanded to deal with specific issues. For instance, further research on one of the five main dimensions of the proposed framework that was designed in this study. Regarding the city of Riyadh, further studies on transportation issues are highly recommended because of the absence of a public transport system in the city. The studies could follow the techniques used in this thesis to establish the opinion of the experts as well as the society regarding the idea of developing a sustainable public transport system and to identify the main opportunities and constraints for that. More focus could be given on how to design this system to be sustainable, for example, through the use of solar energy instead of using fuel to develop public transport means. This idea without doubt will help to establish a secure transport system within the city in addition to change the current transport system to be more environmentally friendly.

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APPENDIX A

ETHICAL APPROVAL FORMS

Cardiff School of Engineering

Ethical Approval Application for Non-Clinical Research Involving Human Participants, Data or Materials

Tick one box: ☐ Staff project ☒ PG Research project ☐ UG or PG Taught Project

Title of project : A CONSENSUS-BASED FRAMEWORK FOR THE SUSTAINABLE URBAN PLANNING

DEVELOPMENT OF THE CITY OF RIYADH

Name of researchers: ALI MUFLAH ALQAHTANY

Name of Supervisor (student research projects): Professor Yacine Rezgui

Project Start Date: 01/01/2011

Is this research:

a) non-clinical



Please complete sections A-J.

b) clinical



Your project may be beyond the remit of the School Ethics Committee.

(involving NHS patients,

data, facilities or staff)

Please see the "Ethical Review Options Map" in Appendix C of the School Ethical Procedures. If appropriate, seek approval from the appropriate Local Research Ethics Committee.

A. PARTICIPANTS

		Yes	No	N/A
1	Does your project include children or young people up to 18 years of age?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Does your project include people of any age with learning or communication difficulties?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Does your project include people of any age belonging to a vulnerable group?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

If you have answered "Yes" to any of the above, please confirm that you have gained all necessary authorisation, that ethical issues have been addressed and that you have read CU's Interim Guidance for Researchers Working with Children and Young People (Appendix E of ENGIN Policy). It is your responsibility to check the existence of and comply with any legal requirements, such as vetting procedures. ☐

B. CONSENT AND PARTICIPATION

		Yes	No	N/A
4	Will you tell participants that their participation is voluntary?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Will you obtain written consent for participation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	If the research is observational, will you ask participants for their consent to being observed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Will you tell participants that they may withdraw from the research at any time and for any reasons?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Will you give potential participants a significant period of time to consider participation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Will you give participants the option of omitting questions they may not wish to answer?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Will you explain the main experimental procedures to participants in advance so that they are informed as to what to expect?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Will you debrief participants at the end of their participation (i.e. give them a brief explanation of the study)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you have answered "No" to any questions in this section, please provide an explanation in Section F.

C. RISKS OF HARM TO PARTICIPANTS

		Yes	No	N/A
13	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
14	Is there any realistic risk of any participants experiencing a detriment to their interests as a result of participation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
15	Will your project involve deliberately misleading participants in any way?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

If you have answered "Yes" to any questions in this section, please explain in section F how you propose to minimise these risks.

D. DATA PROTECTION

		Yes	No	N/A
16	Will any non-anonymised and/or personalised data be generated and/or stored?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	If "Yes" will you gain the consent of the individuals concerned?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Will you have access to documents containing sensitive data about living individuals?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	If "Yes" will you gain the consent of the individuals concerned?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If “No” please give details in Section F.

* Sensitive data are *inter alia* data that relates to racial or ethnic origin, political opinions, religious beliefs, trade union membership, physical or mental health, sexual life, actual and alleged offences.

E. HUMAN MATERIALS

		Yes	No	N/A
18	Does your research involve the use of human materials?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	If “Yes” will your research conform to all the requirements of the Human Tissue Act 2004?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If “No” please give details in Section F.

F. Please use this space to provide further information/explanation in relation to your responses above:

Continue on a separate sheet as necessary.

G. OTHER ETHICAL CONSIDERATIONS

Please note in the space provided any additional ethical issues that you think the Committee should consider. It

Continue on a separate sheet as necessary.

is your obligation to bring to the attention of the Committee any ethical issues not already covered on this form.

H. Please give a brief description of the project, or attach copy of funding application:

Continue on a separate sheet as necessary.

I. Health & Safety/Risk Assessment

Principal Investigator/Supervisor: please sign to confirm that the relevant health and safety measures, in accordance with University policy and School requirements, have been taken into account for the proposed research.

J. UG/PGT Student Project Authorisation

To the student: please submit this form to your project supervisor.

To the supervisor: please sign in Section I. Health & Safety/Risk Assessment and then submit this form to the Research Office for consideration by the School Ethics officer.

Approval by School Ethics Officer

I confirm that I believe that all research ethical issues have been dealt with in accordance with University policy and the research ethics guidelines of any relevant professional bodies.

Name: _____ Signature: _____ Date: _____

The School Ethics Officer's signature indicates the project is approved and may commence.

K. PGR/Staff Project Authorisation

Principal Investigator/ PGR Supervisor: please sign below to confirm that you believe all research ethical issues have been dealt with in accordance with University policy and the research ethics guidelines of any relevant professional bodies.

Name: _____ Signature: _____ Date: _____

Please submit this form to the Research Office. The application will be considered by the School Ethics Officer, the Lay Member and the Internal Member of the School Ethics Committee, and a recommendation on approval made to the next meeting of Research Committee, after which you will be informed of the decision of the Committee. Please note the project may not commence until you have received approval from the Committee.

Recommendation by Lay Member of School Ethics Committee

I recommend ☐ / do not recommend ☐ that this project should be approved by Research Committee

If not recommended for approval, please note reason (or attach separately):

Name: (Cardiff and Vale University Health Board (UHB) Signature: _____ Date: _____

Recommendation by Internal Member of School Ethics Committee

I recommend ☐ / do not recommend ☐ that this project should be approved by Research Committee

If not recommended for approval, please note reason (or attach separately):

Name: _____ Signature: _____ Date: _____

Recommendation by School Ethics Officer to Research Committee

I recommend ☐ / do not recommend ☐ that this project should be approved by Research Committee

If not recommended for approval, please note reason (or attach separately):

Name: _____ Signature: _____ Date: _____

Date reviewed at Research Committee : Outcome: Approved ☐ Not Approved ☐

Date reported to School Board :

APPENDIX B

INVITATION TO PARTICIPATE IN THE RESERACH

INVITATION TO PARTICIPATE IN THE DELPHI TECHNIQUE QUESTIONNAIRE

Dear Participant,

I am a PhD student at School of Engineering in Cardiff University in United Kingdom. As a part of my Degree, I am undertaking a research that aims to examine the urban planning in the City of Riyadh based on a proposed framework of an effective sustainable urban planning. This framework has been designed based on two main bases. Firstly, the scientific research and knowledge, which include the academic research papers and reports. Secondly, based on the strengths of the existing frameworks of city sustainable development such as BREEAM for Sustainable Communities, CASBEE for Urban Development and LEED for Neighbourhood Development.

This stage of research focuses primarily on the evaluation of this proposed framework in order to ensure that it is acceptable, reliable and valid. This process will be done through the use of one of the most valuable techniques to evaluate the framework, which is the Delphi Techniques. It will be used to obtain the views of experts regarding the proposed framework in terms of the dimensions, categories and criteria and will involve three rounds of questionnaires.

Your contribution to this research is very significant to the success of this study work. Therefore, I would be grateful if you accept this invitation to participate in this study. Reading and answering the questionnaire will take approximately 30 minutes, and I am looking forward for your participation. All information submitted from the participants will be used for research purposes only and will be treated and analysed confidentially. Only statistical summary and summarised information will be reported or published.

Please do not hesitate to contact me for any further questions.

Sincerely,

Ali Al-Qahtany
PhD Candidate
Cardiff University
Cardiff
United Kingdom
E-mail: AlqahtanyA@cardiff.ac.uk
Alqahtany-Ali@hotmail.com
Mobil: 00966503999959
00447423334946

INVITATION TO PARTICIPATE IN THE ANALYTICAL HIERARCHY PROCESS (AHP) QUESTIONNAIRE

Dear Participant,

First of all, I would like to express my sincere thanks for your participation in the three rounds of Delphi Technique that aimed to examine the proposed framework for sustainable urban planning of the City of Riyadh. The result of those three rounds shows that experts have reached a consensus regarding the contents of the proposed framework and emphasised the importance of such as framework being implemented in the City of Riyadh.

This final questionnaire aims to evaluate the relative importance of the main dimensions and categories within the proposed framework. In the questionnaire, experts are asked to compare pairs of dimensions and categories, decide which of the two is more important and quantify the intensity of importance using the 9-point Saaty scale. This stage is a very important where the result will be analysed using Analytical Hierarchy Process (AHP) and the analytical functions of Expert Choice software to elicit the weights and priorities of the dimensions and categories.

Your contribution to this final stage is very important to the success of this research work. Therefore, I would be grateful if you participate in this stage. Reading and answering this final questionnaire will take approximately 30 minutes. All information submitted from the participants will be used for research purposes only and will be treated and analysed confidentially. Only summarised information will be reported or published.

Please do not hesitate to contact me for any further questions.

Sincerely,

Ali Al-Qahtany

PhD Candidate

Cardiff University

Cardiff

United Kingdom

E-mail: AlqahtanyA@cardiff.ac.uk

Alqahtany-Ali@hotmail.com

Mobil: 00966503999959

00447423334946

APPENDIX C

DELPHI TECHNIQUE QUESTIONNAIRE (ROUND ONE)

Towards an Effective Sustainable Urban Planning Development

1. The Scope of the Study

The capital city of the Kingdom of Saudi Arabia, Riyadh, is generally considered the largest Arab city in terms of space. It is also one of the fastest growing cities in the world because of the significant expansion in various fields. It has grown from a small mud-walled town to a global metropolis with universal aspirations. In less than half a century, the area of Riyadh has expanded more than a hundred times from a small town surrounded by walls to a modern city that occupies an area of approximately 2435 square kilometres.

The contribution of this research is to examine the urban planning development in the city based on a proposed model of an effective sustainable urban planning development that can be seen below in Figure 1. It has been designed based on two main bases. Firstly, the scientific research and knowledge, which include the academic research papers and reports. Secondly, based on the strengths of the existing frameworks of city sustainable development such as BREEAM for Sustainable Communities, CASBEE for Urban Development and LEED for Neighbourhood Development from the USA.

Figure.1 Proposal for the sustainable urban planning development framework with the dimensions, categories and criteria.



This stage of research will focus primarily on the evaluation of this proposed Model in order to ensure that it is acceptable, reliable and valid. This process will be done through the use of one of the most valuable techniques to evaluate the model, which is the Delphi Techniques. It will be used to obtain the views of experts regarding the proposed model in terms of the dimensions, categories and criteria. Undoubtedly, the views and opinion will play a great role to obtain the desired objectives of this study.

2. Personal Information

1. Personal Information

Name:	<input type="text"/>
Institution:	<input type="text"/>
Address:	<input type="text"/>
City/Town:	<input type="text"/>
Country:	<input type="text"/>
Email Address:	<input type="text"/>
Phone Number:	<input type="text"/>

Towards an Effective Sustainable Urban Planning Development

3. The Current Status of Urban Planning in the City of Riyadh

At the current time and as a result of the remarkable developments and oil boom in the Kingdom, the city of Riyadh has experienced many environmental, social, economic and urban planning changes. It has affected the living conditions of the citizens, natural resources, environment and economy. The aim of this part of the survey is to give a comprehensive review of the current state of sustainable urban planning development within the capital city of Riyadh.

2. Generally speaking, what do you think about the current status of urban planning in the city of Riyadh?

*3. To what extent do you agree or disagree with that the city of Riyadh has been developed in unsustainable manner?

- ☐ Extremely agree
- ☐ Moderately agree
- ☐ Slightly agree
- ☐ Neither agree nor disagree
- ☐ Slightly disagree
- ☐ Moderately disagree
- ☐ Extremely disagree

Add comments (please specify)

*4. Please indicate the level of influence of the following issues on the process of urban planning development in Riyadh?

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential	N/A
Social issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planning issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ICT issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

***5. How concerned are you about the sustainable urban planning development in the city of Riyadh?**

- ☐ Extremely concerned
- ☐ Very concerned
- ☐ Moderately concerned
- ☐ Slightly concerned
- ☐ Not at all concerned

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

4. A Proposed Model for Sustainable Urban Planning Development for the City...

The core of this framework has four key dimensions, which must be integrated in order to achieve the desired goal of this proposal framework. Namely environmental, social, economic and planning dimension. Furthermore, each one of them has a number of major categories in addition to a number of criteria. In the same context, the model has an additional dimension, which is the information and communication technology dimension (ICT). This one will be presented as an implicit dimension that will be included within all of the four key dimensions. This proposed framework can be seen in Figure 1 which includes its main dimensions, major categories and the criteria.

*6. To what extent do you agree or disagree with the contents of this proposed model?

- ☐ Extremely agree
- ☐ Moderately agree
- ☐ Slightly agree
- ☐ Neither agree nor disagree
- ☐ Slightly disagree
- ☐ Moderately disagree
- ☐ Extremely disagree

Add comments (please specify)

*7. Does this model have too many, too few, or about the right number of dimensions, categories and criteria?

- ☐ Much too many
- ☐ Somewhat too many
- ☐ Slightly too many
- ☐ About the right number
- ☐ Slightly too few
- ☐ Somewhat too few
- ☐ Much too few

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*8. Please indicate the level of importance of the following dimensions?

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Social dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planning dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ICT dimnsion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*9. In your opinion, do you think there are another factors that should be considered within this model?

- ☐ Yes
- ☐ No
- ☐ I am not sure

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

5. Social Dimension

The social dimension looks at meeting the different needs for people in order to provide high citizens satisfaction. There is no doubt that sustainable urban planning development is difficult to achieve without people who feel that they have a fair share of wealth, safety and influence as mentioned before. Therefore, this dimension aims to provide the society with the essential services in order to reach citizen satisfaction. It has five main categories which are health, education, equity, community and security. Each one of these five categories has a number of criteria.

*10. Please indicate the level of influence of the following categories of social dimension on sustainable urban planning development?

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Security	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*11. Please rate the importance of the following criteria of Health Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Consideration of health and safety issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing medical facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Easy access to health services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public awareness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*12. Please rate the importance of the following criteria of Education Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Providing educational facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health and safety within educational environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Development of educational process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Educational management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Easy access to educational services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*13. Please rate the importance of the following criteria of Equity Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Equitable distribution of services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equitable distribution of income	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public participation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heritage preservation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*14. Please rate the importance of the following criteria of Community Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Community involvement in decision-making	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Characteristics of the population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enhancement of the community with essential services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Application of the concept of digital community (connected the community through the broadband network)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consideration of the culture and background of the community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*15. Please rate the importance of the following criteria of Security Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Natural hazards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Man-made hazards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk mitigation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crime prevention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

6. Economic Dimension

The economic dimension deals with a number of aspects regarding the economy and it aims to achieve sustainable economic environment and focuses on the importance of the achievement of stable economic growth. Additionally, it works to organise the production and consumption processes and choosing forms of production that minimise the use of resources and reduce environmental pollution. The dimension has five key categories, which are sustainable economy, growth, employment, employees and productivity. Each one of these five categories has a number of criteria.

*16. Please indicate the level of influence of the following categories of economic dimension on sustainable urban planning development?

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
Sustainable economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic growth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Productivity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*17. Please rate the importance of the following criteria of Sustainable Economy Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Enhancement of local economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diversity of economic activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Efficient use of resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Balance between income and spending	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*18. Please rate the importance of the following criteria of Economic Growth Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Developing new investment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting local industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic capacity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*19. Please rate the importance of the following criteria of Employment Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Healthy employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Possibility of obtaining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*20. Please rate the importance of the following criteria of Employees Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Skills and qualifications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vocational guidance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Motivation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees participation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*21. Please rate the importance of the following criteria of Productivity Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Efficient pricing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delivery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accessible to everyone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

7. Planning Dimension

It is argued in this research that sustainable urban planning development not only based on environmental protection, economic growth and social equity, but also on a strong foundation of good planning. The planning dimension highlights several concerns in terms of planning aspects that include the proper use of the land, addressing the infrastructure issues and consideration of the importance of transportation matters. It contains five main categories which are land use, infrastructure, transport, governance and management. Each one of these main categories has a number of criteria.

*22. Please indicate the level of influence of the following categories of planning dimension on sustainable urban planning development?

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
Land Use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*23. Please rate the importance of the following criteria of Land Use Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Distribution of land use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Residential schemes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open spaces/park	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective use of land	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*24. Please rate the importance of the following criteria of Infrastructure Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Green infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*25. Please rate the importance of the following criteria of Transport Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Consideration of traffic issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public transportation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport policies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*26. 31. Please rate the importance of the following criteria of Management Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintenance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

8. Environmental Dimension

The environmental dimension focuses on a number of critical issues that are related to the environment. For instance, it considers the phenomenon of global warming and reduces the emissions to the environment. Also, it touches the subjects of the biodiversity, natural environment and the ecosystem. Moreover, the energy and resource issues have been taken into account in this framework with the aim to maintain a stable resource base. The dimension has five main categories and each one of them has a number of criteria. These categories are climate, ecology, energy, resource and pollution.

*27. Please indicate the level of influence of the following categories of environmental dimension on sustainable urban planning development?

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
Climate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pollution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*28. Please rate the importance of the following criteria of Climate Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Global warming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Climate emissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solar radiation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flood risk issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*29. Please rate the importance of the following criteria of Ecology Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Ecology assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flora / Fauna	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecological Appraisal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecological Survey	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

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*30. Please rate the importance of the following criteria of Energy Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Passive Design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy Efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consumption	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*31. Please rate the importance of the following criteria of Resource Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Resource recycling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of local resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using of renewable resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*32. Please rate the importance of the following criteria of Pollution Category

	Extremely important	Very important	Moderately important	Slightly important	Not at all important	N/A
Pollution assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Noise and waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water pollution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pollution prevention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Air quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

9. Information and Communication Technology Dimension (ICT)

Undoubtedly, the role and importance of ICT has emerged as one of the most important key issues that must currently be taken into account. It looks at a number of essential issues that affect the daily human life. For example, it emphasises the 21st century skills outcomes and the ability of citizens to access the technologies, services and resources. It has five main categories which are 21st century skill outcomes, universal access to technology, access to services and resources (24/7) in addition to ICT management.

***33. Please indicate the level of influence of the following main categories of ICT dimension on sustainable urban planning development?**

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
21st century skill outcomes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Universal access to technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to services and resources 24/7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ICT management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

APPENDIX D

DELPHI TECHNIQUE QUESTIONNAIRE (ROUND TWO)

Towards an Effective Sustainable Urban Planning Development

Feedback and Revision from Round 1.

Dear expert,

First of all, I would like to thank you for your valuable contribution in Round 1 of this study and I would be grateful if you could participate in the second Round which contains the feedback and suggestions from the experts regarding Round 1. In Round 2, there will be a review for the categories and criteria that obtained an acceptable rating during the Round 1 in addition to assess the new criteria that were given by the experts during the Round 1.

Once again thank you for your valuable participation with my great appreciation for your time and effort.

*** 1. Please write your full name:**

Name:

Towards an Effective Sustainable Urban Planning Development

A Proposed Model for Sustainable Urban Planning Development for the City of...

This section aims to review the important level of the core dimensions of the proposed model for sustainable urban planning development for the city of Riyadh.

*2. Please indicate the level of importance of the following dimensions:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
1. Social Dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Economic Dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Planning Dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Environmental Dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. ICT Dimension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

1. Social Dimension

This section aims to review the selected and recommended categories of Social Dimension and their criteria. These categories are as follow:

- Health.
- Education.
- Equity.
- Community.
- Security.

*3. Please indicate the level of influence of the following categories of social dimension on sustainable urban planning development:

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Security	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*4. Please rate the importance of the following criteria for category of Health:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Consideration of health and safety issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing medical facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Easy access to health services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public awareness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*5. Please rate the importance of the following criteria for category of Education:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Providing educational facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health and safety within educational environment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Development of educational process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Educational management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Affordable access to standard educational services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*6. Please rate the importance of the following criteria for category of Equity:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Equitable distribution of services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equitable distribution of income	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public participation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heritage preservation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*7. Please rate the importance of the following criteria for category of Community:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Community involvement in decision-making	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Characteristics of the population	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enhancement of the community with essential services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting digital community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consideration of the culture and background of the community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

***8. The following criteria are recommended to be included within the category of community under the social dimension. Could you please indicate your opinion about these recommended criteria?**

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Promoting community participation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Governance model	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Legislation and regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***9. Please rate the importance of the following criteria for category of Security:**

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Natural hazards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Man-made hazards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk mitigation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crime prevention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

2. Economic Dimension

This section aims to review the selected and recommended categories of Economic Dimension and their criteria. These categories are as follow:

- Sustainable economy.
- Economic growth.
- Employment.
- Employees.
- Productivity.

***10. Please indicate the level of influence of the following categories of economic dimension on sustainable urban planning development:**

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
Sustainable economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic growth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Productivity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***11. Please rate the importance of the following criteria for category of Sustainable Economy:**

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Enhancement of local economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diversity of economic activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Efficient use of resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Balance between income and spending	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*12. Please rate the importance of the following criteria for category of Economic Growth:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Developing new investment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting local industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic capacity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*13. The following criteria are recommended to be included within the category of economic growth under the economic dimension. Could you please indicate your opinion about these recommended criteria?

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Provide a healthy economic environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Facilitate procedures to attract investments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*14. Please rate the importance of the following criteria for category of Employment:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Healthy employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Possibility of obtaining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*15. Please rate the importance of the following criteria for category of Employees:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Skills and qualifications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vocational guidance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Motivation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees participation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*16. The following criteria are recommended to be included within the category of employees under the economic dimension. Could you please indicate your opinion about these recommended criteria?

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Working efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*17. Please rate the importance of the following criteria for category of Productivity:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Efficient pricing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delivery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accessible to everyone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

3. Planning Dimension

This section aims to review the selected and recommended categories of Planning Dimension and their criteria. These categories are as follow:

- Land use.
- Infrastructure.
- Transport.
- Management.

***18. Please indicate the level of influence of the following categories of planning dimension on sustainable urban planning development:**

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
Land use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***19. Please rate the importance of the following criteria for category of Land Use:**

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Distribution of land use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Residential schemes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open spaces/park	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective use of land	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***20. The following criteria are recommended to be included within the category of land use under the planning dimension. Could you please indicate your opinion about these recommended criteria?**

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Land ownership	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*21. Please rate the importance of the following criteria for category of Infrastructure:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Green infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*22. Please rate the importance of the following criteria for category of Transport:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Consideration of traffic issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public transportation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport policies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*23. Please rate the importance of the following criteria for category of Management:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintenance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*24. The following criteria are recommended to be included within the category of Management under the planning dimension. Could you please indicate your opinion about these recommended criteria?

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Governmental rules and regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planning policies and legislations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

4. Environmental Dimension

This section aims to review the selected and recommended categories of Environmental Dimension and their criteria. These categories are as follow:

- Climate.
- Ecology.
- Energy.
- Resource.
- Pollution.

***25. Please indicate the level of influence of the following categories of environmental dimension on sustainable urban planning development:**

	Extremely Influential	Very Influential	Moderately Influential	Slightly Influential	Not at all Influential
Climate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pollution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***26. Please rate the importance of the following criteria for category of Climate:**

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Global warming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Climate emissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solar radiation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flood risk issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*27. Please rate the importance of the following criteria for category of Ecology:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Ecology assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flora / Fauna	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecological Appraisal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecological Survey	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*28. Please rate the importance of the following criteria for category of Energy:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Passive Design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy Efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consumption	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*29. Please rate the importance of the following criteria for category of Resource:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Resource recycling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of local resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using of renewable resource	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*30. Please rate the importance of the following criteria for category of Pollution:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Pollution assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Noise and waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water pollution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pollution prevention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Air quality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

5. Information and Communication Technology Dimension (ICT)

This section aims to review the selected and recommended criteria of ICT Dimension.

*31. Please indicate the level of the importance of the following criteria of ICT Dimension:

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
21st century skill outcomes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Universal access to technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to services and resources 24/7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ICT management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*32. The following criteria are recommended to be included within the ICT dimension. Could you please indicate your opinion about these recommended criteria?

	Extremely Important	Very Important	Moderately Important	Slightly Important	Not at all Important
Technological and institutional aspects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

APPENDIX E

DELPHI TECHNIQUE QUESTIONNAIRE (ROUND THREE)

Towards an Effective Sustainable Urban Planning Development

Final Ranking Round

Dear Expert,

Thank you very much for your participation in both Round One and Two of Delphi Technique that carried out during this research. I would be grateful if you could participate in this final round which aims to obtain your final judgement.

This round is known as Ranking Round which provides the expert with the rating average for the dimensions, categories and criteria that have been reviewed during the previous rounds by almost 40 experts. The average rating is based on a 5-point Likert scale, where 5 means extremely important and 1 not at all Important.

Therefore, you are kindly asked to give your final rating for the dimensions, categories and criteria of the proposed model for sustainable urban planning development with reference to the city of Riyadh. Please note that no new categories or criteria are required, however, you can use the box attached with each question to add your comments.

Once again thank you for your valuable participation with my great appreciation for your time and effort.

* Please note that the rating average will be presented beside the dimensions, categories and criteria (e.g. Social Dimension: 4.77).

*** 1. Please write your full name**

Name:

Towards an Effective Sustainable Urban Planning Development

The Proposed Model for Sustainable Urban Planning Development

***2. Please indicate the level of the importance of the following dimensions for the proposed model:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Social Dimension (4.77)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic Dimension (4.49)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental Dimension (4.80)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planning Dimension (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ICT Dimension (4.15)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

Social Dimension

***3. Please indicate the level of the importance of the following categories of Social Dimension:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Health (4.69)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Education (4.57)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equity (4.14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Community (3.97)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Security (4.49)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***4. Please indicate the level of the importance of the following criteria for Category of Health:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Consideration of health and safety issues (4.63)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing medical facilities (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Easy access to health services (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public awareness (4.37)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*5. Please indicate the level of the importance of the following criteria for Category of Education:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Providing educational facilities (4.80)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health and Safety within educational environment (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
development of educational process (4.26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Educational management (4.40)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Affordable access to standard educational services (4.51)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*6. Please indicate the level of the importance of the following criteria for Category of Equity:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Equitable distribution of services (4.63)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equitable distribution of income (4.29)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public participation (4.26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heritage preservation (3.90)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*7. Please indicate the level of the importance of the following criteria for Category of Community:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Community involvement in decision-making (4.43)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Characteristics of the population (4.11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enhancement of the community with essential services (4.00)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting digital community (3.91)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consideration of the culture and background of the community (4.31)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting community participation (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Governance model (4.23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Legislations and regulations (4.49)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*8. Please indicate the level of the importance of the following criteria for Category of Security:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Natural hazards (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Man-made hazards (4.57)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk mitigation (4.43)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risk management (4.46)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Crime prevention (4.46)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

Economic Dimension

***9. Please indicate the level of the importance of the following categories of Economic Dimension:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Sustainable economy (4.66)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic growth (4.43)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment (4.49)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees (4.17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Productivity (4.26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***10. Please indicate the level of the importance of the following criteria for Category of Sustainable Economy:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Enhancement of local economy (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diversity of economic activities (4.37)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Efficient use of resource (4.57)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Balance between income and spending (4.17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*11. Please indicate the level of the importance of the following criteria for Category of Economic Growth:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Developing new investment (4.29)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting local industry (4.37)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business facilities (4.09)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic capacity (4.17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provide a healthy economic environment (4.46)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Facilitate procedures to attract investments (4.34)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*12. Please indicate the level of the importance of the following criteria for Category of Employment:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Healthy employment (4.31)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment opportunities (4.43)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employment prospect (4.17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work environment (4.26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*13. Please indicate the level of the importance of the following criteria for Category of Employees:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Skills and qualifications (4.57)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective training (4.40)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vocational guidance (3.94)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Motivation (4.26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Employees participation (4.14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Working efficiency (4.51)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*14. Please indicate the level of the importance of the following criteria for Category of Productivity:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Quality (4.74)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost efficiency (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Efficient pricing (4.34)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Delivery (3.80)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accessibility (3.97)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

Planning Dimension

***15. Please indicate the level of the importance of the following categories of Planning Dimension:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Land use (4.71)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure (4.69)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport (4.60)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Management (4.47)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***16. Please indicate the level of the importance of the following criteria for Category of Land Use:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Distribution of land use (4.74)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Residential schemes (4.34)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public services (4.43)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open spaces/park (4.31)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective use of land (4.26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land ownership (4.51)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*17. Please indicate the level of the importance of the following criteria for Category of Infrastructure:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Green infrastructure (4.40)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure efficiency (4.63)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure management (4.60)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*18. Please indicate the level of the importance of the following criteria for Category of Transport:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Consideration of traffic issues (4.51)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public transportation (4.69)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport facilities (4.29)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Transport policies (4.23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

***19. Please indicate the level of the importance of the following criteria for Category of Management:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Monitoring (4.46)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Control (4.43)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Operation (4.37)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maintenance (4.51)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Governmental rules and regulations (4.51)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planning policies and legislations (4.47)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

Environmental Dimension

***20. Please indicate the level of the importance of the following categories of Environmental Dimension:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Climate (4.20)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecology (4.09)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy (4.46)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource (4.53)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pollution (4.60)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

***21. Please indicate the level of the importance of the following criteria for Category of Climate:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Global warming (4.00)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Carbon emissions (4.14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Solar radiation (4.06)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flood risk issues (4.03)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

22. Please indicate the level of the importance of the following criteria for Category of Ecology:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Ecological assessment (4.09)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity (3.88)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flora / Fauna (3.71)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecological Appraisal (3.83)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecological Survey (3.85)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*23. Please indicate the level of the importance of the following criteria for Category of Energy:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Passive Design (4.09)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy Efficiency (4.34)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy consumption (4.26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy management (4.54)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

*24. Please indicate the level of the importance of the following criteria for Category of Resource:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Resource recycling (4.26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource efficiency (4.29)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of local resource (4.31)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using of renewable resource (4.40)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resource management (4.31)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

*25. Please indicate the level of the importance of the following criteria for Category of Pollution:

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
Pollution assessment (4.66)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Noise and waste (4.11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Water pollution (4.74)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pollution prevention (4.49)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Air quality (4.66)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

Towards an Effective Sustainable Urban Planning Development

Information and Communication Technology Dimension (ICT)

***26. Please indicate the level of the importance of the following categories of ICT Dimension:**

	Extremely Important (5)	Very Important (4)	Moderately Important (3)	Slightly Important (2)	Not at all Important (1)
21st century skill outcomes (4.31)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Universal access to technology (4.40)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to services and resources 24/7 (4.46)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ICT management (4.43)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Technological and institutional aspects (4.46)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Add comments (please specify)

APPENDIX F

ANALYTIC HIERARCHY PROCESS (AHP) QUESTIONNAIRE

Pairwise Comparison of the Main Dimensions and Categories of the Proposed Model for Sustainable Urban Planning Development of the City of Riyadh

· Brief Introduction:

First of all, I would like to express my sincere thanks for your participation in the three rounds of Delphi Technique to examine the proposed model for sustainable urban planning development. The result of those three rounds shows that experts have reached a consensus regarding the contents of the proposed model and emphasised the importance of such as model being implemented in the city of Riyadh.

This final questionnaire aims to evaluate the relative importance of the main dimensions and categories within the proposed model. In the questionnaire, experts are asked to compare pairs of dimensions and categories, decide which of the two is more important and quantify the intensity of importance using the 9-point Saaty scale. This stage is a very important where the result will be analysed using Analytical Hierarchy Process (AHP) to elicit the weights and priorities of the dimensions and categories.

NOTES: Table 1 explains how the 9-point Saaty scale works.

Intensity of Importance	Definition	Explanation
1	Equal importance	Equal importance of both element
3	Moderate importance	Moderate importance of one element over another
5	Strong importance	Strong importance of one element over another
7	Very strong importance	Very strong importance of one element over another
9	Extreme importance	Extreme importance of one element over another
2, 4, 6, 8	Intermediate values	

Final Version of the Proposed Model for Sustainable Urban Planning Development



1. Please provide the following information:

Name:	
Institution:	
Country:	
Email Address:	
Phone Number:	

2. Please compare and indicate the intensity of the importance of following dimensions of the Proposed Model:

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)	Extremely More Important (9)	
Environment																		Society
Environment																		Economy
Environment																		Planning
Environment																		ICT
Society																		Economy
Society																		Planning
Society																		ICT
Economy																		Planning
Economy																		ICT
Planning																		ICT

(2, 4, 6, 8 = Intermediate Values)

3. Please compare and indicate the intensity of the importance of following categories of Social Dimension:

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)	Extremely More Important (9)	
Health																		Education
Health																		Equity
Health																		Community
Health																		Security
Education																		Equity
Education																		Community
Education																		Security
Equity																		Community
Equity																		Security
Community																		Security

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4. Please compare and indicate the intensity of the importance of following categories of Economic Dimension:

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)	Extremely More Important (9)	
Sustainable Economy																		Economic Growth
Sustainable Economy																		Employment
Sustainable Economy																		Employees
Sustainable Economy																		Productivity
Economic Growth																		Employment
Economic Growth																		Employees
Economic Growth																		Productivity
Employment																		Employees
Employment																		Productivity
Employees																		Productivity

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5. Please compare and indicate the intensity of the importance of following categories of Planning Dimension:

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)	Extremely More Important (9)	
Land Use																		Infrastructure
Land Use																		Transport
Land Use																		Management
Infrastructure																		Transport
Infrastructure																		Management
Transport																		Management

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6. Please compare and indicate the intensity of the importance of following categories of the Environmental Dimension:

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)	Extremely More Important (9)	
Climate																		Ecology
Climate																		Energy
Climate																		Resource
Climate																		Pollution
Ecology																		Energy
Ecology																		Resource
Ecology																		Pollution
Energy																		Resource
Energy																		Pollution
Resource																		Pollution

(2, 4, 6, 8 = Intermediate Values)

7. Please compare and indicate the intensity of the importance of following categories of the ICT Dimension:

	Extremely More Important (9)	(8)	Very Strongly More Important (7)	(6)	Strongly More Important (5)	(4)	Moderately More Important (3)	(2)	Equally Important (1)	(2)	Moderately More Important (3)	(4)	Strongly More Important (5)	(6)	Very Strongly More Important (7)	(8)		
21st Century Skill Outcomes																	Universal Access to Technology	
21st Century Skill Outcomes																	Access to Services 24/7	
21st century skill outcomes																	ICT Management	
21st Century Skill Outcomes																	Technological /Institutional Aspects	
Universal Access to Technology																	Access to Services 24/7	
Universal Access to Technology																	ICT Management	
Universal Access to Technology																	Technological /Institutional Aspects	
Access to Services 24/7																	ICT Management	
Access to Services 24/7																	Technological /Institutional Aspects	
ICT Management																	Technological /Institutional Aspects	

(2, 4, 6, 8 = Intermediate Values)